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# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED RUSUMO FALLS HYDROELECTRIC PROJECT

## DAM & POWERPLANT COMPONENT

VOLUME 1: MAIN REPORT

**FINAL REPORT – REVISION 1 – JULY 2013**

PREPARED UNDER THE AUSPICES OF:


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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ACDP | Acoustic Doppler Current Profile |
| ADB | African Development Bank |
| AIDS | Acquired immunodeficiency syndrome |
| ANP | Akagera National Park |
| ARI | Acute Respiratory Infection |
| ARVs | Anti-Retroviral treatments |
| AU | African Union |
| CITES | Convention on International Trade in Endangered Species in Wild Fauna and Flora |
| CNTB | National Commission for Land and Other Properties |
| COP | Conference of the parties |
| DTM | Digital Terrain Model |
| EAC | East African Community |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| EPFIs | Equator Principles Financial Institutions |
| ESIA | Environmental and Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| ESMU | Environmental and Social Management Unit |
| EWSA | Energy, Water and Sanitation Authority (RWANDA) |
| EWURA | Energy and Water Utilities Regulatory Authority |
| FAO | Food and Agriculture Organization of the United Nations |
| FDS | Full Development Scheme |
| FRW | Franc Rwandais |
| FS | Feasibility Study |
| FSL | Full Supply Level |
| GHG | Greenhouse Gas |
| GIS | Geographic Information System |
| GNP | Gross National Product |
| GoR | Government of Rwanda |
| GPS | Global Positioning System |
| GWh | Gigawatt hours |
| Ha | Hectare |
| HEC | Hydrologic Engineering Center (USA) |
| HIV | Human immunodeficiency virus |

| | |
|---|---|
| HSE | Health, Safety and Environment |
| HV | High Voltage |
| ICOLD | International Commission of Large Dams |
| IDS | Intermediate Development Scheme |
| IFC | International Finance Corporation |
| ILO | International Labour Organization |
| IUCN | International Union for Conservation of Nature |
| JAF | Joint Action Forum |
| Km | Kilometer |
| $Km^2$ | Square Kilometer |
| Kt éq.CO2/TWh | Tonnes of equivalent carbon per terawatt hour |
| Kw | Kilowatt |
| LAN | Local Area Network |
| LDP | Local Development Plan |
| LiDAR | Light Detection and Ranging |
| m.a.s.l. | Meter above sea level |
| m3 /s | Cubic meter per second |
| mg/L | Milligram per liter |
| MINAGRIE | Ministry of Agriculture and Livestock |
| MINALOC | Ministry of Local Administration, Good Governance, Community Development and Social Affairs |
| MINATTE | Ministry of Planning, Tourism and Environment |
| MINECOFIN | Ministry of Finance and Economic Planning |
| MINEDUC | Ministère de l'éducation, de la science, de la technologie et de la recherche scientifique |
| MINELA | Ministry of the Environment and Lands |
| MINICOM | Ministry of Commerce, Industry, Investment Promotion, Tourism and Cooperatives |
| MININFRA | Ministry of Infrastructure |
| MINITERE | Ministry of Land, Environment, Forest, Water and Natural Resources |
| MLHSD | Ministry of Lands and Human Settlement Development mm Millimeter |
| Mm3 | Millions of cubic meters |
| MOL | Minimum Operating Level |
| MP | Management plan |
| Mw | Megawatts |
| NBI | Nile Basin Initiative |
| NBITEAP | Nile Basin Initiative Transboundary Environmental Action Project |
| NECTA | National Examination Council of Tanzania |
| NEL | Nile Equatorial Lakes |
| NELSAP | Nile Equatorial Lakes Subsidiary Program |

| | |
|---|---|
| NEMC | National Environment Management Council |
| PAPs | Project-affected people |
| PIC | Project Implementing Committee |
| PMF | Probable Maximum Flood |
| PMP | Probable Maximum Precipitation |
| ppm | Parts per million |
| Q | Discharge (flow) |
| RADA | Agence Rwandaise de Développement Agricole |
| RAMSAR | The Convention on Wetlands of International Importance |
| RAP | Resettlement Action Plan |
| REMA | Rwanda Environmental Management Authority |
| RoR | Run-of-River |
| SLII | SNC-LAVALIN International Inc. |
| SM | Suspended materials |
| SMA | Soil Moisture Accounting |
| SRTM | Shuttle Radar Topography Mission |
| SS | Suspended solids |
| SSEA | Sectoral Social and Environmental Assessment |
| STD | Sexually Transmitted Disease |
| STI | Sexually Transmitted Infection |
| TAC | Technical Advisory Committee |
| TANESCO | Tanzania Electric Supply Company |
| TANROADS | Tanzania National Roads Agency |
| TB | Tuberculosis |
| TOR | Terms of Reference |
| UNDP | United Nations Development Program |
| UNESCO | United Nations Educational Scientific and Cultural Organisation |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USACE | US Army Corps of Engineers |
| USD | United State Dollar |
| UTM | Universal Transverse Mercator |
| WB | World Bank |
| WCD | World Commission of Dams |
| WHO | World Health Organisation |

# 1. INTRODUCTION

## 1.1. PREAMBULE

### 1.1.1. Purpose of the Report

This Environmental and Social Impact Assessment (ESIA) has been prepared by Artelia Eau & Environnement on behalf of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), which has the responsibility of managing the Rusumo Falls hydroelectric Project.

The dam and powerplant are planned to be situated at the Rusumo Falls where the Kagera River forms the boundary between Tanzania and Rwanda, and about 2 kilometres downstream of the river's confluence with the Ruvubu River. The dam and powerplant component comprises the construction and operation of a 15 metre high concrete gravity dam at the Rusumo Falls. The capacity of the powerplant will be 80 MW and the total cost of the project is 346 Million USD.

The purpose of the report is to assess the environmental and social impacts associated with the dam and powerplant component, which is one of a number of component which make up the Rusumo Falls Hydroelectric Project (see §1.1.2 below). It should be noted that the assessment of the Transmission Lines component are not included in this report and an ESIA and Resettlement Action Plan (RAP) for the Transmission Lines has been issued as a separate report.

The project is a Category A project with respect to the World Bank’s OP/BP 4.01 for Environmental Assessment; and the study has been prepared in order to comply with (i) the Safeguard Policies of the World Bank, which is the main International Funding Agency which has donated funds for the project, and (ii) the environment regulatory requirements of Rwanda and Tanzania, which are the countries affected by the Project, of which key regulations are:

- Rwanda - Ministerial Order N° 003/2008 of 15/08/2008 relating to the requirements and procedures for environmental impact assessment, and
- Tanzania, the Environment Impact Assessment and Audit Regulations, N°349 of 2005.

### 1.1.2. Background

The objective of the Rusumo Falls Hydroelectric Project is to develop hydroelectric power and regional transmission connecting Burundi, Rwanda and Northwest Tanzania, and support local area development and benefit sharing activities in the area of the dam and transmission lines. The Project is part of an overall Kagera Basin Integrated Development Framework, which is part of the

Nile Basin Initiative. The Project comprises four components, as summarized as follows:

*Component 1: Hydroelectric Power Generation.* This component includes an 80 MW hydropower facility with power production to be shared between Rwanda, Tanzania and Burundi. The feasibility studies for the power generation component have compared three alternative development scenarios, (i) Full Development Scheme (FDS), Intermediate Development Scheme (IDS), (iii) and Run-of-River (RoR) Scheme, including their technical, economic, social and environmental aspects. In February 2012, based on the Environmental and Social Impact Assessment (ESIA) for the IDS, the participating governments selected the RoR scheme with a normal operating water level of 1,320 metres above sea level as the preferred development option given that it minimizes environmental and social impacts of the project, and provides for the least cost implementation for environmental management and resettlement. The capacity of the powerplant will be 80 MW and the estimated project cost for the dam and powerplant is 346 Million USD.

*Component 2: Power Transmission, Regional Integration of Networks and Distribution.* Three transmission lines from Rusumo to (i) Gitega, Burundi (161 kilometres); (ii) Kigali, Rwanda (109 kilometres); and (iii) Nyakanazi, Tanzania (98 kilometres) will connect the power station to the national grids of Rwanda and Burundi, and supply electricity to the western mining provinces of Tanzania, which are currently not connected to the country's national grid.

*Component 3: Environmental and Social Mitigations and Multipurpose Local Area Development.* This component addresses (i) the dam site and area affected by changes in seasonal variations of water level, and (ii) along the transmission corridor. The sub-component will provide funds for the implementation of the Environmental and Social Management Plan (ESMP) and Resettlement Action Plan (RAP) which include the Local Area Development Plan (LADP).

*Component 4: Institutional Capacity Enhancement.* Preliminary studies into possible institutional arrangements between the three countries are on-going. Preliminary analysis suggests that a Rusumo Power Company could be jointly established by the three governments and possibly with private financiers. For broader technical oversight, the possibility of establishing a joint entity with a monitoring, advisory, and approval role as well as a water resources management and development function is under discussion. Such an entity could set operating rules, address water use issues, and resolve any regional issues that may arise.

### 1.1.3. Institutional Arrangements

***Project Developer***

The Rusumo Falls Hydroelectric Project is a joint development undertaking by the Governments of Burundi, Rwanda and Tanzania. The agreed project preparation management arrangements consist, at the regional level, of (i) a Council of Ministers in charge of electricity in the three countries; (ii) a Project Implementation Committee (PIC) consisting of the Managing Director/Director General of the Electricity Utility, Director General/ Commissioner/Director of Energy in each country, (iii) a Project Manager at the NELSAP Coordination Unit (NELSAP-CU), and (iv) a Technical Advisory Committee.

Prior to the start of the implementation phase, a Share Holders' Agreements (SHA) and an Implementation Agreement (IA) will be established between the participating countries.

Once the project is in the implementation phase, the role of project owner will be delegated to a Special Purpose Vehicle Project Company (SPV). The SPV shall be responsible for all aspects of project management, including those associated with its environmental and social issues. The SPV will be assisted by an Owner's Engineer (OE) who will assist and collaborate with the the SPV, carry out the detailed design of the structures and facilities, prepare tender documents and supervise the work of the construction contractor.

***The Role of the Nile Basin Initiative and NELSAP***

The Nile Basin Initiative (NBI) was launched in 1999 in order to ensure sustainable socioeconomic development for all the Nile riparian countries. The NBI establishes a consensual framework aiming at combating poverty and promoting socioeconomic development in the ten Nile riparian countries. As part of this initiative, a strategic action plan has been developed in order to translate the vision of sharing and using water resources equitably into meaningful activities and projects. The strategic action plan is divided into two main components – the programs affecting the entire Nile basin and the subsidiary action programs on sub-basins within the Nile basin. The Nile Equatorial Lakes Subsidiary Action Program (NELSAP) aims at implementing actions or joint projects in order to reduce poverty promote economic development and reduce environmental degradation.

NELSAP launched a comprehensive investment program aimed at increasing the supply of electricity and at finding more effective ways of sharing energy resources among countries. The NELSAP countries include: Burundi, Democratic Republic of Congo (DRC), Egypt, Kenya, Rwanda, Sudan, Tanzania, and Uganda. NELSAP promotes investments in power development, power transmission interconnection and power trade, water resources management,

management of lakes and fisheries, agricultural development, and control of water hyacinth. The long-term objectives of the NELSAP's energy development and exchange sub-program are as follows:

- Promoting regional economic development and improving quality of life through a largely sufficient and reasonably priced electricity supply;
- Increasing electricity supply in the Nile Equatorial Lakes region by improving import and export capacity between member countries;
- Improving the reliability of electricity supply and the quality of electricity transported through the interconnection of isolated networks in each country.

The immediate objectives of the sub-program are to increase the supply of electric power networks in the region and to guide policy makers in the development process, which would achieve the long-term objectives in the most efficient, economical and environmentally friendly way.

***Financing of the Project***

Within the framework of the NBI, the Governments of Burundi, Rwanda and Tanzania will receive financial support from various donors for preparation of the Project, prepared through the NELSAP. In March 2006 in Kigali, the Ministers of Energy of the three countries signed a Joint Project Development Agreement, reconfirming their commitment to jointly develop the Project, and on the 16$^{th}$ February 2012 a tripartite agreement was signed by the three countries. NBI/NELSAP will have fiduciary responsibility and oversee donor grants to the project.

## 1.2. PROJECT OVERVIEW

### 1.2.1. Project Situation

The dam and 80 MW powerplant are planned to be situated at the Rusumo Falls where the Kagera River forms the boundary between Tanzania and Rwanda, and about 2 kilometres downstream of the river's confluence with the Ruvubu River.

The location coordinates for the dam are as follows:

WGS 84 – UTM system:  36S 253,445 mE, 9.736,333 mN

SR 92 system: X = 587,075 E   Y=9,736,452 N

The dam will function as a Run-of-River Scheme and will therefore not create a water storage reservoir upstream of the dam. However, an area of seasonally flooded marshland will become permanently flooded.

### 1.2.2. Administrative Context

Environmental and social impacts are anticipated in Rwanda (Kirehe district of the Eastern Province) and Tanzania (Ngara district of the Kagera region).

No detectable impacts are expected in Burundi.

***Rwanda***

The affected marshland upstream from the dam is entirely located in Kirehe District.

The sectors which are located with the project area of influence are as follows:

- The village of Rusumo East which will be affected by the construction works is situated in the Nyamungali Sector;
- The villages which border the areas of Kagera valley marshland where there will be creation of a permanently flooded area and creation of additional flooded areas in the wet season are part of Kigarama Sector. The concerned cells comprise: Nyankurazo, Kiremera, Kigalama, Nyakerera and Cyanya;
- No detectable impacts in the Musaza sector (further upstream from Kigarama) are expected, though the rate of seasonal changes in water level may be slightly modified in this area.

***Tanzania***

The affected marshlands of the Kagera and Ruvubu valleys upstream from the dam are entirely located in the Ngara district.

- The village of Rusumo which will be affected by the construction works is situated in the Rusumo Ward;
- Villages along the right bank of the affected marshland of the Kagera valley and left bank of the Ruvubu valley are located in the Nyamiyaga Ward;
- Villages along the right bank of the Ruvubu valley are located in the Rusumo Ward.

### 1.2.3. Project Facilities and Activities

The Project will comprise the construction and operation of the dam structure (concrete gravity dam), an 80 MW powerplant and associated structures which include: water intake; head race tunnel; manifolds and penstocks; powerhouse; tail race channel and substation. The substation represents the point of interface with the Transmission Lines component of the Rusumo Falls Hydroelectric Project. The substation is not included in the ESIA for the dam and powerplant component, but is included in the ESIA for the Transmission Lines, which is issued as a separate report.

### 1.2.4. Current stage of Project Preparation

At the time of the preparation of this ESIA study, the final feasibility study for the dam and powerplant has been completed and a call for tender has been launched for the owner's engineer. The owner's engineer will be responsible for preparing the detailed dam and powerplant design and preparation of tender documents for the construction engineer. The tentative project implementation schedule can be summarized by the following milestones:

- Construction works will start in Q2 2015 and continue through to the end of 2018;
- Manufacture of the electromechanical plant will start in Q2 2015 and installation is expected to start in Q3 2017 and continue through to the end of 2018;
- Commissioning will start at the end of 2018.

### 1.2.5. Project History

The key milestones in the history of the project are summarized as follows:

- In 1967 Lahmeyer International made an evaluation of the hydropower potential at Rusumo Falls and identified 16 small and medium sized hydropower sites in Rwanda;
- The United Nations Development Program commissioned a pre-feasibility study of three potential hydropower developments on the Kagera River, namely Rusumo Falls, Kishanda Valley, and Kakono hydropower projects. This study was completed by Norconsult/Electrowatt in 1976 and concluded that Rusumo Falls was the key element in the power development program of the Kagera River;
- Between 1979 and 1995 Tractebel carried out pre-feasibility and technical and economic feasibility studies and concluded that the Rusumo Falls was the most attractive site and prepared a final design and tender documents for a 61.5 MW scheme. However, secondary energy had been neglected and no ESIA had been prepared.
- In 2003, Acres International Ltd. Carried out a review of existing documents on Project in order to assess status and determine next steps. It was recommended performing an optimization study of Project alternatives prior to undertaking in-depth engineering, environmental, social, economic and financial studies;
- In the period 2004 – 2006; a Strategic/Sectoral Social and Environmental Assessment of Power Development Options was undertaken by SNC-Lavalin International (SLII). The assessment recommendation that the Rusumo Falls Hydroelectric Project is the power option that should be implemented in the short to mid-term because of low cost and acceptable environmental and social impacts;

- In 2005, a Study on Financing and Implementation Arrangements for Regional Hydro Power Generation and Multi-purpose Projects in the Nile Equatorial Lakes Region was conducted by Manitoba Hydro, in which the Rusumo Falls Project was selected for specific analysis. The modelling and sensitivity studies demonstrated conclusively that Rusumo Falls is financially competitive and economically attractive;
- In 2006-2007, the Norwegian Water Resources and Energy Directorate carried out a review of earlier hydrological and sedimentological investigations in the Kagera River Basin and the catchment upstream of the Rusumo Falls in view of providing a hydrological expert opinion for evaluating the hydropower potential and related sediment transport issues of the proposed Regional Rusumo Falls Hydropower and Multipurpose Project;
- In 2008, SLII produced a Preliminary Design Report which included the assessment of three alternatives; Full Development Scheme (FDS), Intermediate Development Scheme (IDS), and Run-of-river (RoR).
- The FDS was eventually selected by the Member States as the preferred development option, but it was also recognized that a more precise analysis was required using the improved topography that would subsequently become available from a LiDAR topographic survey of the flooded area.
- In the period 2009 to 2011 SLII carried out hydrological and hydrotechnical studies in support of planning and design of the Project on the basis of the LiDAR data.
- Also in the period 2009 to 2011 SLII carried out preliminary studies for the FDS, IDS and RoR schemes, including ESIA, RAP and Local Area Development Plan (LADP).
- In September 2011, based on the feasibility studies, the participating governments selected the IDS option as the preferred development option.
- In 2011 and early 2012, SLII prepared a full ESIA, RAP and LADP for the IDS.
- In February 2012, based on the ESIA for the IDS, the participating governments selected the RoR option at 1,320 metres asl as the preferred development option given that minimizes environmental and social impacts of the project, and provides for the least cost implementation of the ESMP and RAP.

## 1.3. SCOPE AND EXTENT OF THE ASSESSMENT

This report, which assesses the impacts of the RoR Development Scheme has been prepared by *Artelia Eau & Environnement*, a French consulting firm specialized in conducting ESIA for hydropower projects. However, as mentioned in the project history above, prior to the preparation of RoR ESIA report, the Canadian consulting firm, SNC-Lavalin International was contracted by NELSAP to carry out ESIA studies for the Full and Intermediate Development Schemes. The ESIAs were carried out during the period 2008 – 2012 and represented a magnitude of effort of 310 man-months. The work included carrying out collection and review of bibliographic data, environmental baseline surveys, extensive social surveys, and hydraulic modelling to determine the impact of the dam on hydrology and consequently determining the extent of the inundated area. The hydraulic modelling required the construction of a Digital Terrain Model (DTM) using topographic and bathymetric data obtained using a Light Detection and Ranging (LiDAR) survey which was conducted in 2009 and an Acoustic Doppler Current Profiler (ADCP) survey conducted in April 2009.

The ESIA for the RoR was carried out during the period September 2012 – January 2013 and represents a magnitude of effort of 24 man-months (12 man-months for international staff and 12 man-months for local consultants. The work included carrying out (i) additional environmental expertise on the flora and fauna of the project's area of influence, (ii) additional consultations with the Project Affected People and (iii) additional hydraulic modelling to build upon the previous work of SLII to determine the impact of the physical presence of the dam on hydrology and changes to natural seasonal variations in marsh flooding.

The list of ESIA contributors are provided in Appendix A. The Terms of Reference for the study are provided in Appendix B.

## 1.4. OVERVIEW OF THE ESIA REPORT

The ESIA report comprises 7 main chapters, a list of reference and appendices as follows:

***Chapter 1 – Introduction***

The chapter provides information on the purpose of the report, the project developer. It provides an overview of the project, the scope and extent of the ESIA and a summary of the ESIA report.

***Chapter 2 – Legal and Administrative Framework***

This chapter provides a summary description of the relevant key administrative bodies and legislation and regulations relating the ESIA, environmental protection and resettlement in both Rwanda and Tanzania. The international conventions and standards that are applicable are provided as are the safeguard policies of the World Bank.

***Chapter 3 – Project Description***

This chapter provides a description of the structures and operating modes based on the feasibility study for the IDS carried out by SLII in 2011/12. The structures and activities for the RoR scheme will be much the same as for IDS, and environmental and social impacts for the RoR scheme can be accurately predicted from the design of the structures for the IDS. The ESIA study has confirmed that there will be no need to revise the design of the facilities due to the findings of the study.

***Chapter 4 – Baseline Situation***

The description of the environmental and social baseline situation comprises information reported in the IDS ESIA studies and which comprises bibliographic data; information from previous studies; findings of environmental field surveys carried out from November 2007 to June 2008 and completed in January 2012, and social surveys conducted in 2011 and 2012. The work for the IDS has been completed and complemented by the findings of environmental expertise, field work and public consultations carried out by Artelia during the period October 2012 –February 2013.

***Chapter 5 – Alternatives***

The alternatives which are addressed in this chapter comprise: (i) no project alternative, (ii) alternative location, (iii) alternative design and (iv) alternative technology. A comparison of impacts for the Full, Intermediate and Run-of-River Development Schemes is provided and a justification of the selection of the preferred alternative.

***Chapter 6 – Assessment of Impacts and Mitigation Measures***

The assessment and mitigation measures address the impacts of construction, operation and deconstruction on the natural and human environment. The main issues related to the construction phase include (i) the socioeconomic impacts associated with resettlement of households that are located in areas needed for construction activities. These impacts are managed through the Resettlement Action Plan, which is issued as a separate document and (ii) impacts on hydrology and consequently on flora and fauna associated with the diversion of the river through a diversion channel thus bypassing the Rusumo Falls and a section of the river downstream. These impacts are unavoidable. Other impacts on flora, fauna, air quality and water quality can be anticipated during construction and these will be controlled through a number of environmental management plans.

***Chapter 7 – Environmental and Social Management Plan***

This chapter provides a summary of the environmental and social impacts, the objectives of environmental and social management plan, general and specific management plans, the roles and responsibilities for implementation and the implementation schedule and costs.

Chapter 8 provides a list of references.

## 1.5. PUBLIC CONSULTATION AND PUBLIC DISCLOSURE

A key guiding principle to the Public Consultation and Public Disclosure (PCDP) process has been that it has involved free, prior and informed consultations with potentially affected communities to enable informed participation.

Community engagement activities started in 2007 when the Full Development Scheme was being studied. During 2007-2008 hundreds of interviews and focus groups were carried out in the Full development Scheme project area of influence. Then in 2011 a comprehensive government stakeholder consultation process was carried out and additional community and household consultations and investigations. In July 2011 – Feb. 2012 further consultation with 9 000 Project Affected People for the Intermediate Development Scheme was carried out and village-level resettlement committees set up. In September 2011 in Kirehe and Ngoma workshops with district officials were organised to prepare the Local Development Plan. In December 2011 and January 2012 in Kirehe and Ngoma, focus groups were held regarding on land tenure and vulnerable groups.

Under the RoR scheme there are reduced social and environmental impacts compared to the Full and Intermediate Development Scheme. In November 2012 it was necessary to inform those people who would no longer be impact by the project of the reduced impact. There expectations will be managed through the Local Area Development Plan (LADP).

The Community engagement activities that were carried out for the Run-of-River Scheme have involved a self-validation exercise to validate the list the Project Affecte People and the use of arable marshland. Consultations with resettlement committees were carried out at the same time to establish and assess how to manage village/sector grievances. Local/international NGOs and other development partners attended these meetings.

The Process for approval and disclosure is in process. First draft reports of the ESIA, RAP and LADP for the Run-of-River Scheme were presented to the Rusumo Technical Advisory Committee (TAC), the Project Implementation Committee (PIC) and the Council of Ministers (COM) in Bujumbura on 27-28 November, 2012. In December 2012, the draft reports were presented to District Task Forces in their respective countries. On the 18th December 2012, the draft reports were presented to Kirehe Taskforce (Rwanda) and on 20th December, presented to Ngara Taskforce (Tanzania). In both cases, the taskforces commended the progress made in the draft ESIA and RAP and were pleased with reduced Environmental and Social Impacts. On 4th and 5th February 2013, the second draft reports were discussed by representatives of various ministries from the three countries and the development partners. Participants from the three countries represented institutions namely: Ministries of Energy, Minerals, Environment, Agriculture, Natural Resources, National Environmental Management Councils, Utility Agencies, District Heads, Country Investment

Agencies, Forest Reserve Management Heads, NGO representatives, and Development Partners.

A Public Consultantion and Public Disclosure Plan has been prepared and is included as an annex to the RAP. A summary of the PCDP is provided in Appendix J.

## 1.6. OVERALL PROJECT COST

The estimated project cost for the dam and powerplant is 346 millions USD which can be broken down as follows:

- Civil, Mechanical and Engineering costs: 317 Millions USD
- ESMP (see Chapter 7): 6.6 Million USD
- RAP: 7.4 Million USD
- LADP: 15 Million USD

# 2. LEGAL AND ADMINISTRATIVE FRAMEWORK

## 2.1. INTRODUCTION

This chapter describes the administrative and legal framework relevant to the Project:

- Overview of legal and institutional frameworks related to social issues for each of the countries involved in the project: Rwanda and Tanzania;
- Relevant institutions regulating and managing environmental affairs;
- Regional environmental and social policies, and
- Summary of the World Bank's Safeguard Policies.

This ESIA Report has been prepared in compliance withal national policies in both Tanzania and Rwanda.

## 2.2. INSTITUTIONAL FRAMEWORK

### 2.2.1. Rwanda

#### *National Level - Ministries and Government Agencies*

At a national level the ministries and government agencies concerned by hydropower projects in Rwanda comprise the following:

*Ministry of Infrastructures*

The Ministry of Infrastructures (MINIFRA) is responsible for the water and sanitation sector. Within MININFRA, the Minister of State in Charge of Energy and Water is responsible for development and maintenance of infrastructure for water supply and sanitation. The National Water Commission is responsible for creating water resource development plans and programs to support the Ministry's policies. The ministry also includes (i) the state secretary in charge of Transport, (ii) the State secretary in charge of Energy and Water and (iii) The Energy, Water and Sanitation Authority (EWSA) which is in charge of rural water supply, management of water resources and sanitation.

*Ministry of Natural Resources*

The Ministry of Natural Resources (MINIRENA) is a multi-sectorial ministry covering five sectors: Lands, Water Resources, Forest, Mining and Environment. MINIRENA is responsible for the development of policies, laws and regulations as well as coordination of all activities in the management of land, water resources, forest, mining activities and environment, as well as their follow up and evaluation.

MINIRENA, through its Directorate of Water and Sanitation, is responsible for helping to set national water policy; ensuring compliance with relevant legislation; representing the government in intergovernmental organizations on matters related to water; and promoting international and regional cooperation on water resource issues.

The Rwanda Environment Management Authority (REMA) is an organization which is part of MINIRENA and which is in charge of implementing government policy for the environment and carrying out environmental monitoring. REMA was established in 2004 to act as the implementation organ of environment –related policies and laws in Rwanda. REMA is also tasked to coordinate different environmental protection activities undertaken by environmental promotion agencies; to promote the integration of environmental issues in development policies, projects, plans and programmes; to coordinate implementation of Government policies and decisions taken by the Board of Directors and ensure the integration of environmental issues in national planning among concerned departments and institutions within the Government; to advise the Government with regard to the legislation and other measures relating to environmental management or implementation of conventions, treaties and international agreements relevant to the field of environment as and when necessary; to make proposals to the Government in the field of environmental policies and strategies; etc.

*Ministry of the Lands, Forest Environment and Mines*

Ministry of the Lands, Forest Environment and Mines (MINIRENLA) has responsibility for: planning and implementing water quality and distribution programs; to ensure that the use of water and wetlands is done without endangering the environment; to put in place legislation for monitoring and reduction of pollution; and to foster appropriate environment-friendly methods and techniques for the exploitation and management of natural resources.

*Ministry of Agriculture and Animal Resources*

The Ministry of Agriculture and Animal Resources (MINAGRI) is responsible for the rational use of water potential for agricultural purposes. MINAG, through the Unit of Agricultural Engineering and Soil Conservation, manages agricultural development and soil conservation through terracing, drainage and irrigation.

*Ministry of Local Administration, Good Governance, Community Development and Social Affairs*

The Ministry of Local Administration, Good Governance, Community Development and Social Affairs (MINALOC) is the institution that monitors the quality of governance. MINALOC's main objectives are: (i) decentralization and democratization; (ii) capacity reinforcement; (iii) social wellbeing of populations; (iv) protection of vulnerable groups; (v) risk and disasters management; and vi) supervision of Districts and Provinces. MINALOC's main sponsor is Rwanda Local Development Support Fund.

*Rwanda Development Board*

The Rwanda Development Board (RDB) was created by the Organic Law N° 53/2008 of 02/09/2008. It has a mission of improving the well-being of all Rwandans by fast-tracking development, catalyzing sustainable economic growth, and creating prosperity for all. The responsibility for follow-up of ESIA studies is the responsibility of the RDB.

***District Organization***

Rwanda is subdivided in 5 provinces. The project lies within the Eastern Province. The district which is concerned by the project is that of Kihere.

All districts are led by a District Council, the highest authority of the District. An Executive Committee composed of a Mayor and two vice-Mayors ensures daily supervision of the District. There are six Technical Departments led by an executive secretary (Internal Resources; Infrastructure; Economic Development; Good Governance, Health & Social Affairs; Education and Youth and Culture). Districts also have jurisdiction upon cells and villages (*imidugudu*), the closest entities to populations.

According to the District Development Plan, the District Administration Units includes the six units, all important for understanding Rwanda's institutional framework at the district level.

Each level of this governance structure has different responsibilities:

- Central government introduces policies and national programs; mobilize external and local resources; ensure institutional capacity reinforcement, monitoring and evaluation.
- Provincial administration must foremost validate that District Development Plans correspond to national policies and promote provincial socio-economic development on its own resources.
- Districts are legal entities responsible for general coordination of economic development, planning, financing and execution of services to the Sector level as well as for promoting cooperation among other local governments. The Common Development Fund (CDF) is an institution created by the central government to finance investment expenditure in district. The CDF receives its revenues from both development partners and Government, which should allocate 10% of its domestic resources to the CDF. District's budgets, including their own revenues (tax collection) and donor support, must be approved on a yearly basis by the District Council.

- Sector is the following local government level also elected, with its main organization the Community Development Committee (CDC). Members of the CDC elect their representative at the District level. Sectors have some technical capacities with social affair officers, agronomists, forest officers (sharing with other sectors).
- The responsibilities of the cells are mainly for community mobilization and include also a CDC. Cells generally include 100 to 200 households.

### 2.2.2. Tanzania

This section describes an overview of relevant policies, administrative and legal framework, which are to be triggered during planning and implementation of this project pertaining to the environmental management in Tanzania. Since the issue of environmental management is a cross - cutting issue, other sector and donor community environmental policies and legislation are also described

***National Policies***

The following relevant policies will be triggered by this project and have been reviewed within this section and are described below:

- National Environment Policy (NEP) (1997);
- The Energy Policy (2003);
- Water Policy (2002);
- National Human Settlements Development Policy (2000);
- National Land Policy (1995);
- National Strategy for Growth and Poverty Reduction (2005);
- The Agriculture and Livestock Policy (1997);
- National Forest Policy (1998);
- The Wildlife Policy (1998);
- The National Employment Policy (1997), and
- The National Policy on HIV/AIDs (2001).

*National Environmental Policy (NEP – 1997)*

This is the main policy document governing environmental management in the Tanzania. The NEP defines environmental issues as both natural and social concerns and adopts the key principle of sustainable development. The NEP has also proposed the framework environmental legislation to be taken into account by the numerous agencies of the Government involved in regulating the various sectors. The NEP defines strategic plans for environmental management at all levels and provides an approach for mainstreaming environmental issues for decision-making.

The NEP identifies six key environmental management and protection problems, which shall be taken on board during this ESIA study:

- Land degradation;
- Lack of access to good quality water;
- Environmental pollution;
- Loss of wildlife habitat and biodiversity;
- Deterioration of aquatic ecosystems; and
- Deforestation.

The NEP requires Environmental and Social Impact Assessment (ESIA) to be mandatory for all development projects likely to have significant environmental impacts. The intention is to ensure that the development projects are implemented in an economically sustainable manner while safe-guarding environmental and social issues for the benefit of present and future generations. Rusumo falls hydroelectric power project triggered NEP.

*Energy Policy (2003)*

The relevancy of this policy for the Rusumo Falls Project is to recognize energy as a critical aspect for the national economic development. The overall policy objective is to provide an input to support the national economic development process. The policy promotes the establishment of efficient energy production, procurement, transportation, distribution and end use, in an environmentally sound manner and with due regard to gender issues.

The Energy Policy recognises the increasing demand for natural forests as a major source of firewood and charcoal (mainly for cooking), which is leading to serious deforestation and environmental degradation. Therefore, the policy emphasizes the need to identify economically and financially cost effective methods for meeting this energy demand. Rusumo falls hydroelectric power project is going address the needs of energy in the protection of environmental degradation.

*Water Policy*

The main objective of the National Water Policy of 2002 is to develop a comprehensive framework for sustainable development and management of the Nation's water resources and putting in place an effective legal and institutional framework for its implementation (URT, 2002). The policy aims at ensuring that beneficiaries participate fully in all stages of water resource developments.

The Policy recognizes the fundamental but elaborate linkages between water and socio-economic development, including environmental requirements. The Policy expounds on the importance of water for domestic use, agriculture, livestock keeping, mining, energy, fisheries, environment, human health, wildlife and tourism, forestry, navigation and trans-boundary requirements. Therefore the implementation of Rusumo Falls Hydroelectric Power Project required observing all issues mentioned above.

The Policy calls for an Integrated Water Resource Management in Tanzania so that "there is equitable and sustainable use and management of water resources for socio-economic development, and for maintenance of the environment" (URT, 2002). Several policy measures proposed to ensure sustainable utilization of the water resources. Some of these measures include economic and legal instruments. The proposed development i.e. energy project will require water for generation of electricity and other domestic use.

*National Employment Policy*

Among the objectives of the Employment Policy of 1997 is the identification of potential sectors for employment and establishing strategies to utilize such sectors to create employment opportunities. It also seeks to make more attractive and lucrative, employment in key sectors. In this regard, the policy emphasizes the way in which science and technology can promote employment. The Employment Policy encourages the investment in and improvement of basic infrastructure such as roads, water supply and electricity.

*National Policy on HIV/AIDs*

The National Policy on HIV/AIDS provides the framework for leadership and coordination of the National multisectoral response to the HIV/AIDS epidemic. The objective of the policy is that there be formulation, by all sectors, of appropriate interventions which will be effective in preventing transmission of HIV/AIDS and other sexually transmitted infections, protecting and supporting vulnerable groups, mitigating the social and economic impact of HIV/AIDS. The policy also provides the framework for strengthening the capacity of institutions, communities and individuals in all sectors to arrest the spread of the epidemic. Local government councils will be the focal points for involving and coordinating public and private sectors, NGOs and faith groups in planning and implementing of HIV/AIDS interventions, particularly community based interventions. The main specific objectives of the policy are in relation to (i) prevention of transmission of HIV/AIDS; (ii) HIV testing; (iii) care for people living with HIV/AIDS; (iv) sectoral roles and financing; (v) research and (vi) legislation and legal issues.

*Other Sectoral Policies*

Together with the NEP in Tanzania environmental protection and management is also guided by other sectoral policies. The sectoral policies which triggered by the implementation of Rusumo Fall Hydroelectric Power Project include:

## Table 2-1 Sectoral Tanzanian Policies Triggered by the Project

| S/No. | Policy Triggered | Relevancy |
|---|---|---|
| 1 | The National Land Policy (1996) – Under Ministry of Land, Settlement and | Human Development The policy emphasized that the environment and natural resources are given due consideration from planning, construction and implementation stages. Therefore the project proponent should make sure that they comply with this policy |
| 2 | Sustainable Industrial Development Policy - SIDP (1996 - 2020) - Under Ministry of Industry and Trade The policy insisted in the following, which are relevancy for this project: | Environmental Impact Assessment (EIA) and appropriate mitigation measures are enforced.<br>Promotion of Investment, which contain anti pollution programs.<br>The government will promote the continuous application of integrated environmental strategy to industrial process, products and services. This strategy will include propagating efficient use of raw materials and energy; elimination of toxic or dangerous materials, as well as reduction of emissions and wastes at resources.<br>The government will forge deliberate and mandatory devices to reactivate legal mechanisms to enable involved institutions to be more effective in matters of environmental management. |
| 3 | National Human Settlement Development Policy of (2000) - Under the Ministry of Land, Settlement and Human Development | This policy aim at harnessing existing initiatives in the shelter delivery and infrastructure investment by various actor in the public, private, informal and community sectors as well as guide the rapid urban growth and the transformation of the settlement pattern. |
| 4 | Health Policy under the Ministry of Health | This policy emphasizes the importance of project proponent to consider all aspects ranging from the welfare and health of the workers or other people who may be affected negatively or positively and whether directly or indirectly. |
| 5 | Agriculture and Livestock policy (1997) – Under the Ministry of Agriculture and Food Security | The policy advocate the best practise on agricultures and livestock keeping as well as environmental management |
| 6 | Forest Policy (1998) - Under the Ministry of Natural Resources and Tourism | The policy emphasized the best practice on environmental management and also on the protection of forest reserves. Early consideration of all aspect will make the investment to be sustainable. |
| 7 | Construction Industry Policy Under the Ministry of Works | The policy advocate the best practise on construction industry as well as safety , health and environmental management |
| 8 | The Wildlife and Wetland Policies (2007) under the Ministry of Natural Resources and Tourism | The policy recognizes the implication of human and development activities on wildlife resources inside and outside protected areas, and calls for environmental assessments for proposed development in order to minimize negative impacts.<br>The Wetland policy promotes conservation and management of wetlands as important natural resources of great biological value playing also an important role in poverty alleviation, water and soil conservation and for nutrition of people |
| 9 | Tanzania Development Vision - 2000 | Composite Development Goal for the Tanzania Development Vision 2025 (URT, 2000) foresees the alleviation of poverty through improved socio-economic opportunities, good governance, transparency and improved public sector performance. The construction of the of Rusumo Falls Hydroelectric Power Plant is aimed at increasing power supply to Tanzania National grid to enable development to take place. Power in needed for industrial development and improvement of livelihoods. |
| 10 | National Strategy for Growth and Reduction of Poverty | The National Strategy for Growth and Reduction of Poverty (NSGRP) or Mkakati wa Kukuza Uchumi na Kuondoa Umasikini Tanzania (MKUKUTA) is focusing on promoting economic growth and reducing poverty in Tanzania.<br>Among the various factors that have been identified to stimulate growth is the improvement of energy generation for economic growth |

***Institutional Framework***

Different institutions in one way or another will be involved in the implementation of this project, but the relevant institutions include

*National Level – Ministries and Government Agencies*

At the national level the responsibility for policy formulation and regulations concerning all aspects of water resources rest with the following administrative units:

At the national level the responsibility for policy formulation and regulations concerning all aspects of water resources rest with the following administrative units:

- Vice President's Office – Division of Environment

The mission of the Vice President's Office is to be highly efficient and effective in harmonizing and strengthening union and non-union matters and coordinating environmental management for the improvement of the welfare of Tanzanians. Its activities with respect to the environment comprise (i) preparation of regulations and guidelines in accordance with the requirements the environmental management act (2004); (ii) coordinate and monitor environmental programmes, plans and strategies; (iii) coordinate implementation of multilateral regional and sub-regional environmental agreements; (iv) coordinate commemoration of environmental days, and (v) coordinate preparation of the state of the environmental report.

The Environment Division is responsible for coordination of national and international matters related to environmental conservation and management. The Division is to be led by a Director and comprises of three Sections as follows:

*Environmental Natural Habitats Conservation*: This section is responsible for developing, reviewing and coordinating implementation of environmental policies, acts, regulations, guidelines, programmes and strategies which are related to natural habitats and environmental conservation. Some of the specific areas of focus include biosafety; State of the Environment reporting; and biodiversity conservation of major lake basins such as Lake Tanganyika and Lake Nyasa. In addition, the section coordinates the Global Environment Facility (GEF).

*Environmental Management of Pollution*: The section is charged with the prepararation, review and provision of advice on policies, legislation and guidelines which are related to environmental management of pollution. Some of the specific areas of focus include ozone depleting substances; persistent organic pollutants (POPs); and sustainable consumption and production.

*Environmental Impact Assessment*: The main responsibilities of this section is to prepare and review environmental management policies, legislatives, regulations, guidelines, criteria and procedures for environmental impact assessments, risk assessments and Strategic Environmental assessments. Some of the specific areas of focus include climate change; poverty and environment mainstreaming; approval of Environmental Impact Statement (EIS) and Strategic Environmental Assessment (SEA).

- Ministry of Water

The vision of the Ministry is to have sustainable management and development of water resources for social and economic development, and to enhance sustainable irrigation development that drives to increase productivity, profitability, increased incomes, food security, and therefore contribute effectively in economic growth and poverty reduction. The Ministry's mission is to ensure that water resources are developed and managed sustainably and in collaboration with all stakeholders. The Ministry's mission is also to facilitate participatory irrigation so as to enhance sustainable production and productivity, food security, poverty reduction and achieve national economic development. In order to achieve the above objectives different authorities have been established these include:-

*Basin Water Boards*: The Basin Water Boards are under Ministry of Water and its main function with others is to issue water permits and create water management plans; prepare guidelines for construction of water-source structures; collect and analyze data for water resources management; monitor water use and pollution; resolve intra-basin water conflicts; and serve as a channel of communication to water users. Basin Water Boards maintain a registry of water permits issued.

*Urban Water and Sanitation Authorities*: In urban areas, Urban Water and Sanitation Authorities (UWSSAs) manage water and sanitation services. Water supply in small towns is covered by District Urban Water Supply and Sanitation Authorities, while Community Owned Water Supply Organizations (COWSOs) are created to manage water supply and distribution in rural areas; the Energy and Water Utilities Regulatory Authority (EWURA), licenses all providers of urban water services, sets technical standards and monitors performance.

- Ministry of State for Regional Administration and Local Government

The ministry will have responsibilities of overseen development activities and permission to conduct any activity in a particular area in the district or municipality i.e. it is responsible for coordinating the roles and duties of local authorities and community organizations. Permission of undertaking any activities within the local governments has to come from the district/ municipal council directors.

- Ministry of Energy - TANESCO

TANESCO is a parastatal organisation under Ministry of Energy and Minerals. TANESCO have responsibilities of generates, transmits, distributes and sells electricity, and owns most of the electricity generating, transmitting, and distributing facilities in Tanzania. TANESCO will be the buyer of the electricity in bulk and distributes to the customers therefore it will have the responsibilities for all environmental management.

- National Environmental Management Council - NEMC

The National Environmental Management Council (NEMC) is under Vice–President Office and its principal functions are to advise the Government on all matters relating to the Environment, in particular relevant for this project:

i. To ensure the requirement of the Act with regard to Environmental Impact Assessment

ii. To review Environmental Impact Statement (EIS) through the Multi-Sectoral Technical Review Committee (TRC). Advice and recommends to the Minister responsible for environment to issues an Environmental Impact Assessment Certificate upon the EIS meets the acceptable standard.

iii. Follow up and monitoring of implementation of environmental mitigation measures as planned.

iv. Advice on all environmental matters related to this project.

Furthermore The Environmental Management Act Cap 191 provides an institutional set-up for environmental management with details of responsibilities at national and village (including a mtaa level, which is the lowest administrative level). The institutional set up involves the following main decision making points:

- National Environment Advisory Committee;
- Minister Responsible for Environment;
- Director of Environment (DOE);
- National Environmental Management council (NEMC);
- Sector Ministries;
- Regional Secretariats; and
- Local Government Authorities [City, Municipality, District, and Town Councils;
- Township; Hamlet (Kitongoji); Ward; Street (Mtaa); and Village].

- Ministry of Land and Human Settlement Development

Advice and monitoring all issues, which will be related with Land Acquisition and Resettlement

*Organisation at District Level*

The Kagera region covers 40,838 square kilometres of which 28,953 is land and 11,885 covered by the water bodies of Lake Victoria, Ikimba and Burigi Lakes, Kagera and Ngono Rivers.

The region is divided into six districts namely Biharamulo, Ngara, Muleba, Karagwe, Bukoba Rural and Bukoba Urban. Only the district of Ngara is part of the study area and is subdivided in four Divisions, 17 Wards and 70 villages. Ngara has an estimated population of 250,000 people (2000). The structural organization is as follows:

Village Councils are formed by four (4) Standing Committees: (i) Committee for finance, administration, planning and economy; (ii) Committee for works, and economic affairs; (iii) Committee for defense and security; (iv) HIV/Aids Committee.

District Authorities (District Councils, Town Authorities and Village Councils) are responsible for maintaining peace, order and good governance. They promote the social welfare and economic well-being of all persons within its area of jurisdiction. They comply with the national policy and plans for the rural and urban development and foster the social and economic development of its area of jurisdiction.

## 2.3. ENVIRONMENTAL LEGISLATION

### 2.3.1. Rwanda

***Environmental Impact Assessment Procedures***

Rwanda has adopted recent environmental legislation including environmental impact assessment procedures. According to the National Policy on Environment issued in 2003, Environmental Impact Assessments must be carried out prior to development of infrastructure projects. The Rwanda Environment Management Authority (REMA) was set up to implement this policy.

In April 2005, Rwanda adopted a legal framework in accordance with its National Policy on Environment, the Organic Law *N° 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda.* Article 67 of this law stipulates that “Every project shall be subjected to an environmental impact assessment, before obtaining authorisation for its implementation. This applies to programmes and policies that may affect the environment. An order of the Minister having environment in his or her attributions shall determine the list of projects mentioned in this organic law”. More specifically, EIAs must be carried out prior to works on wetlands and watersheds and must outline the costs and benefits of the protection of watersheds and of other related ecosystems. The EIA must be submitted to the Rwanda Development Board (RDB). The Environmental Compliance and cleaner production unit within RDB provides advice on EIA and ensures compliance as part of the investor facilitation.

***Legislation Regarding Water Management***

The main department in charge of water management in Rwanda is the Ministry of Natural Resources, through its Directorate of Water and Sanitation, is in charge of rural water supply, management of water resources and water treatment. In 2004 the Ministry issued a Sectoral Policy on Water and Sanitation which recognizes the sustainable management principle and has the stated objectives, among other things, of improving access to drinking water, access to water for agricultural use and the use of water as energy source.

In general, the '*Politique Nationale de l'Environnement'* (PNE) of 2003 and the '*Loi organique N° 4/2005 du 8 avril 2005 portant modalités de protéger, sauvegarder et promouvoir l'environnement au Rwanda'* provide for measures to protect watersheds in order to prevent wetlands deterioration.

Since the adoption of the 2004 Water Policy, the government has undertaken a significant number of actions to address the identified challenges and gaps. A Water Law was enacted in 2008, and the governmental bodies responsible for water resource management have been restructured.

The government has implemented several projects addressing specific water resource issues. The World Bank-supported Integrated Management of Critical Ecosystems (IMCE) Project assists farmers in four selected wetland ecosystems (Rugezi, Kamiranzovu, Akagera and Rweru-Mugesera) to adopt sustainable agricultural intensification technologies that are designed to improve farmers' livelihoods while protecting the rare biological resources of wetlands. The project supported a national marshland inventory in 2008, resulting in the classification of certain wetlands for conservation, controlled exploitation, and cultivation.

***Land Tenure and Land Use Rights***

Land ownership is divided into "formal written rights" and customary tenure. The first type recognizes lands that are subject to private ownership and customary tenure allocates areas where the owner of the land is the State but where inhabitants have rights to use the land. For instance, marshes are mostly considered crown lands and users have only usufruct rights on them, whereas cultivated lands around their houses on the hills are rather lands based on customary rules.

The Land Act of 2004 prepared by the Ministry of Land, Environment, Forest, Water and Natural Resources (MINITERE) defines land ownership, rights and duties of land owners and transaction rules. The Act recognizes private ownership, State ownership and communal ownership. In all cases, where private property must be expropriated, the owner must be compensated either under a mutually agreed settlement or under a court decision.

For buffer zones, it is the ownership of lands by the Ministry of Water for 70 meters of river, and is similar for areas around lakes.

***Resettlement***

The power to expropriate and the pertaining procedure can be found in:

- Law N° 18/2007 of 19/04/2007 relating to expropriation in the public interest, O.G. special N° of 21/5/2007, and
- Organic Law N°8-2005.

The Expropriation law includes land-redevelopment as one of the designed land uses that can justify expropriation in case of public interests. This position allows non-governmental entities to initiate expropriation. Expropriation is carried out by the government, but the law stipulates that the project proponent must cover the expenses of the expropriation and provide fair compensation.

The district executive committees or national ministries initiate expropriation by creating an application and the corresponding land commissions evaluate and approve the proposed expropriation. Two public meetings are held by and before the appropriate land commission, are to occur during the evaluation and decision process. The first meeting is “consultative,” and the second meeting is for purposes of declaring a final decision.

The compensation must be “awarded” and paid before the land is taken. If a period of 120 days passes between the award and the payment, the expropriation will be invalid, except where the parties have otherwise agreed. After payment, expropriated people have 90 days to relinquish the property. An expropriated person may challenge a valuation by undertaking an independent valuation. If the alternative value is rejected, the expropriated person may appeal to the land commission at the next highest level. If that appeal is rejected, appeal may be made to the court.

### 2.3.2. Tanzania

This section addresses the legal and regulatory framework, which is relevant to the proposed development of the Rusumo Falls Hydroelectric Power. The legal and regulatory framework provides the various legal aspects that must be adhered to as the project in designed, implemented and later when it is decommissioned

***Environmental Management Act - Cap 191***

Environmental Management Act Cap.191 is the principal act in Tanzania which provides a range of measures for sustainable management of the environment, prevention and control of pollution, waste management, and directs mechanisms for compliance.

Section 7 (2) states that " the Act provides a legal framework necessary for coordinating harmonious and conflicting activities with a view to integrating such activities into an overall sustainable environmental management system by providing key technical support to sector Ministries"

The Act is therefore a cross-sectoral law that takes precedence above all other laws except the Constitution with respect to environmental management. Consequently, Section 232 stipulates that:

"Where the provision of this Act is in conflict or is otherwise inconsistent with a provision of any other written law relating to environmental management the provision of this Act shall prevail to the extent of such inconsistency"

Matters pertaining to environment management are governed by sectoral legislation however; the latter shall not be in conflict with EMA CAP 191.

The Act emphasizes and echo the Constitution of Tanzania by stressing on the need for Tanzanians to leave in a clean, safe and health environment and to access various areas for recreational, educational, health, spiritual, cultural and economic purposes (Article 4 (1) and (2).

Part VI of the Act directs developers to undertake Environmental Impact Assessment (EIA) at their own cost prior to commencement of a project. The types of projects requiring EIA are listed in the Third Schedule of the Act. The EMA prohibits any development to be initiated without an Environmental Impact Assessment (EIA) Certificate from the Minister responsible for Environment.

***Environmental Impact Assessment and Audit Regulations, 2005***

The Environmental Impact Assessment and Audit Regulations of 2005 were made pursuant to Section 82 (1) and 230 (h) and (q) of the Environmental Management Act Cap 191. In addition, the regulations provide the procedures and requirements for undertaking Environmental Impact Assessments and Environmental Audits for various types of development projects with significant environmental impacts. The Regulations provides a list of projects that qualify for Environmental Assessment and Audit procedures in Tanzania. Regulation 46(1) classifies projects into two types: (i) Type A Projects requiring a mandatory Environmental Impact Assessment; and. (ii) Type B projects requiring a Preliminary Environmental Assessment (PEA).

The Fist Schedule lists typical examples of Type A and B projects. The proposed development for the construction of the Rusumo Falls Hydroelectric Power Plant falls under the energy project (generation of electricity) category that require mandatory Environmental Impact Assessment. The steps that must be taken to conduct an EIA are provided in the Fourth Schedule whilst Regulation 16 directs that the EIA study in addition to environmental impacts, also must address social, cultural and economic impacts. Regulation 17 stipulates the need for public participation during the EIA process and Part V, Regulations 18 (1), (2) and (3) directs the content and format of the Environmental Impact Statement. This EIA report responds to the legal requirement as provided in these Regulations.

***Water Resources Management Act - 2009***

The Water Resource Management Act 2009 is the main legal text with respect to water management in Tanzania. The Act was enacted in order to control and protect water resources. The Act puts in place a regime of water permits to govern access to water use. Pollution control norms are also embodied in water permits.

The Act provides for Institutional and Legal framework for sustainable management and development of water resources, to outline principles for water resources management; to provide for the prevention and control of water pollution; to provide for participation of stakeholders and the general public in implementation of the National Water Policy, repeal of Water Utilization (Control and Regulation) Act and to provide for related matters.

The Act sets out principles of sustainable integrated water resources management and sustainable development as follows:

- The precautionary principles;
- Polluter pays principles;
- The principle of eco-system integrity;
- The principles of public participation in the development policies, plans and processes for the management of the water resources;
- The principle of international co-operation in management of environmental resources shared by two or more states and
- The principles of common but differentiated responsibility.

Part IV of the Act gives powers for the management of water resources to the following:

- Minister who will be responsible for national policy and strategy formulation and ensuring the execution by authorities connected with the implementation of the Act.

- The Director of Water Resources will be the advisory person to the government in all matters pertaining to water resources.
- The National Water Board, which is an advisory board to the minister on matters related to multi-sectoral coordination in integrated water resources planning and management as well as resolution of national and international water conflicts, and
- Basin Water Boards.

Section IV part (b) of the act among others gives power to the water boards to prepare basin water resources management plans, projects and implementation strategy. In the Country there are nine (9) National Water Basin Authorities which are managed by Basin Water Boards. The Water Basin Authorities interested for this project is Lake Victoria Basin Authority

The Basin Water Boards provides guidelines and standards for construction and maintenance of water resources structures and approve issue and revoke water use and discharge permits.

The Act also recognizes the transboundary water. In this regard, Tanzania is a member of the following international River Basin Commissions:

- The Congo River Basin Commission;
- The Nile Basin Commission;
- Southern African Development Community - Zambezi River Basin, and
- East African Community – Lake Victoria.

In the extraction of water from these international waters, proponent has to make notification of Riparian Countries. The proponent will officially request the Ministry of Foreign Affairs to notify on its behalf fellow riparian countries on the water extraction needs of the project through the appropriate bodies (i.e. Ministry of Foreign Affairs and the Water Basin Management Authorities in those countries).

***Forest Act, 2002***

The Forest Act of 2002 provides for the management of forests in order to enhance the contribution of the forest sector to the development of Tanzania and the conservation and management of natural resources. In addition, the legislation fosters ecosystem stability through conservation of the forest biodiversity, water catchments and soil fertility.

Section 18, of the Act is relevant to the proposed development as it requires developers to prepare and submit to Director of Forestry, an Environmental Impact Assessment report. The law states that: " any proposed development in a forest reserve, private forest or sensitive forest area including watersheds, whether that development is proposed by, or is to be implemented by a person or organization in the public or private sector, the developer of the development shall prepare and submit to the Director an Environmental Impact Assessment of the proposed development. Section 70 of the Act prohibits any person from burning any vegetation on any land outside the cartilage of his own house or compound without permission.

In addition, Section 49 of the Act outlines various permits that are required when certain activities are undertaken. These activities include:

- For activities carried out in national and local authority forest reserves
- Felling or extraction of timber (for domestic use; export; mining purposes, or for prospecting and for exploitation of mineral resources)
- Gathering and picking parts or extracts of any protected plant for the purposes of research or the production manufacture of any medicine or product.
- Erection of buildings or other structures.
- Construction of roads, bridges, paths, waterways or runways;
- Sow, plant or cultivate trees, crops or other vegetative matter;
- Enter to hunt or fish.

Relevant provisions of this Act have been addressed during the Environmental and Social Impact Assessment for the proposed construction of Rusumo Falls Hydroelectric Power Project. TANESCO must obtain the relevant permits from the Director of Forest and Beekeeping before undertaking any activities in the forest reserve found along the way leave.

***Wildlife Conservation Act, 1974***

The Wildlife Conservation Act of 1974 provides for the protection, conservation, development, regulation, control of fauna and fauna products and for matters incidental thereto, and connected therewith. The Act restricts entry into a protected area without proper permission, restricts carrying of fire arms; bow and arrow; prohibits wilfully or negligently cause of bush fire, felling of trees, hunting, digging, laying, or constructing any pitfall, net, trap, snare or other device whatsoever, capable of killing, capturing or wounding any animal. The construction of Rusumo falls hydroelectric power does affect wildlife-protected areas or any concentration of wildlife in a single area.

The types of wildlife that are expected to be affected comprise fish life in the Kagera River immediately upstream of the dam and in the bypassed stretch of the Kagera River downstream from the dam. In the section of bypassed river, local people report the occasional presence of the Nile Varan (*Varanus niloticus*) and python (*Python sebae*), both of which are protected but which are not dependent on the affected habitat.

***Land Act, 1999***

The Land Act, No.4 of 1999, provides basic legal requirements in relation to land other than village land, the management of land, settlement of disputes and related matters.

Tanzanian land falls under three categories, namely;

- Reserved Land is land set aside for wildlife, forests, marine parks, etc., and the ways these areas are managed is explained in the respective laws that protect each sector (e.g. Wildlife Conservation Act, National Parks Ordinance, Marine Parks and Reserves Act, etc.). Specific legal regimes govern these lands under the laws used to establish them.
- Village Land includes all land inside the boundaries of registered villages, where the Village Councils and Village Assemblies are given power to manage. The Village Land Act gives the details of how this is to be done. The Village Land Act is governing this land.
- General Land is land, which is neither reserved land nor village land and is therefore managed by the Commissioner. The Land Act is governing this land

Since some of the areas where the project will be developed fall under public lands, this Act is relevant. The Act lays down fundamental principles for occupying and using the land. Among them, is the principle that any land user shall ensure that land is used productively and that any such use complies with the principles of sustainable development.

The Land Act confirms National Land Policy directive that that all land in Tanzania is public land vested in the President as trustee on behalf of all citizens. The Land Act seeks to achieve the following objectives:

- To ensure that existing rights in and recognized longstanding occupation or use of land are clarified and secured by the law;
- To facilitate an equitable distribution of and access to land by all citizens;
- To regulate the amount of land that any one person or corporate body may occupy or use;
- To ensure that land is used productively and that any such use complies with the principles of sustainable development;
- To take into account that land has value and that value is taken into consideration in any transaction affecting that land.
- To pay full, fair and prompt compensation to any person or institution whose right of occupancy or recognized long-standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the state under this Act or is acquired under the Land Acquisition Act; and
- Provided that in assessing compensation for land acquired in the manner provided for in this Act, the compensation shall be based on the following:
  - Market value of the real property;

- Disturbance allowance;
- Transport allowance;
- Loss of profits or accommodation;
- Any other cost, loss or capital expenditure incurred with respect to the development of the subject land;
- Interest at market rate; and

- Provision of an efficient, effective, economical and transparent system of land administration.

***Village Land Act No. 5, 1999***

The Village Land Act No. 5 of 1999 governs village land and all matters related to land tenure under the Village Councils. Most of the land that will be involved in the construction of Rusumo falls hydropower project may be on village land, except for new areas where the project area may be in forest reserves or social infrastructures belonging to specific institutions. Section 8 (1), (2) and (3) of the Village Land Act empowers the Village Council to manage all village lands in accordance with the principles of a trustee with the villagers being the beneficiaries. In exercising these functions, the Village Council is required to have regard to the following principles:

- Sustainable development and the relationship between land use, other natural resources and the environment in and contiguous to the village and village land;
- The need to consult with and take account of or comply with the decisions or orders of any public officer or public authority with jurisdiction over any matter in the area where the village is; and
- The need to consult with and take account of the views of other local authorities with jurisdiction over the village.

Although the Village Land Act recognizes the role of the Village Councils in management of village land, most of the land in the villages is under individuals through the customary land rights. The right of the individuals to the land must be recognized and respected and any development should take the land which is need and not take more than the land required for that particular development.

***Land Regulation, 2001***

The Land Regulations provides guidance on the issue of compensation, which is relevant in the proposed development of Rusumo Falls Hydropower. According to Section 10 (1) of the Land (Compensation Claims) Regulation 2001, compensation shall take the form of:

- Monetary compensation;
- Plot of land of comparable quality, extent and productive potential to the land lost;
- A building or buildings of comparable quality, extent and use comparable to the building or buildings lost;
- Plants and seedlings;
- Regular supplies of grain and other basic foodstuffs for a specified time.

Under the Regulation on Assessment of Value for Compensation states that "...the basis for assessment of the value of any land shall be the market value of such land". The market value is arrived at by the use of the comparative method substantiated by market recent sales of similar properties, or by use of income approach or replacement cost method, in case the property is of special nature and not saleable.

In Tanzania the assessment of the value of land and any improvements will be done by a Qualified Valuer and verified by the Chief Valuer of the Government or his/her representative.

In addition, the Regulation defines affected persons that are eligible for compensation/resettlement if some of their properties are affected by a proposed development:

- Holder of right of occupancy;
- Holder of customary right of occupancy whose land has been declared a hazard land;
- Holder of customary and who is moved or relocated because his/her land becomes granted to other person;
- Holder of land obtained as a consequence of disposition by a holder of granted or customary right of occupancy but which is refused a right of occupancy;
- Urban or peri-urban land acquired by the President.

If the person does not agree with the amount or method of payment or is dissatisfied with the time taken to pay compensation, he/she may apply to the High Court for redress. If proved justifiable, the High Court shall determine the amount and method of payment, determine any additional costs for inconveniences incurred, and order the plaintiff to be paid accordingly.

***Land use Planning Act No.6 of 2007***

The purpose of the Act (in association with Town and Country Planning Ordinance) is to regulate and organise which land areas are used for which purpose. The Act requires that land use be organized in a planned fashion, with government approvals required. Land planning is divided into two categories:

Regional land planning areas and land planning for certain specific areas, such as towns and urban areas.

The National Land Use Planning Commission Act creates the National Land Use Planning Commission (NLUPC) whose most significant functions are to prepare regional physical land use plans, formulate land use policies for implementation by the government and to specify standards, norms and criteria for protection of beneficial uses and maintenance of the quality of land. As an advisory organ, the NLUPC is also to recommend measures to ensure that government policies, including those for the development and conservation of land, take adequate account of their effects on land use, stimulate public and private participation in programmes and activities related to land use planning for the national beneficial use of land and seek advancement of scientific knowledge of changes in land use and encourage the development of technology to prevent or minimize adverse effects that endanger man's health or welfare. Section 2 of the Act defines a "beneficial use" as "a use of land that is conducive to public benefit, welfare, safety or health."

Any business operating in a rural area will be expected to follow the conditions of the regional physical land use plan for the particular region. In the case of the Rusumo hydroelectric project the regional land use plan is the Lake Zone (1978-82) Plan which covers the Mwanza, Mara, Kagera and Shinyanga regions.

***Land Disputes Courts Act No. 2, 2002***

Every dispute or complaint concerning land shall be instituted in the Court having jurisdiction to determine land dispute in the given area (Section 3).

The Courts of jurisdiction include-

i. The Village Land Council

ii. The Ward Tribunal

iii. District Land and Housing Tribunal

iv. The High Court (Land Division)

v. The Court of Appeal of Tanzania.

The Act gives the Village Land Councils powers to resolve land disputes involving village lands (Section 7). If the Council fails to resolve the dispute, the matter may be referred to the Ward Tribunal as established by the Land Act (1999) and the Village Land Act. If any dispute will arise because of this project, the provision of this Act shall be observed.

***Local Government Act of 1982***

In 1982 a corpus of laws was passed to implement the decision to reintroduce local government, the most important being:

- The Local Government (District Authorities) Act, 1982, No. 7 of 1982;
- The Local Government (Urban Authorities) Act, 1982, No. 8 of 1982;
- The Local Government Finances Act, 1982, No. 9 of 1982;
- The Local Government Service Act, 1982, No. 10 of 1982; and
- The Local Government Negotiating Machinery Act, 1982, No. 11 of 1982;

The Local Government Acts are an important legal framework for the organisation of village councils and local government. The Acts establish and regulate district councils, township authorities and village authorities. Acts number 7 and 8 deal with governance, and Acts number 10 and 11 deal with local government staff. The Act No. 7 established the local government district authorities in rural areas, and Act No. 8 established the local government urban authorities.

The district authorities include district councils, village councils, and township authorities, vitongoji, and Ward Development Committees. All of them except the vitongoji and Ward Development Committees have powers to make by-laws, pass annual budgets and tax according to regulations within their area of jurisdiction.

Part V of the Act No. 7 describes the functions of local government authorities in the context of resettlement. The Act grants local government authorities a role in resettlement processes to ensure that, the affected people's social welfare is taken into account when resettlement and compensation matters are involved. Section 111 (b) states that the local government authorities shall" promote the social welfare and economic well-being of all persons within its area of jurisdiction". Section 111 (c) obliges the local authorities to promote social and economic development in their areas of jurisdiction.

***Employment and Labour Relations Act, 2004***

The National Assembly passed on the 14th and 15th April 2004 two labour related statutes: the Labour Institution Act, 2004 and the Employment and Labour Relations Act (hereinafter, Labour Law), 2004. The Labour Law Act guarantees core rights and protections, minimum employment standards, regulates the registration of trade unions and associations, offers a framework for collective bargaining, regulates the right to strike and lockout and introduces a new labour dispute resolution system with mediation and arbitration as the new elements.

The Labour Institution Act provides the institutional machinery to operationalise the Labour Law Act.

***The HIV and AIDS (Prevention and Control) Act, 2008***

The Act provides for prevention, treatment, care, support and control of HIV and AIDS, for promotion of public health in relation to HIV and AIDS; and provides for appropriate treatment, care and support using available resources to people living with or at risk of HIV and AIDS and for related matters.

The Act stipulates the general duty of every person, institution and organization living, registered or operating in Tanzania in relation prevention and control of HIV and AIDS. It provides the framework for public education and programmes on HIV and AIDS. The Act provides the provisions regarding testing and counselling, confidentiality, health and support services, stigma and discrimination, rights and obligations of persons living with HIV and AIDS, research, monitoring and evaluation, and offences and penalties.

***Occupational Health and Safety Act, 2003***

The safety, health and welfare of workers in factories and all other places of work is governed by this Act. In addition, it provides for the protection of persons other than those at work against hazards to health and safety arising out of or in connection with activities of persons at work. Relevant sections of the Act are Part IV Section 43 (1) - Safe means of access and safe working place; Prevention of fire; and Part V on health and welfare provisions, which includes provision of supply of clean and safe water to workers, sanitary convenience, washing facilities and first aid facility.

Section 15 gives powers to the Registrar of factories and workplace to enter any factory in our case generation power plants or workplace to perform his duties as provided by the Act. Section 16 requires that factories i.e. generation power plants and workplace should register with Registrar of factories and workplaces before commencing operations.

Part VI is dealing with special safety provisions for working places involving handling hazardous chemicals, hazardous processes or hazardous equipment. This Act is relevant for the proposed development of construction of Rusumo Falls Hydro Electric Power Plant. Safety issues will be important in the project during construction and operation since the project involves construction activities, handling high voltage electricity cables, construction power house, use of machines and instruments that may affect workers or other people. The need to ensure that all workers and workstations adhere to the laws is imperative. Personal protective gear during all times the worker is at the site must be enforced to the maximum, and people who are not relevant to the site are prohibited.

***Legal Provisions on Waste Management Issues***

Tanzania developed guidelines for waste management however, the Part IX of the Environmental Management Act Cap 191 directs on the management of solid waste. Section 114 provides duties of the local government authorities to manage and minimize solid waste and Sections 133- 139 refers to management of hazardous waste.

Similarly and in tandem with the Environmental Management Act No. 20 (Cap 191), more legislation governing waste management in Tanzania are found in the Local Government (District) Authorities Act No.7 of 1982. The Act provides for the protection and management of the environment. Section 111 of the Act promotes social welfare and economic well being of all residents within their areas of jurisdiction.

Section 118 deals with protection and management of the environment. The District councils are required to take necessary measures to control soil erosion and desertification; to regulate the use of poisonous and noxious plants, drugs or poisons, regulate and control the number of livestock; maintain forests, manage wildlife, ensure public health, and provide effective solid and liquid waste management.

In connection with the development of Rusumo Falls Hydroelectric Power, Project developer will be required to obtain permission from the District councils for the disposal of waste, and take care of the solid waste that can be hazardous - e.g. sharp metal pieces, nails and wires. Developer shall provide proper disposal facilities or recycling.

***Legal Provisions on Pollution***

Several environmental standards are relevant to the proposed development. The legal provisions for these standards is provided in Part X of the Environmental Management Act Cap 191, which provides directives on environmental standards and compels the National Environmental Standards Committee of the Tanzania Bureau of Standards to develop, review and submit to the Minister (responsible for Environment) for approval standards and criteria covering:

- Water quality,
- Discharge of effluent into water,
- Air quality,
- Control of noise and vibration pollution,
- Sub sonic vibrations,
- Soil quality,
- Control of noxious smells,
- Light pollution, electromagnetic waves and microwaves, and

- Any other environmental quality standards.

The above mentioned standards are relevant to the proposed development. The project developer shall consult and use the above mentioned standards during the project implementation i.e. construction and operation. Government has issued some of these standards.

The Regulations for Soil Quality compels all developers to ensure they do not emit any substances that may contaminate the soils beyond levels that are provided in the laws. Possible areas of soil pollution from the project activities include vehicle and equipment maintenance yards (from oil spills), metals from construction sites where oil spills and metals could contaminate the soil.

The Regulations for Water Quality Standards are made under Section 143, 144 and 230 (2) (s) of the Environmental Management Act Cap.191 to provide for minimum standards of water quality and sets mechanism for the protection of water sources and ground water. The Regulations further prohibits to discharge hazardous substances, chemicals and materials or oil into water bodies and outlines procedures that have to be followed in sampling an assessing the quality of water for different purposes and allowable emission for different sources. The project developer in particular must adhere to emission standards especially during construction and operation by avoiding contaminating sources of water.

In addition the Local Government Act of 1982 also empowers the local governments to enact by-laws to protect public health and regulate pollution problems. Other relevant legislation with regard to soil includes the National Land Use Planning Act of 1984, the Town and Country Planning Ordinance of 1961, and the Mining Act of 1998. Developer will be compelled to comply with all legal provisions governing environmental issues with respect to this development.

## 2.4. THE WORLD BANK'S SAFEGUARD POLICIES

The World Bank, has identified eight key policies, among the overall set of Operational Policies guiding its operations known as the 'Safeguard Policies', which are critical to ensuring that potentially adverse environmental and social consequences of projects are identified, minimized, and mitigated. The policies which are applicable to the Project are summarized as follows:

***OP/BP 4.01 Environmental Assessment***

This policy is considered to be the umbrella policy for the Bank's environmental "safeguard policies". This policy requires Environmental Assessment of projects proposed for Bank financing to ensure that such projects are environmentally sound and sustainable. All projects proposed must be screened by the Bank and put into one of four categories for Environmental Assessment purpose. If a project falls into categories A or B, a Comprehensive Environmental Assessment (also known as EIA or SEIA for Social and Environmental Impact Assessment) must be conducted to respond to Bank requirements. An EIA must include a comprehensive environmental management plan. The Rusumo Falls Dam and Powerplant Project is a category A project, and in compliance with the policy a comprehensive ESIA and ESMP have been prepared.

***OP 4.04 Natural Habitats***

This policy seeks to ensure that development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats which are natural habitats either legally protected, officially proposed for protection, or unprotected but of known high conservation value. For the Rusumo Falls dam and powerplant component, this safeguard policy has been triggered because of the impact on the Falls and a downstream stretch of river. The project will result in diverting the river and bypassing the Falls and a 500 metre stretch of downstream river. The habitat of the Rusumo Falls spray zone, although of particular environmental interest is not considered to be a critical or unique habitat. This has been established through baseline surveys and review of scientific publications.

***OP/BP 4.12 Involuntary Resettlement***

This policy aims to avoid involuntary resettlement when feasible, or to minimize and mitigate its adverse social and economic impacts. This policy promotes participation of displaced people in resettlement planning and implementation. The policy’s main economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living. This policy also prescribes compensation and other resettlement measures and requires that project submitted includes adequate resettlement planning instruments. For the Rusumo Falls dam and powerplant component, this safeguard policy has been triggered because of the need for resettlement and compensation as a result of land take at the villages  where dam construction works will take place and because of the need to compensate people impacts by a loss of a fringe of arable marshland bordering the marshland area upstream from the future dam site. A full Resettlement Action Plan (RAP) including a Local Area Development Plan (LADP) has been prepared for the Project and is issued as a stand-alone document.

***OP. 4.11 Physical Cultural Resources***

This policy aims to avoid, or mitigate, adverse impacts on cultural resources from development projects that the World Bank finances. Project falling under category A or B must addresses impacts on physical cultural resources as an integral part of the environmental assessment (EA) process. The baseline survey work has included the search for physical cultural resources, although no such resources have been identified this policy has been triggeredas a precautionary measure, and the construction contractor will be required to prepare and implement a chance find procedure.

***OP 4.37 Safety on Dams***

This policy requires that the design and supervision of construction of dam project must be carried out by experienced and competent professionals and that dam safety measures be adopted and implemented through the project cycle. The policy also applies to existing dams where they influence the performance of a project. In such case, a dam safety assessment should be carried out and necessary additional dam safety measures should be implemented. Although the Rusumo Dam is slightly lower than the threshold limit for triggering the OP 4.37, it is intended that the contract for the detailed dam design include the dam safety study and dam rupture studies in order to be in-line with the requirements of OP 4.37.

***OP/BP 7.50 Projects on International Waterways***

This policy underscores the importance of riparian states making appropriate agreements or arrangements for the entire waterway, or parts of it. If there are no such agreements or arrangements, the Bank requires, as a general rule, that the borrower notify the other riparians of the project. The Policy lays down detailed procedures for the notification requirement, including procedures in case there is an objection by one of the riparian to the project. For the Rusumo Falls dam and powerplant component, this safeguard policy has been triggered. The Project is developed by the governments of Burundi, Rwanda and Tanzania and on the 16$^{th}$ February 2012 a tripartite agreement was signed by the three countries. The Tripartite Agreement is provided in Appendix I.

# 2.5. INTERNATIONAL CONVENTIONS

## 2.5.1. Rwanda

Rwanda is party to the following international conventions.

**Table 2-2 Status of Principal International Conventions - Rwanda**

| Convention/Protocol | Rwanda |
|---|---|
| African Convention on the Conservation of Nature and Natural Resources (Algiers Convention) (Open for accession by any independent African State) | In force |
| Basel Convention on Hazardous Wastes | Accessed |
| Convention on Biological Diversity | Ratified |
| Convention on International Trade in Endangered Species (CITES) | In force |
| Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR) | Ratified |
| Kyoto Protocol to the United Nations Framework Convention on Climate Change | Accessed |
| United Nations Convention to Combat Desertification (UNCDD) | In force |
| International Union for Conservation of Nature (IUCN) | - |
| Vienna Convention for the Protection of the Ozone Layer and Subsequent Protocols and Amendments | Signed + Accepted Subsequent Amendments and Protocols |

***National Parks and Protected Areas***

Regarding commitments with respect to the Convention on Biodiversity, Rwanda has four protected areas covering 10% of the national territory. These are the Nyungwe National Park (924,000 hectares), Volcanoes National Park (12,000 hectares), Akagera National Park (90,000 hectares), and the Rugezi wetland (6,735 hectares). National parks and protected areas are discussed in more detail in §4.3.10. However, it is noted here that Akagera National Park is located 60 kilometres downstream from the future dam.

Regarding commitments with respect to the RAMSAR Convention, Rwanda has created one RAMSAR wetland which is the Rugezi-Bulera-Ruhondo (Ramsar site No. 1589). Rwanda's National Report on the Implementation of the RAMSAR Convention on Wetlands (2012) indicates that the Rweru-Mugesera complex, Kamiranzovu and Akagera Complex have been designated as potential sites for

RAMSAR status and the application for Rweru-Mugesera complex is currently ongoing. However, is underlined that the Rweru-Mugesera complex is located 80 kilometres upstream from the future dam and will not be affected by the Project.

***Climate change***

Rwanda ratified the **Kyoto Protocol to** the United Nations Framework Convention on Climate Change in July 2004. Rwanda's National Adaptation Programmes of Action (NAPA) to Climate Change, December 2006 constitutes a decisive step in its search to respond to immediate and urgent needs for adaptation to negative effects of climate change. In this report, six priority adaptation options to climate change are included. These are:

- An Integrated Water Resource Management;
- Setting up an information systems to early warning of hydro-agro meteorological system and rapid intervention mechanisms;
- Promotion of non-agricultural income generating activities;
- Promotion of intensive agro-pastoral activities;
- Introduction of species resisting to environmental conditions;
- Development of firewood alternative sources of energy.
- Electricity falls within category number 6. The alternative production of energy is on the use of methane gas from Lake Kivu, developing hydroelectricity, using peat, photovoltaic solar energy, biogas, using improved stoves/ovens and the production of fuel from biomass.

### 2.5.2. Tanzania

The main international conventions dealing with environment and their status in Tanzania are listed in Table 2-3. World Heritage Sites in the Tanzania are listed in Table 2-4, while Ramsar Sites in Tanzania are listed in Table 2-2.

**Table 2-3 Status of Principal International Conventions - Tanzania**

| Convention/Protocol | United Republic of Tanzania |
|---|---|
| Convention on Biological Diversity (SBD) | Adopted in May 1992 |
| The Climate Chge Convention | Adopted in June 1992, Ratified March 1996 |
| Convention concerning Protection of Workers against Occupational Hazards in the Working Environment due to Air pollution, Noise and Vibration | Adop1977ted in June |
| Basel Convention on trans-boundary movements of hazardous wastes and environmentally sound management of hazardous wastes | Adopted in April 1993 |
| Stockholm convention on Persistent Organic Pollutants (POPs). | |
| United Nations Convention to Combat Desertification (UNCDD) | Adopted in 1994 |

Other conventions include:

- The Convention on Biological Diversity (CBD) has been ratified. A major objective of the Convention is to ensure the conservation of biological diversity and the sustainable use of its components.
- Tanzania has signed, but not ratified, the Convention on the Conservation of Migratory Species of Wild Animals (CMS). The objective of the Convention is to conserve those species of wild animals that migrate across national boundaries.
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has been ratified by Tanzania. It seeks to ensure that the international trade in species of wild fauna and flora does not threaten survival in the wild of the species concerned.
- Tanzania has ratified the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).

During project development, the project may have in one-way or another trigger the above mentioned convention, therefore the developer has to comply with the international conventions and agreements that Tanzania has signed or ratified and ensure the conservation of the environment as per the agreements of conventions. Tanzania have a number of World Heritage Site, Ramsa site as well as National Parks which, are related to international conventions which Tanzania ratified and others are in force as shown below:

**Table 2-4 World Heritage Site - Tanzania**

| States/Parties | World Heritage Sites (year of designation) |
|---|---|
| Tanzania | Ngorongoro Conservation Area (1979)<br>Ruins of Kilwa Kisiwani and Ruins of Songo Mnara (1981)<br>Serengeti National Park (1981)<br>Selous Game Reserve (1982)<br>Kilimanjaro National Park (1987)<br>Stone Town of Zanzibar (2000)<br>Kondoa Rock Art Sites (2006) |

**Source: UNESCO Web site (www.unesco.org).**

**Table 2-5 List of Ramsar Wetlands - Tanzania**

| States | Ramsar Wetlands |
|---|---|
| Tanzania | Malagarasi-Muyovozi Wetlands (Ramsar site No. 1024)<br>Lake Natron (Ramsar site No. 1080)<br>Kilombero Valley Floodplain (Ramsar site No. 1173)<br>Rufiji-Mafia-Kilwa Marine Ramsar Site (Ramsar site No. 1024) |

**Source: Convention on Wetlands of International Importance (18 January 2012).**

***National Parks and Protected Areas***

In Tanzania, a total area of 17,449 square kilometres has been designated as protected area. There are 12 National Parks and 2 proposed National Parks, 34 Game Reserves, 1 Conservation Area, 1 Biosphere Reserve, 3 World Heritage Sites and 43 Game Controlled Areas. National parks and protected areas are discussed in more detail in §4.3.10. No national parks or Ramsar wetlands will be affected by the project.

***Climate Change***

Tanzania ratified the **Kyoto Protocol to** the United Nations Framework Convention on Climate Change in August 2002.

Tanzania's National Adaptation Programme of Action (NAPA), January 2007, addresses urgent and immediate needs for adapting to the adverse impacts of climate change and identifies and promotes different activities to achieve this objective. The focus is on adaptation needs in the agriculture, water, energy, health and forestry sectors. For the energy sector it states that biomass and hydropower power are vulnerable due to reduced rainfall and high temperatures but encourages developing community based mini-hydropower.

The National Energy Policy**,** February 2003, also addresses greenhouse gases as follows:

***Renewable Energy***

- Policy Statement 36: "Establish norms, codes of practice, guidelines and standards for renewable energy technologies, to facilitate the creation of an enabling environment for sustainable development of renewable energy sources".
- Policy Statement 38: "Ensure inclusion of environmental considerations in all renewable energy planning and implementation, and enhance co-operation with other relevant stakeholders".
- Policy Statement 39: "Support research and development in renewable energy technologies".

***Energy Efficiency and Conservation***

- Policy Statement 49: "Enhance energy efficiency and conservation initiatives in all sectors".
- Policy Statement 50: "Ensure energy audits in industries, particularly the energy intensive ones".

## 2.6. REGIONAL INSTITUTIONS

Emerging regional development structures that cooperate actively with the Nile Basin Initiative (NBI) and NELSAP include the following:

- African Union (AU);
- New Partnership for Africa's Development (NePAD);
- East African Community (EAC – five member states);
- Southern Africa Development Community (SADC – 14 member states);
- Common Market of Eastern and Southern Africa (COMESA – 20 member states);
- Economic Community of the Great Lakes Countries (CEPGL) – three member states;
- Inter-Governmental Authority for Development (IGAD – seven member states).

In 2006, the East African Community states adopted the Protocol on Environment and Natural Resources Management. The objectives of this Protocol are to promote sustainable development and sustainable utilization of environment and natural resources and to promote the cooperation of the States in the management of those resources including those that are transboundary. The Protocol promotes development and harmonisation of policies, laws and strategies for environment and natural resources management to support sustainable development including the Environmental Impact Assessment regulations and policies. The Protocol established the Sectoral Committee on Environment and Natural Resources (EAC Protocol).

There is also an IUCN supported programme for capacity enhancement for EIA in East Africa, possibly the most important on-going activity in the region in terms of development of EIA practice and regulation.

## 2.7. COMPARISON OF ESIA PROCEDURES AND GAP ANALYIS

The Table 2-5 overleaf provides a comparison of the ESIA procedures in Rwanda, Tanzania and for the World Bank.

The Tables 2-5 and 2-6 provide the gap analysis of national policies and legislation compared with the policies of the World Bank.

### Table 2-6 Comparison of ESIA Procedures

| | Procedure | Rwanda[1] | Tanzania[2] | World Bank[3] |
|---|---|---|---|---|
| 1 | **Initiation** | Developer submits Project Brief (PB) to Rwanda Environmental Management Authority (REMA). | Developer or proponent submits a Project Brief to the National Environmental Management Council (NEMC). | At PCN stage, the ISDS establishes project planning and review needs under the 10 safeguard policies. |
| 2 | **Screening** | Based on the PB, REMA determines the level of EIA required based on established screening criteria. If PB identifies adequate mitigation measures, the need for an EIA may be eliminated, and the project approved with or without implementation conditions. Possible impact levels (ILs):<br>1. Minimal adverse impacts. No further analysis needed.<br>2. Impact mitigation and management can be readily incorporated into project. Full EIA not required, but some assessment needed.<br>3. Full EIA required.<br>Where significant transboundary effects are expected, Minister notifies other country(s) and provides opportunity for them to participate in the EIA process. | Types of projects requiring EIA are specified in Schedule 3 of the EMA (S.81 (1)). Dams are included. | In the PCN-stage ISDS, a project is classified as EA category A, B or C so that appropriate studies are undertaken proportional to potential risks and to direct, and, as relevant, indirect, cumulative, and transboundary impacts. Category A projects, require full EAs. Category B projects require EAs and/or EMPs. Strategic EA is required as needed for sectoral or regional initiatives. |
| 3 | **Scoping** | For IL-2 and IL-3 projects, developer prepares Scoping Report, for REMA review, that addresses main issues to be studied and EIA methods, and provides information needed by communities to participate in the EIA.<br>Based on Scoping Report and public comments on it, TOR approved by REMA are sent to developer as authorization to begin EIA study. | Based on examination of a Project Brief, the NEMC agrees with developer on issues that must be addressed; who must be consulted; methods of data collection and analysis; and any other matter in determining the scope of an EIS (S.85(1)). | Carried out during preparation of study TOR, based on PCN-ISDS requirements. Possible scope includes potential impacts on the physical, biological, and socio-economic environments, including cumulative, transboundary and global concerns, and potential impacts on human health and safety. EAs include consideration of other environmental safeguard issues (natural habitats, pest management, physical cultural property, and forests). Involuntary resettlement and indigenous people issues are addressed through other instruments according to OP 4.12 and OP 4.20. |
| 4 | **EA Studies** | Developer is responsible for EIA preparation using experts approved by REMA. Result is an Environmental Impact Report (EIR). Developer may add an addendum to the EIR prepared by the EIA expert that proposes specific changes in mitigation and monitoring measures. | Proponent or developer required to have EIA study done at his own cost (S.81(1)). | Borrower is responsible for getting EA documents prepared for WB review and clearance, and for similar national reviews and approvals. WB normally gives "no objection" for consultant selection. WB clearance required before project appraisal. |

[1] Based on draft "General Guidelines and Procedure for Environmental Impact Assessment, April 2006" and draft "Environmental Impact Assessment Regulations, 2006".
[2] Based on "The Environmental Management Act, 2004".
[3] Based on World Bank OP 4.01 Environmental Assessment (January 1999) and operational principles described in OP 4.00 (March 2005).

### Table 2-6 Comparison of ESIA Procedures *(Continued)*

| | Procedure | Rwanda | Tanzania | World Bank |
|---|---|---|---|---|
| 5 | **Legal and Institutional Setting** | EIR must show that a proposal is in line with policies, laws, institutional framework and development strategy of Rwanda. | Not specifically addressed. | EA studies assess the adequacy of the applicable legal and institutional framework, including applicable international environmental agreements, and confirm that they provide that the cooperating government does not finance project activities that would contravene such international obligations. |
| 6 | **Consideration of Alternatives** | During EIA studies, alternatives need to be analyzed to find feasible ways to prevent or minimize impacts while meeting project objectives. “No project” alternative should also be analyzed. | Not specifically addressed. | EA studies assess feasible investment, technical, and siting alternatives, including the "no action" alternative, potential impacts, feasibility of mitigating these impacts, their capital and recurrent costs, their suitability under local conditions, and their associated institutional, training and monitoring requirements. |
| 7 | **Environmental Standards** | Not specifically mentioned. | Minister may make regulations and guidelines on how EIA is to be conducted. | Where applicable to the type of project being supported, EAs normally apply standards in the Pollution Prevention and Abatement Handbook (PPAH), and justify deviations when alternatives to measures set forth in the PPAH are selected. |
| 8 | **Environmental Management Plan** | EIRs must be accompanied by an EMP. | Falls under the NEMC responsibility | An Environmental Management Plan (EMP) is an essential element of all EA studies, including roles, responsibilities and implementation budget. The purpose of the EMP is to prevent and, where not possible to prevent, at least minimize or compensate for, adverse project impacts and enhance positive impacts through environmental management and planning. An EMP includes the proposed mitigation measures, monitoring, institutional capacity development and training measures, an implementation schedule, and cost estimates. |
| 9 | **Stakeholder Participation** | Consultation with affected communities required during EIA studies.<br>Formal public hearings required for IL-3 EIRs before decision-making process begins. IL-2 EIRs may be exempted. EIRs made publicly available before hearing.<br>Public have a right to participate in EIA process. Can contribute information and advice during scoping and public hearings. | NEMC agrees with developer on who must be consulted during EIS preparation (S.85(1)).<br>When it receives and EIS, NEMC notifies the public of the place and time for review of the document, and submitting written comments; and solicits comments from affected people (S.89(2)).<br>NEMC may convene public hearings to contribute to an EIS review (S.90(1)).<br>Decisions of Minister may be appealed to Environmental Appeals Tribunal (S.95). | Stakeholder consultation is required on EA TOR for Category A projects, and on draft final report for A and B projects. Generally, stakeholders, including project-affected groups and local nongovernmental organizations, are to be consulted as early as possible in the preparation process to ensure that their views and concerns are made known to decision makers and taken into account. Consultations are to continue throughout project implementation as necessary to address EA-related issues that affect them. |

**Table 2-6 Comparison of ESIA Procedures** *(Continued)*

| | Procedure | Rwanda | Tanzania | World Bank |
|---|---|---|---|---|
| **10** | **Independence of EA** | Developer engages EIA expert to conduct EIA studies and prepare the EIR. Developer may prepare an EIR addendum to include with EIR submission to REMA. | EAs must be carried out by experts registered with the NEMC (Environmental Management Act of 2004). | For Category A projects, the EA cannot be undertaken by the same party preparing the feasibility study. Independent advisory panels are normally prescribed during preparation and implementation of projects that are highly risky or contentious or that involve serious and multi-dimensional environmental and/or social concerns. |
| **11** | **Contribution to Project Planning and Design** | EIA is intended to ensure that projects take the necessary prevention, mitigation and monitoring steps to safeguard them from the high costs of environmental remediation if environmental damage occurs. | Not specifically addressed. | To contribute to project planning and design, EAs provide measures to link the environmental assessment process and findings with studies of economic, financial, institutional, social and technical analyses of a proposed project. |
| **12** | **Subprojects** | Not specifically mentioned. | Not specifically addressed. | Where specific investments not known at project appraisal, an ESMF is required to establish the roles, responsibilities and procedures for subproject identification, preparation, review, approval and implementation according to the principles of OP 4.01. |
| **13** | **Disclosure of EA Documents** | Project Briefs and Scoping Reports can be commented on by public, but procedures are not specified. When there are public hearings on IL-2 and IL-3 EIRs, reports are made available for prior public review. | EA documents are kept in a public registry and contents may be searched upon payment of a fee (S.85(2).<br>When it receives and EIS, NEMC notifies the public of the place and time for review of the document, and submitting written comments; and solicits comments from affected people (S.89(2)). | EA documents must be disclosed in-country and through the Bank InfoShop before project appraisal in an accessible place and in a form and language understandable to key stakeholders. |
| **14** | **Decision-making** | Developer submits EIR, EIR Addendum (if any), and EMP to REMA for review. IL-3 and, perhaps IL-2, EIRs are subjected to a formal public hearing and post-hearing consultation. REMA writes Public Hearing Report (PHR). Formal REMA review begins when EIR, EMP, EIR Addendum, and PHR are complete. REMA with Lead Agency decides to approve project or not, and issues Record of Decision. If project approved, REMA issues EIA Certificate of Authorization, with or without conditions embodied in an Implementation and Operations Order (IOO). If REMA rejects a project, developer can appeal to the Minister. Upon project approval, developer pays administrative fee to the environmental fund, determined as a percentage of the investment cost. | NEMC reviews EIS and recommends decision to Minister. If EIS approved, Minister issues EIA Certificate, with or without conditions (S.92(1)). If EIS not approved, Minister recommends to licensing authority that activity not be licensed. EIA Certificate can be revoked if conditions are not satisfied.<br>Minister's decision may be appealed to the Environmental Appeals Tribunal by any person who is aggrieved.<br>Minister may delegate authority to Director of Environment, local government authorities, and sector ministries. | Draft EAs must be reviewed, approved and disclosed before project appraisal by the World Bank. Loan/grant agreements between the WB and Borrower include specific commitments by the Borrower to implement EA requirements. |

### Table 2-6 Comparison of ESIA Procedures *(Continued)*

| | Procedure | Rwanda | Tanzania | World Bank |
|---|---|---|---|---|
| **15** | **Follow up** | Developer is responsible for ensuring mitigation measures and IOO conditions are implemented. Both REMA and developer are responsible for monitoring and auditing to ensure compliance. | Developer or proponent is responsible for implementing the terms of the EIA Certificate.<br>NEMC is responsible for monitoring and auditing project implementation. Where non-compliance with EIA is found, holder of EIA Certificate may be required to take remedial measures or pay a fine. An EIA Certificate can be revoked. | Borrower is responsible for ensuring results of EA, as captured in the EMP, and is implemented. Bank supervises. |

### Table 2-7 World Bank – Rwanda Gap Analysis for Resettlement and Compensation

| World Bank OP 4.12 | Rwanda Legislation | Recommendations to address gaps |
|---|---|---|
| Involuntary resettlement should be avoided wherever possible, or minimized, exploring all alternatives. | Rwanda has no involuntary resettlement policy per se. RAPs are prepared when required by funding agencies. Expropriation law does not stipulate that displacement should be avoided wherever possible. | Ensure that resettlement issues are fully recognized and dealt with at the project planning and design stages in order to avoid or minimize displacement. This is particularly important in a context of land scarcity. |
| Resettlement programs should be sustainable, include meaningful consultation with affected parties, and provide benefits to the affected parties. | There is no requirement in legislation that resettlement programs should provide sustainable benefits to affected parties (although this is inferred in the Land Use Master Plan). | Ensure that resettlement plans are integrated into long term regional development plans (as well as the Land Use Master Plan in Rwanda). |
| Displaced persons as well as “host communities” should be assisted in improving their livelihoods, or at least in restoring them to their previous levels. | There is no stipulation that displaced persons have livelihoods improved or at least restored to former levels (though this corresponds to a key objective of the National Poverty Reduction Strategy). | Ensure that levels of compensation, assistance and benefits are in line with international standards. |
| Displaced persons that are eligible to assistance include those affected by loss of shelter, those affected by loss of land and those affected by the loss of access to resources that support their livelihoods. | Displaced persons that are eligible to assistance are limited to titled and customary landholders rather than to all land users. | Ensure that all affected land users receive appropriate assistance and benefits, including unauthorized occupants (“squatters”), laborers and persons affected by the loss of access to resources that support their livelihoods. |
| Eligibility criteria: Criteria are defined as follows: a) those who have formal rights to land, including legally recognized customary or traditional rights; b) those who do not have formal rights to the land but have a claim to such land or assets that can be recognized through a process identified in the resettlement plan; c) those who have no recognizable right or claim to the land they are occupying or the assets they are using. Eligibility of affected parties is determined on the basis of a census. The cut-off date for eligibility is based upon the date of the census. | Expropriation law defines eligibility as both formal (legal) and informal (customary) owners of lands to be expropriated. However, it does not recognize the eligibility of all occupants or users of the land. Eligibility of affected parties is determined on the basis of a socio-economic census. There is no provision for a cut-off date for eligibility. | Ensure that all users of affected lands (including unauthorized occupants or users, laborers or persons affected by the loss of access to resources) are included as affected parties in the census survey. Implement cut-off procedures based upon the date of the census survey. |

**Table 2-7 World Bank – Rwanda Gap Analysis for Resettlement and Compensation *(Continued)***

| World Bank OP 4.12 | Rwanda Legislation | Recommendations to address gaps |
|---|---|---|
| Consultation: Displaced persons should be informed of their rights and meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs, including the selection of appropriate relocation sites and compensation and/or assistance packages. | There is no provision for affected persons to participate in resettlement planning and implementation. Expropriation law provides for displaced persons being informed of the process underway and for negotiations if necessary between the expropriated and the expropriating party. | Implement resettlement consultation procedures in conformance with international standards. Displaced persons and members of "host communities" should be informed of their rights and consulted during resettlement and compensation planning and during implementation of the resettlement program. |
| Grievance mechanisms: Appropriate and accessible grievance mechanisms must be established. | Ministerial order No. 001/2006 and Article 53 of the Organic Land Law both outline grievance mechanisms in relation to physical and economic displacement which meet OP 4.12 requirements. | Ensure that informal and easily accessible grievance mechanisms are in place and that affected parties benefit from efficient processes for addressing grievances. |
| Compensation and relocation: Preference should be given to land-based compensation and relocation options for displaced persons whose livelihoods are land-based. Displaced persons to be provided with at least equivalent housing, housing sites and/or agricultural land PRIOR TO project implementation and to be assisted during and after relocation. For cash compensation, displaced persons to be provided with compensation at full, not depreciated, replacement cost for losses of assets attributable to the project. | 8. There is no requirement under Rwandan law to place preference on non-cash based compensation. There is no requirement that affected parties be fully compensated and relocated prior to project implementation. There is no requirement that cash compensation be provided at full, non-depreciated, replacement cost for losses of assets attributable to the project. | Preference to be given to land-based compensation and relocation options for displaced persons whose livelihoods areland-based. Affected parties to be fully compensated and relocated PRIOR TO project implementation. Assistance to be provided to displaced persons both during physical relocation and during the transition period leading up to the sustainable restoration and improvement of livelihoods. Cash compensation to be provided at full, non-depreciated, replacement cost for losses of assets attributable to the project. |
| Vulnerable persons: Special assistance must be provided to vulnerable persons in the resettlement process. These may include the handicapped, the elderly, women, widows, children, members of disadvantaged minority groups or indigenous peoples, etc. | 9 There is no requirement under Rwandan law to provide special assistance to vulnerable persons in the expropriation process (though this corresponds to a key objective of the National Poverty Reduction Strategy). | Special assistance to be provided to vulnerable persons both during physical relocation and during the transition period leading up to the sustainable restoration and improvement of livelihoods. |
| Monitoring and evaluation: Adequate monitoring and evaluation of resettlement activities and outcomes must be undertaken. This should be based on performance indicators and must be carried out over a reasonable length of time (typically at least 5 years). In the event where the livelihoods of affected parties have not improved or at least been restored to their former levels, measures must be taken to address identified deficiencies. | There is no requirement under Rwandan law to undertake monitoring and evaluation of the outcomes of the expropriation process (though this corresponds to a key objective of the National Poverty Reduction Strategy). Monitoring is limited to ensuring that displaced persons have been compensated as required under the law. | Independent monitoring and evaluation of resettlement activities and outcomes to be undertaken on the basis of performance indicators and over a reasonable length of time (at least 5 years). In the event where the livelihoods of affected parties have not improved or at least been restored to their former levels, measures to be taken to address identified deficiencies. Trust fund to be set up to finance such measures. |

**Table 2-8 World Bank – Rwanda Gap Analysis for Resettlement and Compensation**

| Resettlement Topic | National Legislative Requirements | WB Policy | Gap | Strategy & Responsibility |
|---|---|---|---|---|
| Timing of Compensat-ion<br>Payment | Prompt payment within 6 months after land has been acquired | Compensation to be paid prior to project implementation, before the impact occurs | Standard Operating Procedure (SUST006) has guided the compensation process, and details the valuation and payment schedule process, which typically (assuming there are no disputes, and govern't valuers and village officials are available) can process payments promptly. | Affected parties to be fully compensated prior to project implementation |
| Calculation of Compensat-ion | Mining Act (1998) requires 'fair and reasonable compensation for crops, trees, buildings, stock or works '<br>Land Act (1999) says that comp. for land should be based on market value of the real property. It also provides for additional compensation, inclu:<br>Disturbance allowance, transport allowance, loss of profits, accommod. allowance, cost of acquiring or getting land, and any other loss or capital expenditure incurred | Cash compensation should be sufficient to replace the lost land and other assets at full replacement cost, which is market value plus transaction costs | Recent land cost study has been completed, and indicates that replacement land costs have risen.<br>Crop rates for 2010 released in January. Compensation rates for other assets (i.e. structures) are calculated by a Registered Valuer, and are by law, to reflect current market value. | NMGM should undertake their own investigation to verify the Valuer's compensation rates are sufficient for someone to replace their structure. |
| Moratorium<br>(Squatters) | Village Land Act 1999 authorizes Village Council right to hold and manage land; holdings of individuals can be by leasehold (for a period of time) or by customary lands; allocation of land, or grant of customary right, requires approval of village council | Establish a cut-off-date for eligibility for inhabitants regardless of tenure. Information regarding the cut-off date will be well documented and disseminated throughout the project area.<br>WB recognizes both those who have formal legal rights to the land prior to cut-off date, and those who may not have formal legal rights (i.e. squatters), but have a legitimate claim to land/assets before the established cut-off date. Squatters would be entitled for compensation for improvements and livelihood restoration (or, if physically relocated, squatters would be entitled to assistance in order to find another location) | Establishing cut-off dates for households eligible for a relocation house has not been agreed to by all stakeholders, nor clearly communicated throughout the affected area. | Develop negotiating strategy for reaching agreement with the Nyangoto Town Council (NYT) on the cut-off date for eligibility.<br><br>Develop communication strategy for posting and disseminating this information to affected households and in communities |

**Table 2-8 World Bank – Rwanda Gap Analysis for Resettlement and Compensation** *(Cont.)*

| Resettlement Topic | National Legislative Requirements | WB Policy | Gap | Strategy & Responsibility |
|---|---|---|---|---|
| Resettlement | | Physically displaced persons will be offered a choice of replacement properties of equal or higher value, equivalent or better characteristics and advantages of location and security of tenure. Compensation in kind (= land based option) is preferred option but cash compensation at full replacement value where appropriate. Based on consultation with such displaced persons, the client will provide relocation assistance sufficient for them to restore their standards of living at an adequate alternative site.<br>The Resettlement Plan will be designed to mitigate the negative impacts of displacement; identify development opportunities; develop a resettlement budget and schedule; and establish the entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable | Security of tenure: title deed not provided<br><br>Option of people eligible for relocation house, taking the equivalent in cash has been requested by the NTC and is being considered. | Legal officer needs to investigate and report to NMGM on the process and cost of acquiring legal tenure for relocation houses.<br><br>Safeguards to prevent homelessness, landlessness and impoverishment, particularly for women and children as a result of offering cash/self build option need to be developed and put in place. |
| Baseline | | Client will carry out a census with appropriate socio-economic baseline data to identify the persons who will be displaced/impacted by the project (including host community), to determine who is eligible for compensation and assistance and to discourage inflow of people who are ineligible for benefits; | Census of households to date has not discouraged influx;<br>Boundaries of land take area for LOM, have not been finalized by Mining department, and could delay Rama 4 census and socio-economic survey | Lands Unit needs to develop an influx management strategy<br><br>Mine Management needs to formally approve boundaries of land take areas for LOM. |
| Livelihoods & Resettlement Assistance | | Provide additional targeted assistance (e.g. credit facilities, training, or job opportunities) and opportunities to improve or restore their income earning capacity, production levels and standards of living to economically displaced persons whose livelihoods or income levels are adversely affected.<br><br>Develop a clear strategy and a set of projects for livelihood restoration of displaced persons and households. | Targeted livelihoods strategy not yet developed; Livelihoods Officer being hired;<br><br>Not clear how CR team (local content officer, cd officer) see affected households as a priority for their program | Livelihoods Officer (LO) needs to review all socio-economic reports on the affected areas, and draft a livelihoods plan for review by Lands Unit, followed by a presentation to Negotiating Council.<br><br>LO needs to work with other CR personnel to ensure relocated/compensated households are a priority for programs and assistance.<br><br>Adequate funding for livelihoods programs and assistance needs to be approved. |

# 3. PROJECT DESCRIPTION

## 3.1. PREAMBULE

### 3.1.1. Type of Project

The Project is a Category A project with respect to the World Bank's OP/BP 4.01 for Environmental Assessment. The dam and powerplant component of the Rusumo Falls Hydroelectric Project comprises the construction and operation of a hydroelectric scheme comprising the dam structure (concrete gravity dam) and associated structures which include: water intake; head race tunnel; manifolds and penstocks; powerhouse; tail race channel and substation.

The dam and powerplant will function as a Run-of-River scheme and thus will not create a water storage reservoir upstream of the dam or change the downstream river hydrology.

It should be noted that the assessment of the Transmission Lines component of the Rusumo Falls Hydroelectric Project is not included in this report and the ESIA and RAP for the Transmission Lines have been issued as separate reports. The substation represents the point of interface between the Dam and Powerplant component and the Transmission Lines component. The substation is not included in the ESIA for the dam and powerplant component, but is included in the ESIA for the Transmission Lines.

### 3.1.2. Alternatives Considered

The alternatives that have been assessed during the project preparation are:

- Alternative location;
- Alternative designs, and
- Alternative technology.

The alternative designs that have been studied comprise:

- Full Development Scheme;
- Intermediate development Scheme, and
- Run-of-River Development Scheme.

In February 2012, based on the ESIA for the Intermediate Development Scheme, the participating governments selected the Run-of-River alternative with a water level of 1,320 metres asl as the preferred development option given that it minimizes environmental and social impacts of the project, and provides for the least cost implementation of the ESMP and RAP. A detailed assessment of the alternatives is provided in Chapter 5.

### 3.1.3. Need for the Project

Lack of electricity is a key constraint hampering economic development and livelihood improvement in Burundi, Rwanda, and Tanzania. Current electricity demand by far exceeds supply, load shedding is chronic. Most urban and rural households rely on biomass for their cooking and heating needs, leading to deforestation and soil erosion.

The lack of access to reliable power supply services hampers countries' growth potential, contributes to the poverty and isolation of rural population, and affects provision of other key services, such as water supply, health, and education. It is also a major constraint for commercial and industrial development. The deficit in power supply is rapidly increasing, despite governments efforts.

The investments in new power generation plans, transmission/distribution lines and substations as well as the rehabilitation of existing facilities are greatly needed. Regional power development and interconnections through the East Africa Power Pool and South Africa Power Pool along with national thermal and national hydro plants are expected to make major contribution to filling such significant and rapidly increasing deficits in power supply.

The Rusumo Falls project will play a role in increasing regional generation and transmission links to help meet national demand.

### 3.1.4. Situation

The dam and powerplant are planned to be situated at the Rusumo Falls where the Kagera River forms the boundary between Tanzania and Rwanda, and about two (2) kilometres downstream of the river's confluence with the Ruvubu River.

The location coordinates for the dam are as follows:

WGS 84 – UTM system: 36M 253,445 mE, 9.736,333 mN

SR 92 system: X = 587,075 E Y=9,736,452 N

Situation maps at country, regional and local scale are provided in Figure 3-1, Figure 3-2 and Figure 3-3 on the following pages.


**Figure 3-1 Project Situation Map – Country Scale**

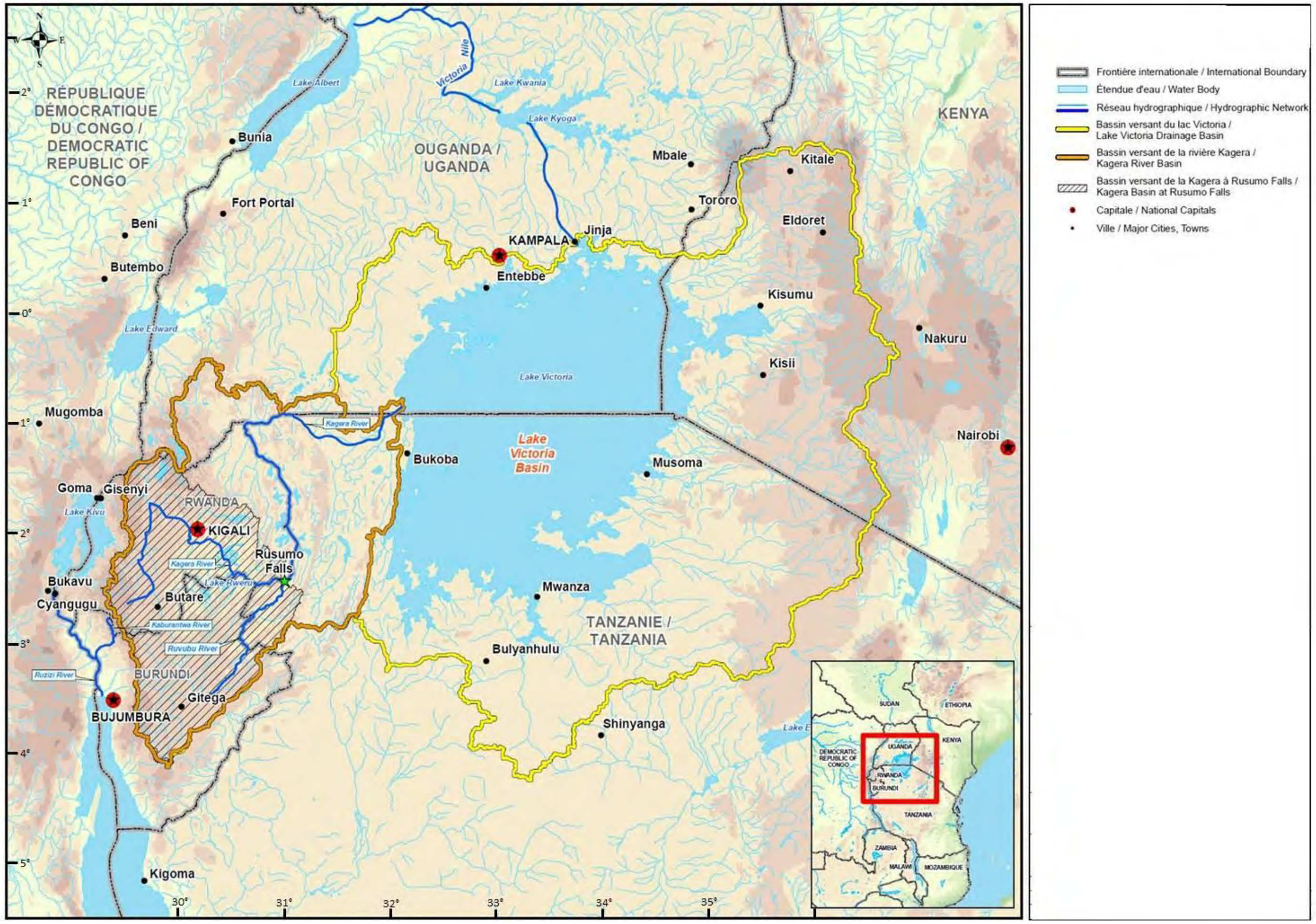
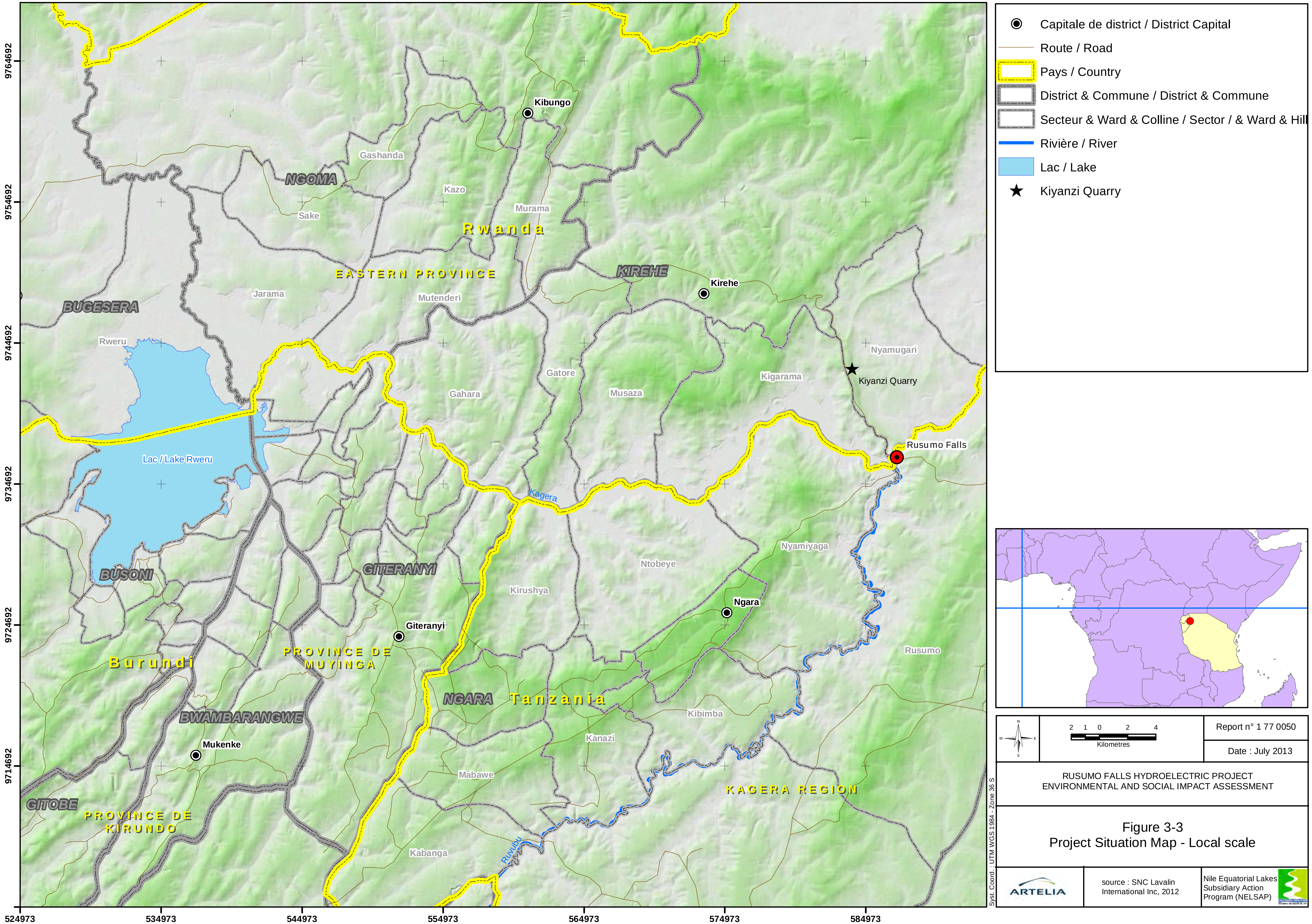



**Figure 3-2 Project Situation Map – Regional Scale**

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RUSUMO FALLS HYDROELECTRIC PROJECT
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Figure 3-3
Project Situation Map - Local scale

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

## 3.2. OVERVIEW AND LAYOUT

The dam and power station would be situated at the Rusumo Falls where the Kagera River forms the boundary between Tanzania and Rwanda, and about 2 kilometres downstream of the river's confluence with the Ruvubu River.

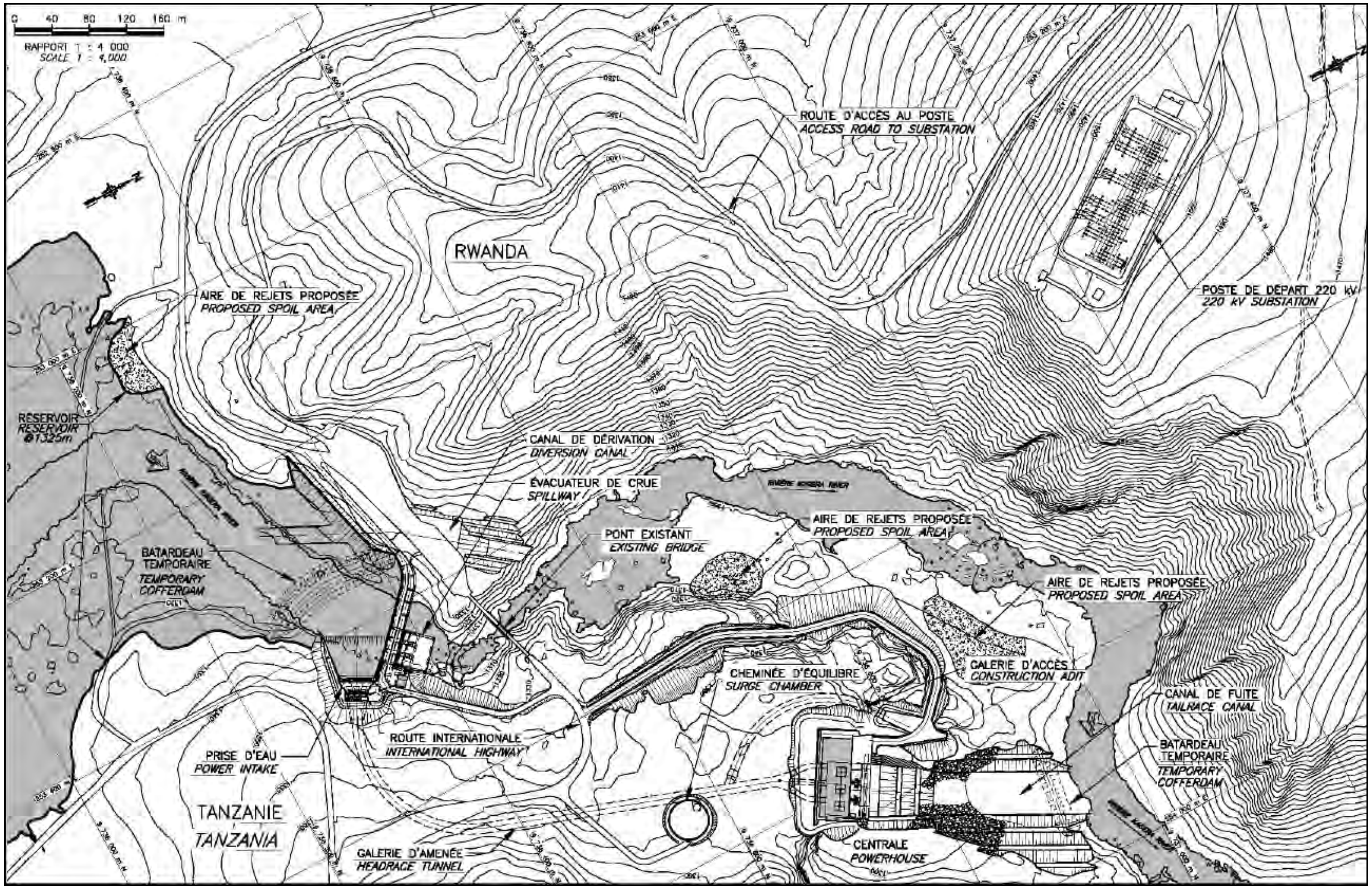
The dam will be a concrete gravity dam and will be located just upstream of the falls and oriented perpendicular to the river channel. The power facilities, except for the substation, are located entirely on the right bank of the Kagera River in Tanzania, while the river diversion works are located on the left bank, in Rwanda. The main power features comprise: an intake structure, a headrace tunnel, a surge tank, a tunnel trifurcation, a surface powerhouse, and a tailrace channel.

This chapter provides a description of the structures and operating modes based on the feasibility study for the IDS carried out by SLII in 2011/12. The structures and activities for the RoR scheme will be much the same as for IDS, and environmental and social impacts for the RoR scheme can be accurately predicted from the design of the structures for the IDS. The ESIA study has confirmed that there will be no need to revise the design of the facilities due to the findings of the study. The main plant characteristics are summarized in the Table and Figure below.

**Table 3-1 Rusumo Falls Hydroelectric Plant Data Sheet**

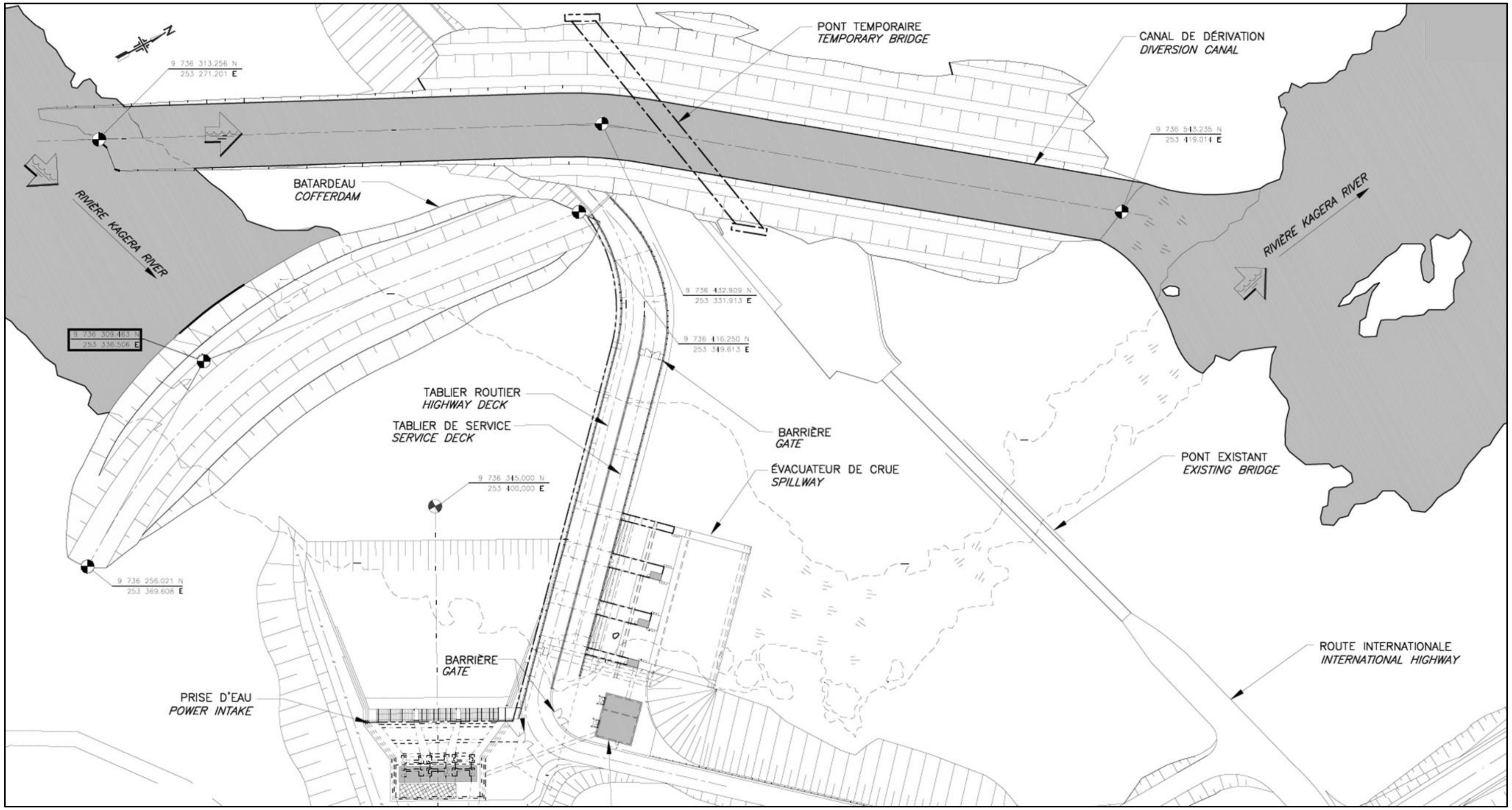
| Data | Unit | Value |
|---|---|---|
| Storage Reservoir | | |
| Full Supply Level (FSL) at the dam | m.a.s.l. | 1,320 |
| Powerhouse | | |
| Number of Units | | 3 |
| Type | | Kaplan, vertical axis |
| Rated Discharge | $m^3/s$ | TBD |
| Speed | rpm | TBD |
| Generators | | |
| Number of Units | | TBD |
| Rated Power | MW | TBD |
| Power Factor | | TBD |
| Output Voltage | kV | TBD |
| Energy / Power | | |
| Maximum Plant Total Discharge | $m^3/s$ | ~ 250 |
| Installed Capacity | MW | Between 75 – 80 |
| Average Power | MW | ~ 45 |
| Firm Energy | GWh/yr | ~ 250 |
| Secondary Energy | GWh/yr | ~ 140 |
| Average Energy | GWh/yr | ~ 400 |
| Capacity Factor | % | ~ 60 |

**Source SLII 2012 TBD: To be determined during the detailed design studies**




Source: SLII, 2012

**Figure 3-4 Overall Layout of Project Structures**




**Source: SLII, 2012**

**Figure 3-5 Detail of Layout of Project Structures**


**Source: SLII, 2012**

**Figure 3-6 Layout of Project Structures in Relation to Natural and Socioeconomic Environment**

## 3.3. DESCRIPTION OF PROJECT STRUCTURES

The characteristics of the project structures are described in the following paragraphs:

### 3.3.1. Dam and Spillway

The concrete gravity dam will be 15 metres in height creating a hydraulic head of about 32 metres at maximum water level estimated at 1,320 metres asl. The dam will be either a fixed crest overflow weir, or a gated system. The dam will be located just upstream of the falls and oriented perpendicular to the Kagera River channel. The axis is chosen at a point in the river where the length of the dam is the shortest. The dam will operate with a maximum normal water level of 1,320 metres asl. The structure will operate as a run-of-river, which means that there will be no storage of water and consequently there will be no impounding of a reservoir upstream from the dam.

The dam and other strutures will be designed specifically to withstand the expected seismic activity.

### 3.3.2. Water Intake

The water intake will be located on the right bank of the Kagera River (Tanzania side). A rock face will be excavated to develop the headrace tunnel portal and the concrete structure will be built in this excavation.

### 3.3.3. Headrace Tunnel

The headrace tunnel at the intake is aligned almost perpendicular with the right bank and parallel with the dam axis. The tunnel descends initially to provide maximum rock cover above the crown of the tunnel over the shortest possible distance. Once the headrace tunnel reaches a sufficient depth it changes direction almost 90 degrees in an easterly direction to continue in a straight line to the powerhouse.

### 3.3.4. Manifold and Penstocks:

Concrete manifold will make the transition between the headrace tunnel and the three penstocks. The three penstocks will extend approximately 30 metres from the manifold to the powerhouse.

### 3.3.5. Surge Chamber

A surge chamber upstream of the powerhouse will be excavated. The dimensions will be around 35 metres in height, and 40 metres in diameter, it will be above ground, circular, and unlined with no concrete walls.

### 3.3.6. Power House

The powerhouse is of the surface type. It is located on the south side of the rapids on the right bank of the Kagera River in the rock cliff that overlooks the Mitako basin (see Figure 3-6). The powerhouse will be seated on sound rock.

The criteria used to identify the best location for the powerhouse are influenced by the geology of the rock, the hydraulic head between the reservoir and the tailrace, the hydraulic losses caused by the length of the headrace tunnel and to a lesser extent the proximity of the surge tank to the powerhouse.

The powerhouse will comprise three turbines (Kaplan units) and three generators with a total maximum capacity of 80 MW. The powerhouse will also accommodate the service bay, mechanical and electrical equipment, oil room, cable and piping galleries, control room and offices. The overall dimensions of the building are around 90 metres by 30 metres. The generator step-up transformers will be located at the downstream side of the power station. Access to the powerhouse is provided by a roadway which is located on the downstream side of the powerhouse adjacent to the tailrace. The generator step-up transformers, located at the downstream side of the power station, are the largest one-piece load brought to the Project. The two transformers are of three-phase oil immersed outdoor type with natural/forced air cooled. The transformers are separated from each other by firewalls. The transformers are equipped with a retention bund capable of containing the totality of the transformer oil. The oil recuperation basin of each transformer should be connected to a common oil/water separation pit in order to recuperate the spilled oil and avoid environmental damage.

### 3.3.7. Tail Race Channel

The tailrace canal will be located in the Mitako basin and is oriented N-NE. The total length of the tailrace will be around 250 metres. The width will decrease from 55 to 45 metres.

### 3.3.8. Substation

The projected site for the substation is located in Rwanda on a summit plateau overlooking Kagera River left bank, downstream of the falls. The substation represents the point of interface with the Transmission Lines component of the Rusumo Falls Hydroelectric Project. The substation is not included in the ESIA for the dam and powerplant component, but is included in the ESIA for the Transmission Lines, which is issued as a separate report.

### 3.3.9. Temporary Structures and Facilities

The construction activities will require the installation of a number of temporary structure and facilities.

Temporary structures that are required for the deviation of the river to allow the dam, water intake, head race, powerplant and tail race to be constructed comprise the temporary river diversion channel and its cofferdam, the closure dike, tail race coffer dam and headrace access tunnel. These structure are described in §3.4 below.

The construction works will require the following temporary facilities to be created in the following areas:

- Contractor's works area, where workshops, storage areas and loading and unloading facilities will be located, ;
- Client's and Contractor's Construction offices and temporary camp area, and
- Concrete bashing and rock crushing area.
- Bridge crossing the diversion channel. Because the temporary diversion channel will cut off the international road leading to the existing bridge over the Kagera downstream from the Falls a temporary bridge spanning approximately 60 metres over the diversion channel will be required to make possible for the traffic to continue passing between Rwanda and Tanzania during construction.

The locations of the temporary facilities are indicted in Figure 3-8.

## 3.4. CONSTRUCTION ACTIVITIES

The construction activities described are expected to be as described in the following subsection.

### 3.4.1. Temporary River Diversion Works and Cofferdam

A total temporary diversion of the river is necessary for the duration of construction of the upstream structures. To minimise length the temporary diversion channel will be constructed on the left bank (Rwandan side of the river) and will comprise of a 265 metre long channel and a 167 metre long cofferdam. The diversion channel's intake is located 150 metres upstream from the falls while the outlet is located just past the downstream rapids.

At both banks, the upstream cofferdam will be constructed on residual soil or weathered rock. Therefore, all existing backfill material and loose soil found on the river banks within the footprint of the cofferdam will need to be removed prior to carrying out the construction works. The cofferdam is constituted of two rockfill shoulders and a clayey silt core. Geotextiles will be installed both on the upstream and downstream sides, and placed between the fine grained core material and coarse rockfill in place of a filter zone and additional transition zones typically required for stability purposes.

### 3.4.2. Closure Dike

Once the construction of the spillway (or alternatively, the powerhouse and tailrace) is completed, the dismantling of the upstream cofferdam and construction of the closure dike will be undertaken.

Though the main purpose of the closure dike is to prevent water from flowing through the diversion channel following completion of the powerhouse, it will also serve as fill for the road connecting the Rwandan customs to the dam, as well as a possible spoil area for the upstream cofferdam materials.

The closure dike will be made impervious by means of a concrete core wall located at the entry of the diversion channel, which is in line with the dam axis. The core wall consists of reinforced concrete.

The construction of the closure dike will require a cofferdam combined with dewatering in the form of conventional sumps and pumps in order to achieve dry working conditions. The cofferdam will be located in the upstream part of the diversion channel. Materials required for the construction of the diversion channel cofferdam could be taken from the existing upstream cofferdam, the latter having to be dismantled, at least partially, in order to permit the river to flow through the spillway or headrace tunnel.

### 3.4.3. Tailrace Cofferdam

In order to proceed with the excavation of the powerhouse and the tailrace channel in dry conditions, a cofferdam will need to be constructed.

The cofferdam is constituted of compacted, impervious colluvium or residual soil and crushed stone on the crest and downstream side for protection against run-off. Geotextile is placed between the residual soil and rockfill to prevent erosion of residual soil.

### 3.4.4. Access Tunnel

A tunnel is planned during construction to access the headrace tunnel and remove excavated material (construction adit). The proposed access tunnel is located on the right bank of the Kagera River. It extends from the rock cliff near the access road to the headrace tunnel. As for the headrace tunnel, the access tunnel is unlined and has an inverted D shape. Its height is 8 metres, its width is 6 metres and its length is some 215 metres.

## 3.5. SOURCE AND TYPE OF CONSTRUCTION MATERIALS

### 3.5.1. Impervious Material from Borrow Area 1

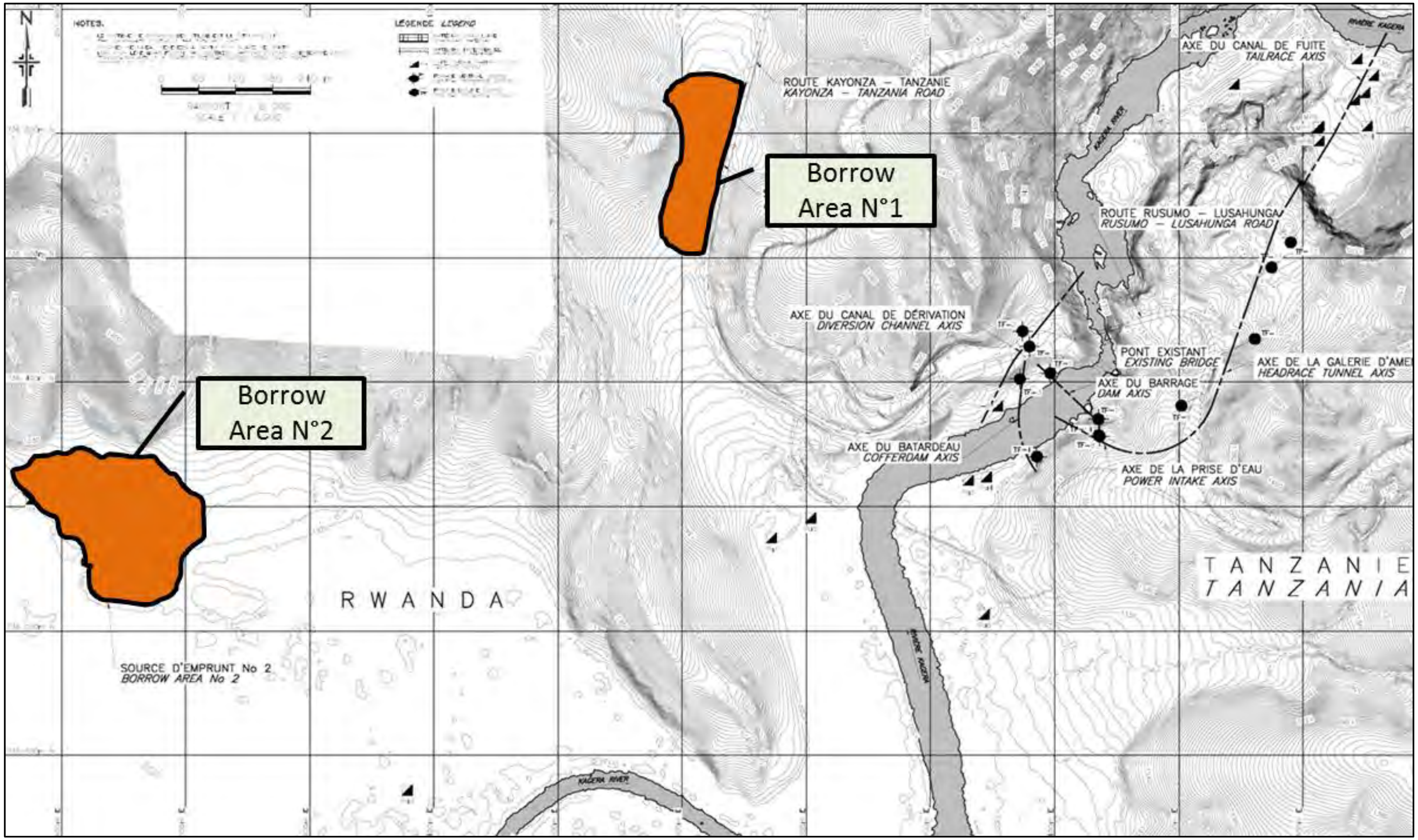
A source of low permeability material constituted of clayey silt (with an average clay content of 21.4%), named “Borrow Area 1”, suitable for the construction of water retaining earthfill structures is located in Rwanda along the international road connecting Kigali and Tanzania, at a distance of 1 kilometre from the border at the Project site. The area of interest stretches parallel to the existing road; it is approximately 200 metres by 100 metres; and it is covered by sparse to moderately thick vegetation. The volume of impervious soil that could be extracted from Borrow Area 1 is estimated at 25,000 cubic metres. The location of Borrow Area 1 is illustrated in the Construction Zone Map provided in Figure 3-7 on following page.

### 3.5.2. Coarse Aggregate from the Kiyanzi Quarry

A site, located at Kiyanzi (Rwanda), approximately 8 kilometres North West of the Rusumo Falls, is considered as a potential quarry (See Figure 3-3 for location). This potential quarry appears to be mostly constituted of quartzite and presents the advantage of being located sufficiently far away from the main road, thus limiting possible environmental and social impacts related to the site development. Moreover, the potential quarry is located on the edge of a valley and is overlain only by a thin cover of unsuitable weathered rock, which will facilitate quarrying. Before concluding that this rock could be used as aggregate for concrete production, a long-term Alkali-Aggregate Reaction (AAR) test should be carried out to demonstrate that the rock is non-reactive.

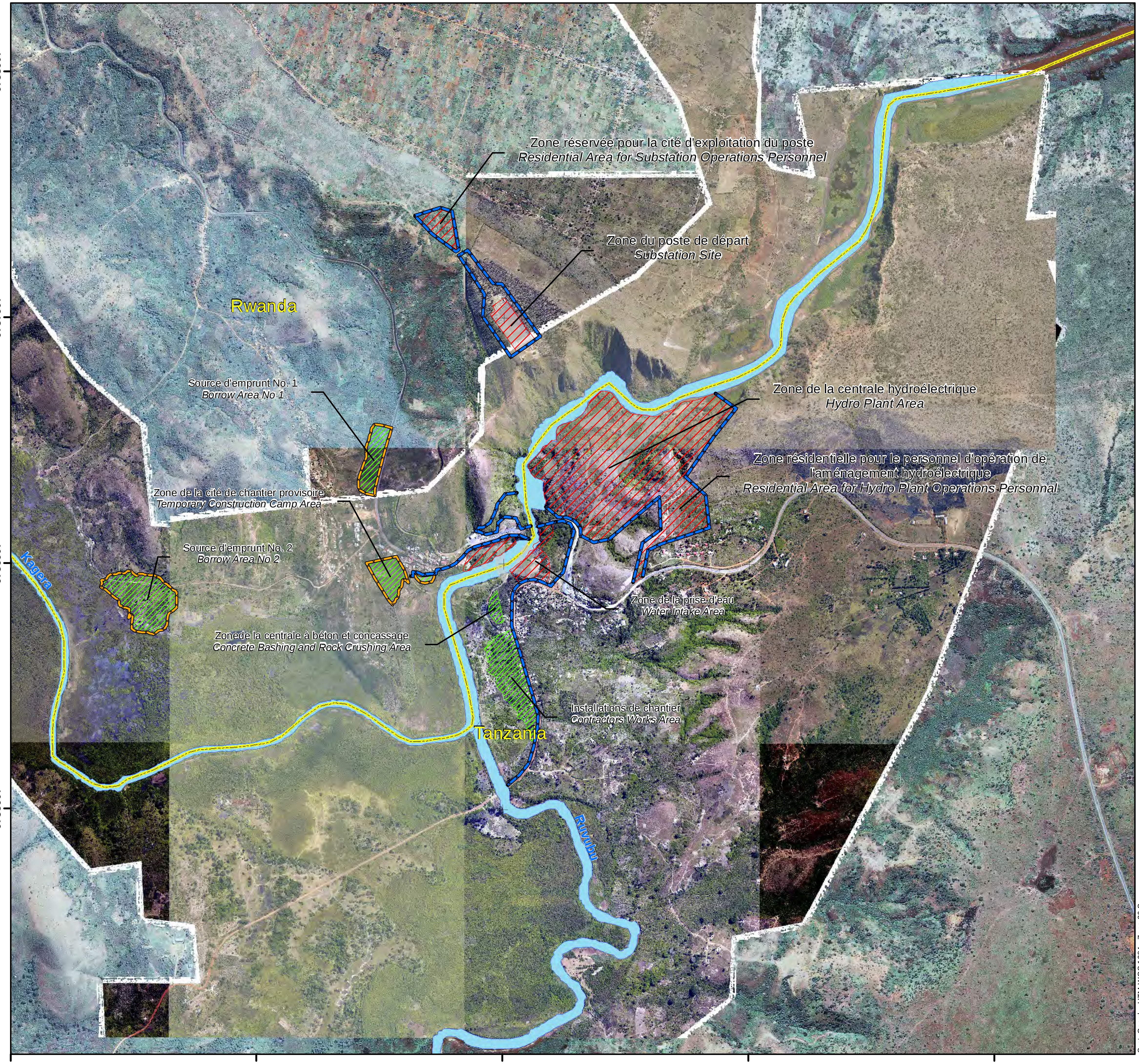
### 3.5.3. Fine Aggregate from Borrow Area 2

A source of fine aggregate, labelled “Borrow Area 2”, is located in Rwanda along an existing dirt track, approximately 2 kilometres South-West of the international border at Rusumo Falls, and 350 metres North of the Kagera River left shoreline. Borrow Area 2 is characterized by a flat topography with no significant variation in ground level. The area is covered by bushes and shrubs as well as banana trees. The area of interest is delineated to the North by the access path and hills, and to the South by a silty alluvium terrace. The proven volume of fine aggregate is evaluated to be in the order of 18,100 cubic metres. The location of Borrow Area 1 with respect to the Project location is illustrated in Figure 3-7 overleaf. A breakdown of the required quantities of excavation in rock and overburden materials for the main structures is given in the following Table.

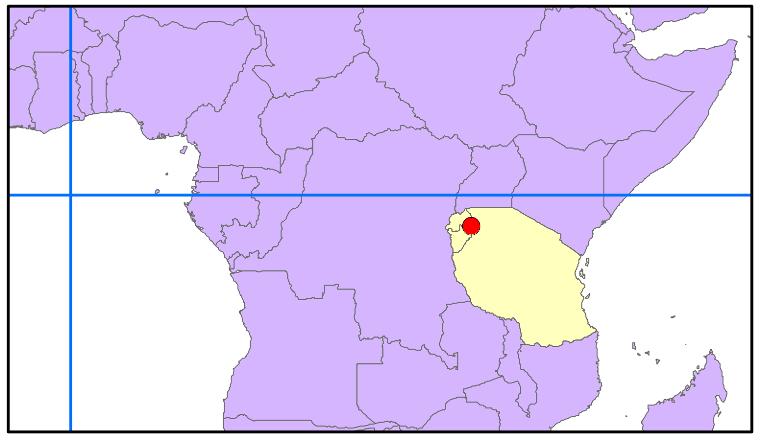



Source: SLII, 2012

**Figure 3-7 Location of Construction Material Borrow Areas**




- Clôture permanente / Permanent Fence
- Clôture temporaire pour zone de construction / Temporary Construction Site Fence
- Emprise permanente proposée pour les installations / Permanent Land Take Boundary
- Emprise des activités de construction / Boundary of Land Take for Temporary Works
- Pays / Country



150 75 0 150 300
Metres

Report n° 1 77 0050

Date : July 2013

RUSUMO FALLS HYDROELECTRIC PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Figure 3-8
Construction zones

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

**Table 3-2 Required Excavation of Rock and Overburden**

| Structure | Overburden Excavation ($m^3$) | Rock Excavation ($m^3$) |
|---|---|---|
| Dam and spillway | 6,100 | 6,400 |
| Water intake | 25,700 | 48,200 |
| Diversion Channel | 50,200 | 40,900 |
| Upstream Cofferdam | 4,000 | - |
| Headrace Tunnel | - | 85,000 |
| Surge Shaft | 1,000 | 57,000 |
| Powerhouse Building | 19,500 | 218,000 |
| Road to powerhouse | 15,900 | 40,000 |
| Tailrace channel | 120,300 | 64,500 |
| Switchyard | 5,000 | 50 |
| Power tunnel | - | 85,000 |
| Removal of cofferdams | 28,300 | |
| **TOTAL** | **278,000** | **650,000** |

### 3.5.4. Concrete

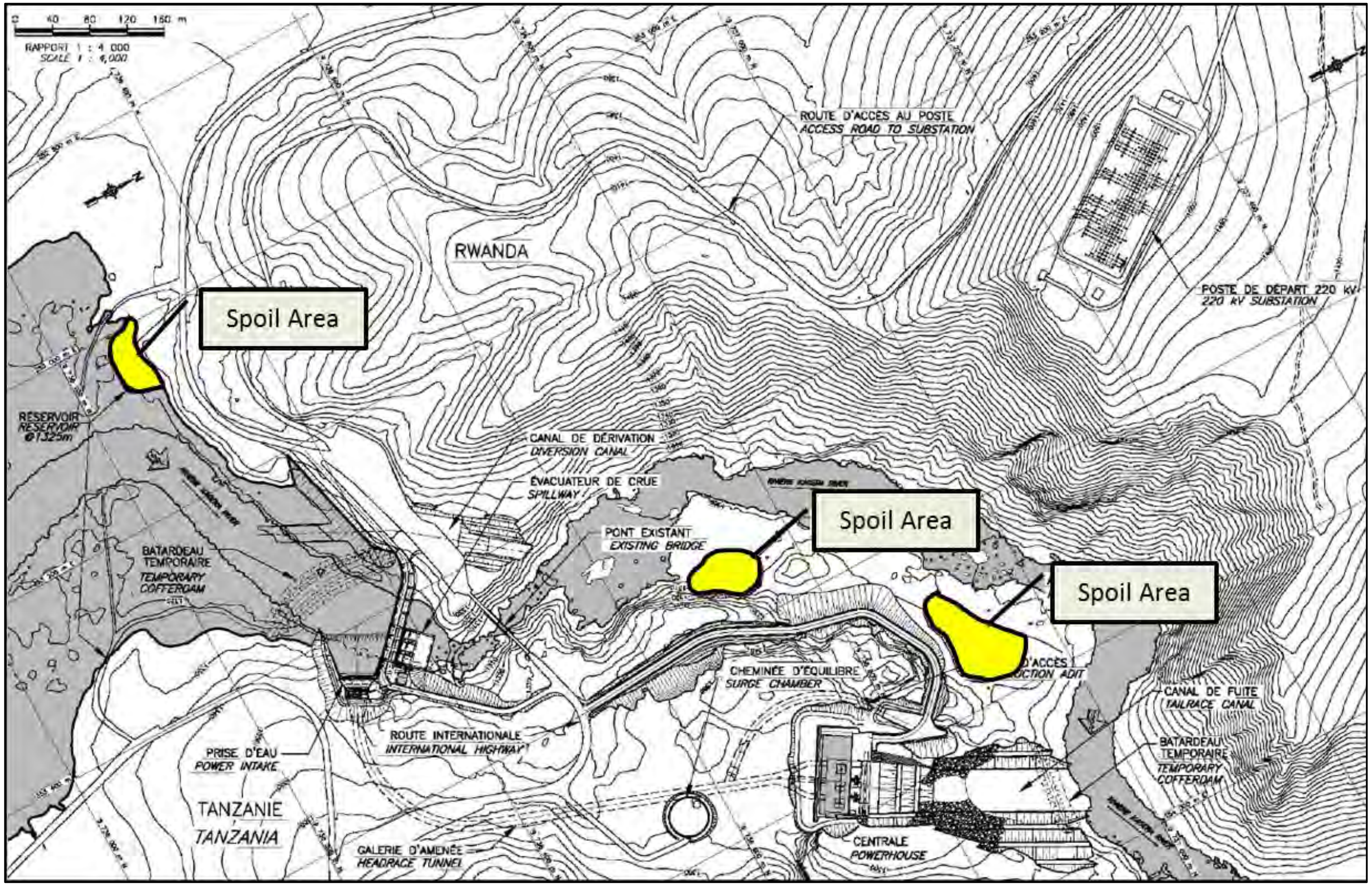
The construction works will require a total of approximately 75,000 cubic metres of concrete for the power plant infrastructures, most of it for the powerhouse building and the dam, including spillway and intake. Concrete will be supplied by a site-specific concrete batch plant. The batch plant will remain available on site until the end of the works.

## 3.6. DECONSTRUCTION AND DECOMMISSIONING ACTIVITIES

The temporary structures that will be deconstructed at the end of the construction phase and at the end of the operating life of the dam and powerplant, the dam and associated structures and facilities will be decommissioned and deconstructed. The means of rehabilitation that will be implemented are discussed in the following paragraphs.

### 3.6.1. Temporary River Diversion Channel

Once the dam and powerplant are in operation there will be no further need for the temporary river diversion channel. Therefore once works on the water intake, headrace, powerplant and tail race have been completed the deviation channel will be plugged with concrete at both the inlet and outlet so that all river flow can be routed to the powerplant (and environmental flow). However, there are two alternative with respect to how the channel can be rehabilitated: The base case will be to backfill the channel using material from the deconstruction of the coffer dam and closure dike and to re-vegetate, and an alternative that will be studied during the detailed design will be to develop the channel into a spillway for the evacuation of flood waters.




Source: SLII, 2012

**Figure 3-9 Location of Spoil Areas**

### 3.6.2. Cofferdams and Closure Dike

As for the temporary diversion channel discussed above, once the works on the water intake, headrace, powerplant and tail race have been completed there is no need for the coffers dams and closure dike and these structures will be deconstructed by progressively removing the construction material using mechanical shovels and earth moving equipment. The removed material can be used for the backfilling of the temporary river and for road construction. The remaining material will be deposited in the designated spoil areas which are indicated on Figure 3-9.

### 3.6.3. Decommissioning and Deconstruction at the End of the Operating Life

The operating life of the dam and powerplant is expected to be in the order of at least 50 to 80 years or even more.

When the decision is taken to terminate production and de construct the scheme, the guiding principals can be anticipated to be as follows:

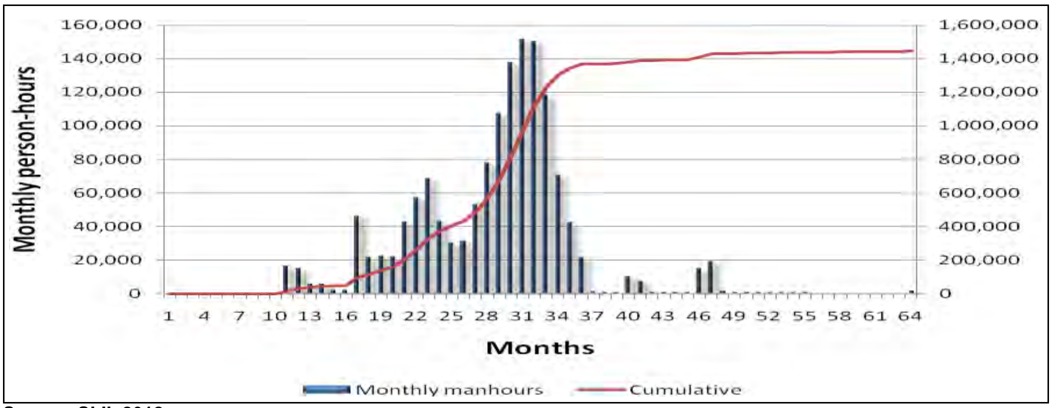
- The dam and associated will be deconstructed and the excavated material will be disposed of in accordance with the regulations in force at that time. The material could be used for road construction or disposed of at suitable spoil areas which will be defined with local authorities;
- The tail race and head race tunnels will be blocked with concrete plugs;
- The electromecanical equipment will be dismantelled, and scrap iron and steel recycled;
- Buildings will be deconstructed and the waste materials managed as for the deconstructed materal from the dam;
- All other equipment will be removed and disposed of or recycled when possible;
- In general all structures, equipment and waste will be removed from the site, there will be a general clean-up to ensure no refuse is left, distrurbed areas will be revegetated.

## 3.7. MANPOWER REQUIREMENTS

Current estimates show that the Rusumo Project will create up to 1,000 temporary jobs during the construction period. There will be in total 2,400,000 person-hours divided into two main contracts: the civil works contract and the electrical and mechanical works contract. The execution of the civil works contract will require approximately 1,500,000 man-hours of which:

- ±10% are foreigners, of which:
- 50% are foremen;
- 50% are highly skilled workers.
- ±90% are nationals, of which:
- 20% are unskilled workers;
- 10% are foremen;
- 20% are equipment operators and truck drivers;
- 5% are concrete workers;
- 13% are carpenters;
- 14.5% are rebar-steel workers;
- 0.5 % are structural steel workers;
- 6.5% are minors;
- 2.5% are drillers;
- 2.5% are plumbers, pipe fitters, welders and milling;
- 5.5% are various skilled and highly skilled workers, mechanics, electricians, etc.

The Figure below depicts the estimated distribution of the Civil Works Contract person-hours throughout the construction period.




Source: SLII, 2012

**Figure 3-10 Estimated Workforce Curve**

The execution of the Electrical and Mechanical Works Contract will require ±900,000 person-hours. The foreign labour context is much higher than for the Civil Works Contract. It is assumed in this contract a ratio of up to 25-30% foreign labour (supervisors or highly skilled labour) and 70-75% national labour (foremen, electricians, mechanicals, welders, helpers, etc.).

The number of indirect jobs created by the project is expected to be higher in every project of this type and magnitude. The indirect jobs created come from various fields such as services, catering, transportation, maintenance and security. The local development plan will aim to maximize economic benefits and employment among communities locally and regionally.

During the operation period, the number of direct jobs will be significantly reduced (managers and engineers, operators, electricians, mechanics and instrumentation, information technology, administrative support staff, accounting and guard service).

However, the presence of these workers will still help create indirect jobs.

## 3.8. PROJECT IMPLEMENTATION SCHEDULE

The construction phase will take approximately 5 years and the tentative project implementation schedule can be summarised by the following milestones:

- Construction works will start in Q2 2015 and continue through to the end of 2018;
- Manufacture of the electromechanical plant will start in Q2 2015 and installation is expected to start in Q3 2017 and continue through to the end of 2018;
- Commissioning will start end of 2018.

## 3.9. OPERATION OF THE SCHEME

### 3.9.1. General Principle

The dam and hydropower plant will function as a Run-of-River (RoR) Scheme. That is to say that there is no upstream reservoir to store water and the outflow from the scheme, which is equal to the sum of the environmental flow and the flow from the turbines, is the same as the river flow upstream of the dam.

The water level at the dam will be maintained at 1,320 metres asl. The increased average water level at the dam compared to natural conditions is necessary to ensure the effective functioning of the water inlet to the head race by avoiding the creation of a vortex and for this extra head of water is needed.

To conclude, there will be no storage of water to create conditions to allow for peak electricity production. The flow of water released downstream from the dam will be continuous and follow the natural season variations of the natural conditions.

### 3.9.2. Operation during the Wet Season

During the wet season the flow of water deviated to the turbines will be 250 cubic metres per second. However the river flow rate will be higher than this value, and in order to avoid increasing the water level upstream from the dam, the excess water will be released to the Rusumo Falls downstream from the dam via an overflow weir (or a gated system). In this case the total flow of water downstream of the dam will be the same as the flow of river water upstream of the dam.

### 3.9.3. Operation during the Dry Season

During the dry season, when the river flow rate decreases and is below the average flow rate, in order to maintain the water level at 1,320 metres asl there will be a need to reduce the flow rate of water deviated to the turbines. In this case the power generation will be reduced and the total flow of water downstream of the dam will be the same as the flow of river water upstream of the dam.

### 3.9.4. Control under Extreme Flood Conditions

The dam will be designed to allow for the release of the high water flows from extreme flood events, via the overflow weir (or gated system). The dam, spillways and water intake structures will also be designed to represent less physical resistance to the flow of water than that of the natural situation. This feature will ensure that in the case of an extreme flood conditions, the increase in water level upstream from the dam (backwater effect) will be less pronounced than that of the natural conditions.

### 3.9.5. Environmental Flow

An environmental flow of 23 cubic metres per second is proposed. This flow represents 10% of the average flow (230 cubic metres per second) of the River. The rationale for selecting the environmental flow rate is provided in Appendix F.

## 3.10. ACCOMODATION AND RESIDENTIAL AREAS

### 3.10.1. Construction Workforce Accommodation

A temporary camp will be constructed to accommodate the construction workforce. The camp will be linked to the main road by a new access road. A two-storey administration building, grouping all services during the construction and operation lifetimes: management, finances, accounting, design, procurement, operations, maintenance will also be constructed at the beginning of the works.

### 3.10.2. Accommodation for Operations Staff

The owner and operations staff will be accommodated in a residential area in the vicinity of the powerhouse on the Tanzanian side of the Kagera River. The residential area will cover an area of about 5 to 6 hectares. There will also be a small residential area covering about 1.5 hectares on the Rwandan side of the river for the substation operations staff.

## 3.11. NEIGBOURING PROJECTS AND INFRASTRUCTURE

The existing infrastructures are listed below and their layout in relation to the Rusumo Project structures and facilities is illustrated in the Figure overleaf:

- The existing road bridge spanning the Kagera River downstream from the Rusumo Falls;
- The existing road and border post on the Rwanda side of the Kagera River and which will be crossed by the temporary deviation channel.
- The existing road and border post on the Tanzania side of the Kagera River. The head race will be tunnelled underneath the road hower the Project structure and facilities will not encroach on the road or border post.

Ongoing and Future Projects comprise the following:

- The Rwanda International Bridge and One Stop Border Post is an ongoing project and construction work has started. A new road will be constructed (see Figure overleaf) as fill new border post facilities.
- The Isaka-Kigali / Keza-Gitega-Musongati Railway Project which is still in the early stages and for which the right of way for the line has not yet been defined.

The interaction between the dam and powerplant project and neighbouring projects and infrastructure is evauated in the cumulative impact section (§ 6.8.3).

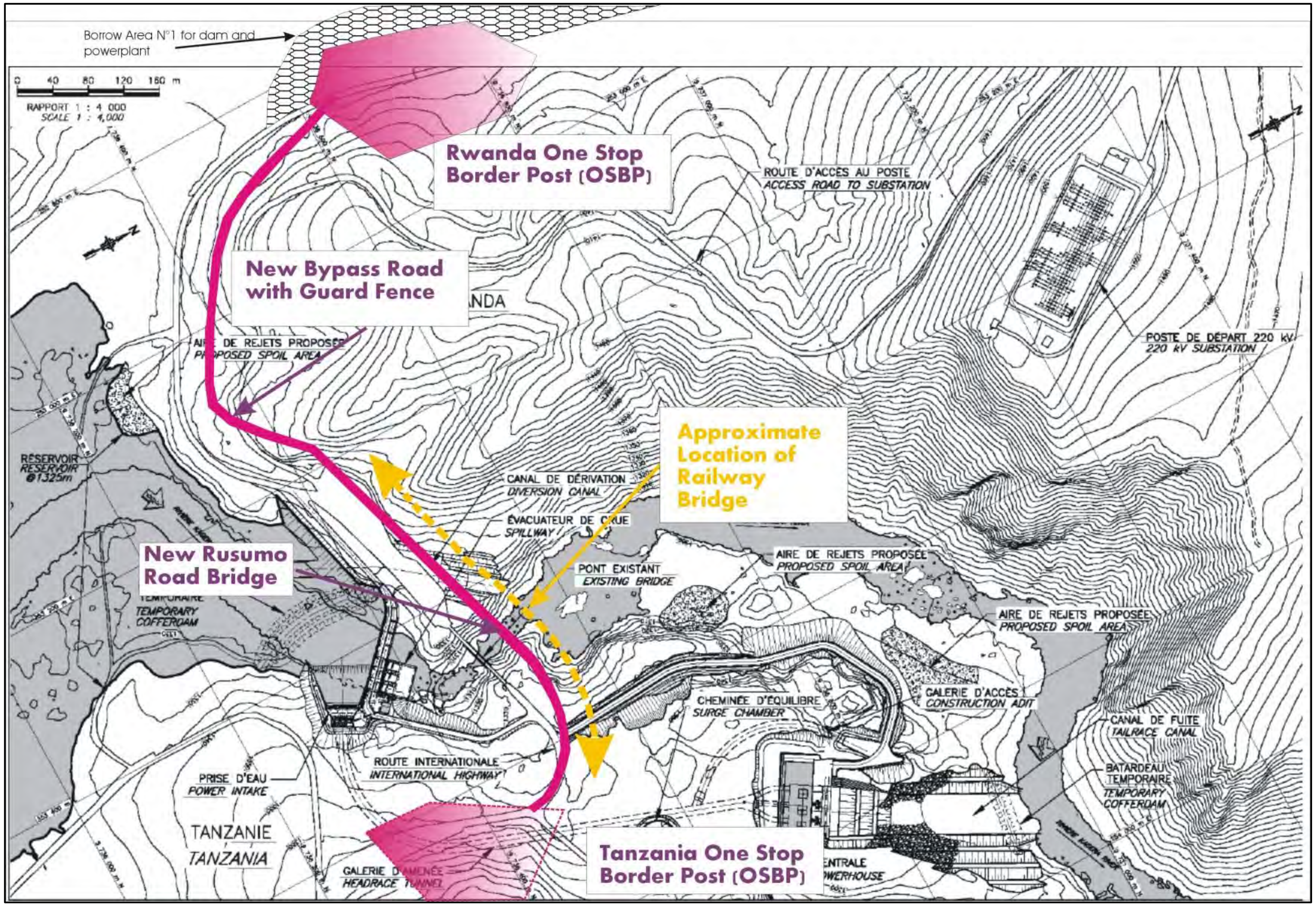



**Figure 3-11 Layout of Neighbouring Projects at Rusumo in Relation to the Dam and Powerplant Project**

# 4. ENVIRONMENTAL AND SOCIAL BASELINE SITUATION

## 4.1. INTRODUCTION

### 4.1.1. Preamble

The information the biological environment has been collected from:

- Meetings with national experts from different technical departments of the countries concerned, agencies specialized in the field of nature protection, conservation of natural resources (soils, water, wildlife, parks, etc.), biodiversity and infrastructure management (climate, land use, etc.), agricultural development, as well as the populations of the project area.
- Review of bibliographic data, and
- A number of field surveys carried out by the ESIA consultants during the period November 2007 – February 2013.

### 4.1.2. Project Area of Influence and Study Areas

***Area of Influence***

The study areas for the environmental and social baseline situation reflect the project area of influence, and which can be described as follows:

Area of influence of construction activities:

- Area around the Falls where project structures and work camps will be constructed;
- The Rusumo Falls and spray zone (downstream of the future dam);
- The stretch of river immediately downstream from the Falls and which will be bypassed by the temporary deviation channel.

Area of influence of operation activities:

- The Kagera River and seasonally flooded marshland of the river's flood plain extending from the site of the future dam upstream for a distance of about 15 kilometres;
- The Ruvubu River and seasonally flooded marshland of the river's flood plain extending from the site of the future dam upstream for a distance of about 10 kilometres;
- The Kagera River extending from the site of the future dam downtream
- The seasonally flooded marshland of the Kagera River flood plain extending from the site of the future dam upstream for a distance of about 15 kilometres.

***Study Areas***

The study areas for the different environmenmental and social aspects have been defined and described below.

*Physical Environment*

- The study area for climate and seismic activity is on a country and regional scale. The site specif information available has been reported;
- The study area for hydrology, water balance, water quality and sediment encompasses the Kagera river basin upstream and downstream of the future dam site;
- The study area for topography, soils, geology is on a regional scale, with focus on the project area of influence.

*Biological Environment*

In terms of habitat, flora and fauna, the information presented is focused on the project area of influence.

*Socioeconomic Environment*

Socioeconomic information is on a local scale with focus on the villages affected by the project.

## 4.2. PHYSICAL ENVIRONMENT

The sources of information presented in this chapter are as follows:

- Review of previous studies;
- The interpretation of available maps and satellite images acquired within the framework of the project ESIA;
- The interpretation of data contained in various databases available for public consultation;
- Observations made during field surveys in the study area carried out in 2007 and during the period May-June 2008, these surveys focused more specifically on:
  - Topography of the construction area and the Lake Rweru area;
  - Geological structure of the construction area;
  - Hydrology and water levels variations;
  - Sediment load and transport;
  - Water quality characterization.

### 4.2.1. Climate

***Winds***

The closest meterological stations to the project area are Kirundo and Mulehe, located at 80 and 170 kilometres respectively from the Rusumo Falls.

Records show that average monthly wind speeds in Auguest-September are slightly lower than 7 kilometres per hour and maximum average speeds are between 7.5 and 8.5 kilometres per hour.In October, the daily maximum wind speed is 24 kilometres per hour. However, also to be taken into account are the strong winds associated with thunderstorms that occur in the afternoon during the rainy season (October-November).

The Figure 4-1 shows the wind rose records for Kigali in 2006. This is the only station with sufficient hourly data to allow the production of representative wind roses. This figure shows a predominance of winds from the south-east sector caused by trade winds. Wind speed is generally less than 20 kilometres per hour, but gusts of more than 25 kilometres per hour were recorded. The winds are calm for nearly 24% of the time.

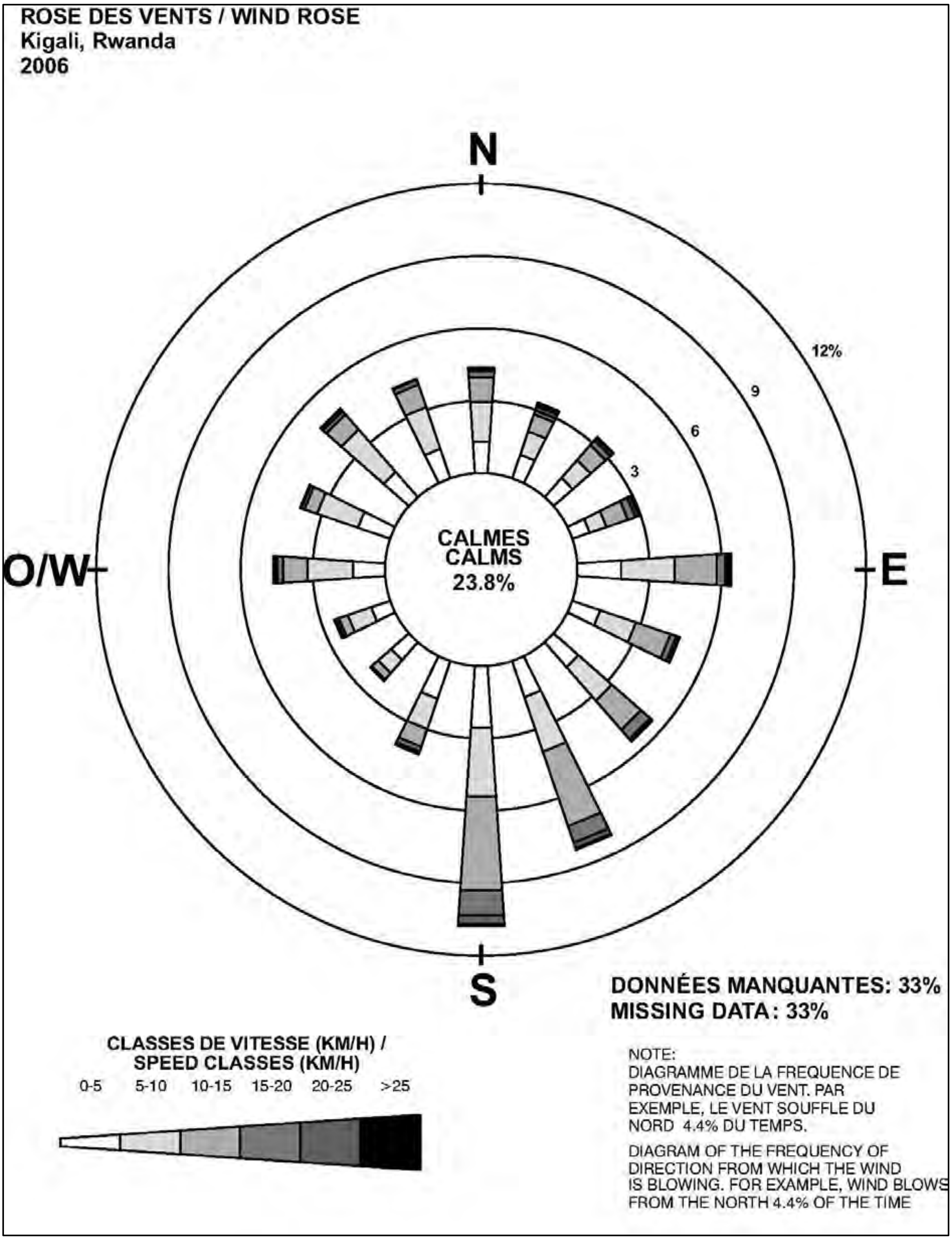



**Figure 4-1 Wind Rose for Kigali**

***Temperature***

The study area is located near the Equator and temperatures are consequenty fairly constant. The climate is moderated by the trade winds and altitude. The average temperature is around 24°C during the day and around 10°C at night. Maximum temperatures of approximately 34°C are observed during the day.

There are four seasons during the year:

- Short dry season in December-January;
- Major rainy season from February to May;
- Major dry season from June through to September, and
- Short rainy season from late October until early December.

The dry seasons are characterized by the frequent presence of a light cloud cover that maintains a pleasant temperature that is never oppressively hot.

The figure overleaf shows average monthly temperature variations at the Rusumo station for the period between 1968 and 1974. Temperatures range between 19.6°C in July and 20.7°C in September.

***Precipitation***

The main sources of hydrometeorological data are the publications from past studies.

- Initially, in 1975, Norconsult and Electrowatt conducted a hydrological study of the Kagera River. Following their hydrological analysis, they prepared a separate feasibility report for the Rusumo Falls hydropower development in 1976.
- Then, in 1979, Tractionel and Electrobel prepared a map of the reservoir.
- In 1987, Tractebel conducted the technical feasibility study of the Rusumo Falls Hydroelectric Development and prepared a final design report in 1992.
- In 2003, Acres international prepared a review of existing documents for the project.
- In 2004 the S.H.E.R prepared the AQUALIUM hydrologic database.
- In 2011, SNC Lavalin Incorporated International (SLII) carried out hydrotechnical studies in the framework of the project and the findings of this study were used in conducting the project ESIA.

Precipitation in the Kagera River Basin is characterized by significant spatial and temporal variability. The precipitations vary from less than 800 mm in the central part of the catchment basin (Rusumo area) and up to 1,800 mm in the mountainous regions of the West (Rwanda) and the South (Burundi), where the majority of runoff water is generated.

The Figure 4-2 overleaf shows the monthly distribution of precipitations over the period between 1960 and 1991 at the station Rusumo. The rainiest months are April (140.8 mm) and November (111.6 mm). The driest months are June, July and August with 13.8 mm, 7.0 mm and 22.8 mm respectively.

Appendix C, Table1, provides the precipitation data for the period 1930 to 2008 that was used in the 2011 hydrotechnical studies.

***Climate Changes***

Climates changes forcast for the years 2050 and 2100 have been determinated in the context of Social and Environmental Strategic Evaluation Study for the Nile Equatorial Lakes Region (SLII, 2007). Overall, the results show that temperatures and precipitations increase annually for each climatic season considered. The detail in forcasted results is presented in the following tables:

**Table 4-1 Forcasted Increase inTemperature for Years 2050 and 2100**

| Concentration of $CO_2$ in the Atmosphere | Increase in Temperature | |
|---|---|---|
| | Year 2050 | Year 2100 |
| 700 ppm | 4 to 14% | 8 to 17% |
| 940 ppm | 11 to 23% | 15 to 50% |

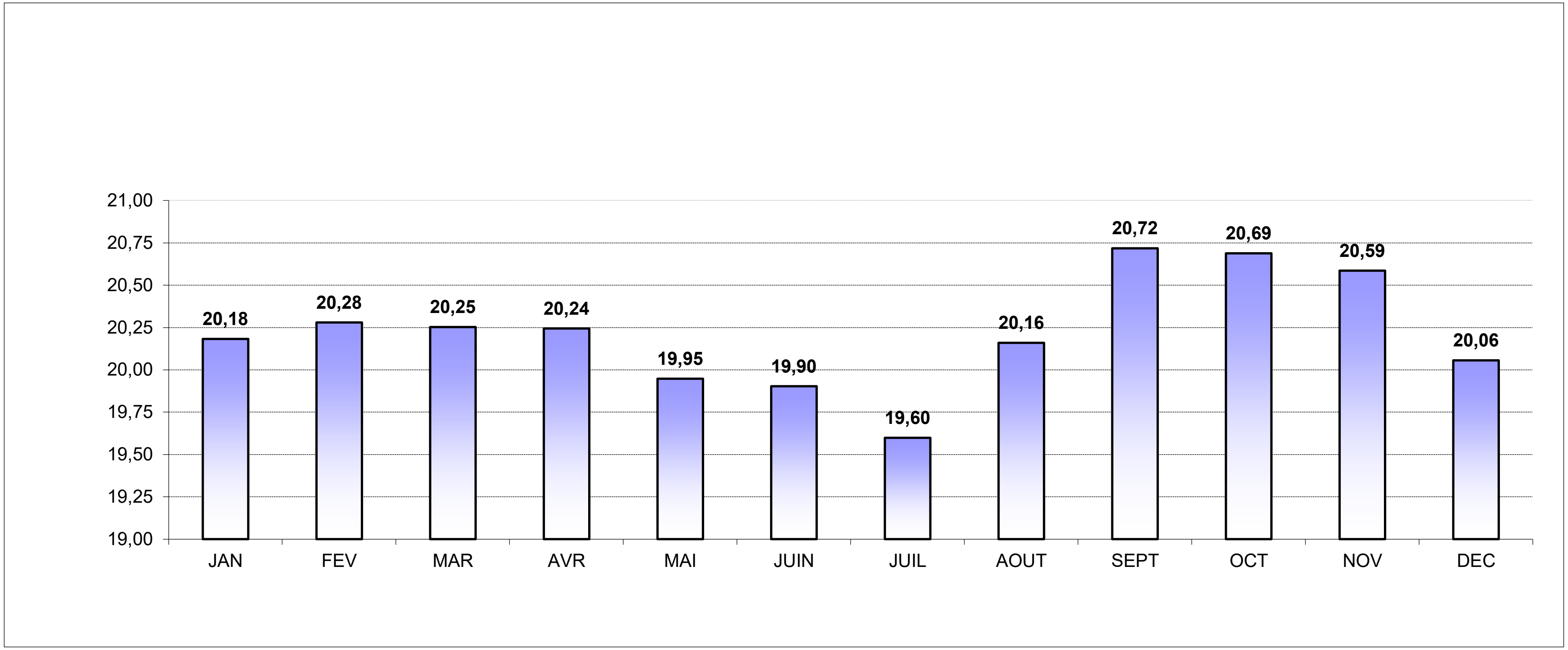
**Source: ESIA for the Intermediate Development Scheme (SLII, 2012)**

**Table 4-2 Precipitation Increase for the 2060's - Kagera Basin**

| Period | Precipitation Increase |
|---|---|
| Year | 6.3% |
| Dec-Jan-Feb | 5% |
| Mar-Apr-May | 14% |
| Jun-Jul-Aug | 0% |
| Sep-Oct-Nov | 5.8% |

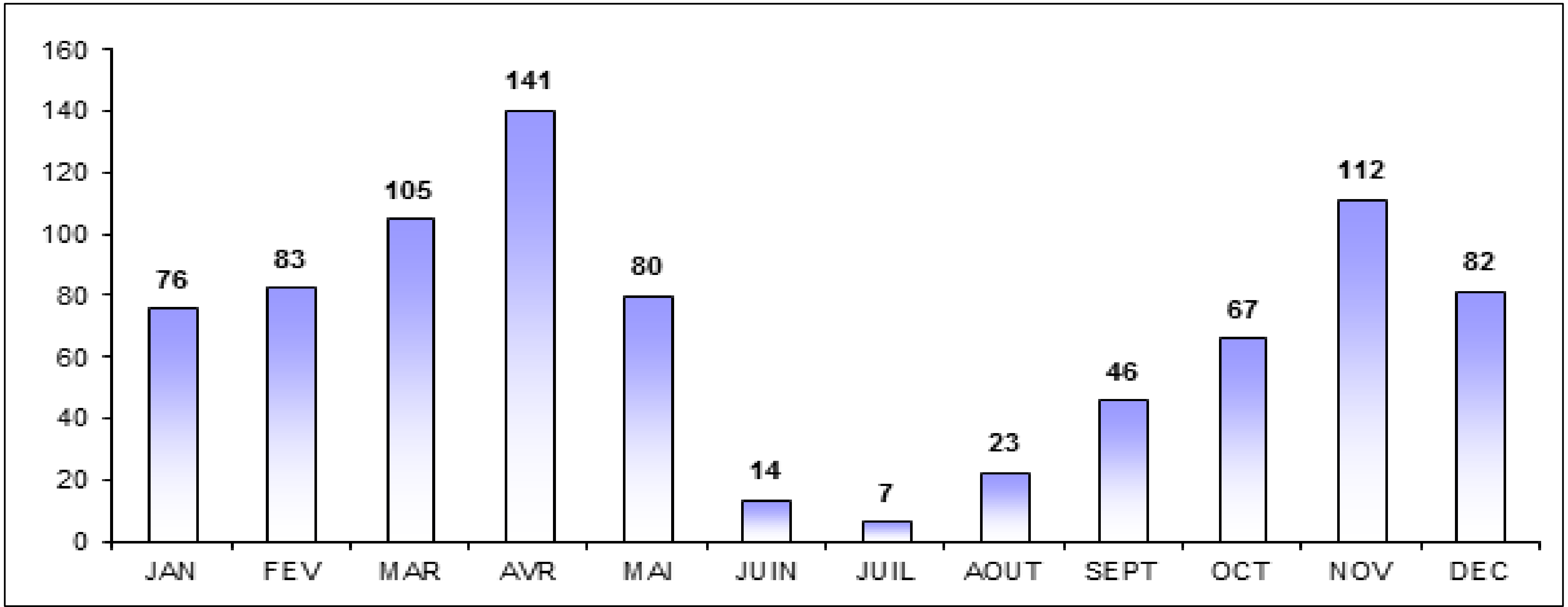
**Source: UNDP**

Within the framework of the Social and Environmental Strategic Evaluation Study for the Nile Equatorial Lakes Region (SLII, 2007), a water-balance model was developed to evaluate precipitation and runoff in the region encompassing the Kagera Basin. The simulations showed that for all cases studied, water flow will increase and that there is an asymmetric and non-linear link between precipitation and water flow. This means that the more precipitation increases, the more the proportion of precipitation that flows into the rivers (run-off) rises. As an example, a 25% increase in precipitation would result in a 75% increase in runoff.



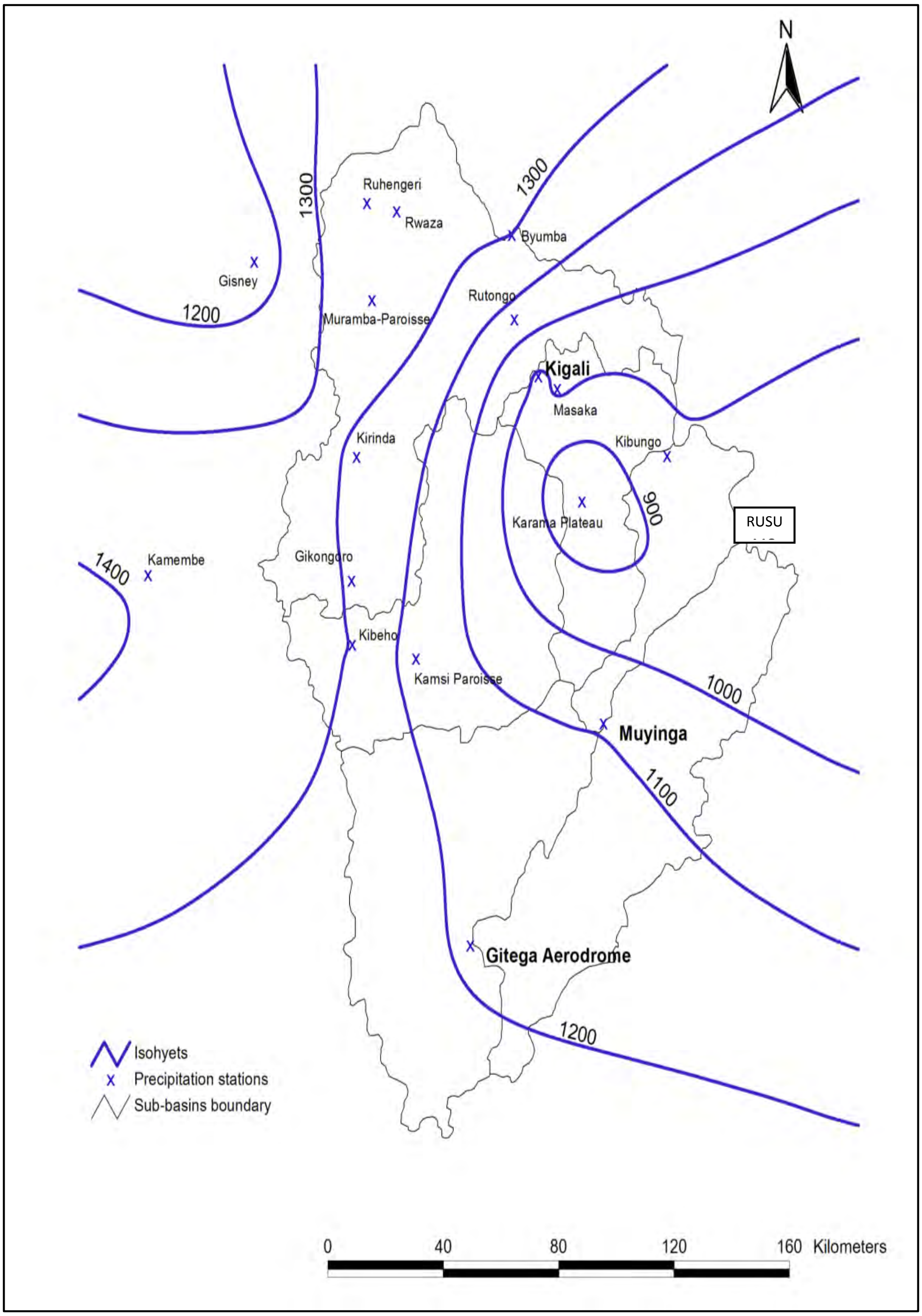

**Source: Station RUSUMO-BGM, Latitude: 02° 16', Longitude: 030° 44', Altitude (m): 1,450.0.**

**Figure 4-2 Monthly Average Temperatures, Rusumo Station (1968 – 1974)**




**Source: Station RUSUMO-BGM, Latitude: 02° 16', Longitude: 030° 44', Altitude (m): 1,450.0**

**Figure 4-3 Monthly Precipitations (1960 – 1991)**




Source: SLII, 2012

**Figure 4-4 Annual Precipitation - Kagera River above Rusumo Falls**

### 4.2.2. Water Balance

The water balance compares the amount of water that is precipitated in the catchment area to evapotranspiration over the same period in order to estimaterunoff water.

Norconsult and Electrowatt (1975), calculated annual evapotranspiration from annual precipitations and annual flow rates for the period prior to 1973. The study concluded that evapotranspiration for the Kagera River at Rusumo Falls is 1,215 mm, 1,061 mm or 1,024 mm respectively for a minimum, medium or maximum flow rate. The study covered the period prior to 1973.

Tractionel, Electrobel Engineering (1986) proposed a rain-evaporation balance to simulate the quantity of water stored based on hydrological data from 1940 to 1984; findings are summarised in the following table. According to this study, annual evaporation is 1,088 mm, which is slightly higher than evapotranspiration figures proposed by Norconsult (1975) for an average flow rate.

**Table 4-3 Evaporation Balance**

| Month | Evaporation (mm) | Precipitation (mm) | Balance (mm) |
|---|---|---|---|
| January | 76 | 93 | 17 |
| February | 63 | 96 | 33 |
| Marsh | 61 | 116 | 55 |
| April | 55 | 155 | 100 |
| May | 70 | 132 | 62 |
| June | 105 | 21 | -84 |
| July | 147 | 5 | -142 |
| August | 160 | 22 | -138 |
| September | 129 | 66 | -63 |
| October | 97 | 110 | 13 |
| November | 57 | 128 | 71 |
| December | 68 | 94 | 26 |
| Annual Total | 1,088 | 1,038 | -50 |

**Source: Tractionel Electrobel Engineering**

ACRES' (2003) review of hydrology for the 1940 – 1979 period proposes an evapotranspiration rate of approximately 1,000 milimetres per year on the upper Kagera watershed, while rates of approximately 1,650 milimetres per year have been observed for the upstream portions of the Kagera/Ruvubu located in Rwanda and Burundi (Climate Research Unit, University of East Anglia, Norwich, UK). Potential evapotranspiration rates for the catchment area are therefore in the range of 1,000 to 1,650 milimetres per year, and according to Climate Change Impact Study carried out as part of the Social and Environmental Strategic Evaluation study for the Nile Equatorial Lakes region (SLII, 2007), evaporatranspiration rates will increase by approximately 10% by the year 2100. (See § climate changes above).

### 4.2.3. Landscape and Morphology

The morphologies of the different areas affected by the project are described in the following paragraphs.

**General view of Kagera valley and marshland**

***Kagera River Upstream from the Rusumo Falls***

The Rwanda side of this area is located with the Kigarama Sector –Nyankurazo, Kiremera, Kigalama, Nyakerera and Cyanya cells). The Tanzania side of this area lies within the Nyamiyaga ward.

The dominant feature of the Kagera Valley upstream from the Rusumo Falls is the vast seasonally flooded marshes which fill the bottom of the valley and in the project area of influence the valley is 3 to 4 kilometres wide. Most of the valley bottom is occupied by marshes, hower there are some ponds, which are depressions filled with water and some loamy sand raised beds which constitute favourable habitats for the development of vegetation and wildlife communities.

At the edge of the seasonally flooded marshland, there is a transition zone between the flood plain and the plateau. It is characterized by gentle slopes and is often flooded during the rainy season. This area is highly fertile and intensively used for agriculture. Above the transition zone there are uplands or hill area. The relief has a variable topography with slopes ranging from 2 to 13%.

***Ruvubu River Upstream of Dam***

The Ruvubu valley is located entirely within Tanzania (Nyamiyaga ward). The morphology of the valley is very similar to that of the Kagera Valley, with the exception that the flood plain is narrower.

***Falls and Rapids Immediately Downstream***

The Rwanda side of this area includes the village of Rusumo East (Nyamugali Sector, Nyankurazo cell) and Rusumo West and Nyakwsi (Kigarama Sector, Nyankurazo cell). The Tanzania side of this area includes the Nyakahanga and Migombani localities around the Rusumo villages (Rusumo Ward, Ngara District).

The Falls represent a vertical drop of approximately 30 meters and they are followed by a sequence of rapids on a stretch of the river 800 metres long for an additional drop of 6 metres. The morphology of this area is illustrated in the following photographs.

***Downstream Area from the Falls***

The Rwanda side of this area includes is located in the Nyamugali Sector. The Tanzania side of this area is located in Rsumo Ward. The area downstream from the future dam is not expected to be affected by the project (other than the risk of change in sediment transport which is discussed in Chapter 6). However, for completeness an overview of the downstream area is provided here.

The lower part of Kagera Valley is the downstream part of the valley, starting from the Rusumo Falls and delineating the border of Rwanda and Tanzania. The Kagera River is the main water course, however, it benefits from the flow of some small rivers and creeks of less importance. It is characterized by more or less large marshes and a complex system of lakes located in the Akagera National Park.

Immediately downstream from the rapids, the valley widens and the next 200 kilometres is dominated by a morphology characterised by areas of lakes and marshes. The river has a low gradient of less than 8 centimetres per kilometre. From downstream of the falls to the confluence of the Kagitumba River, over a distance of about 200 kilometres the valley encloses an area of 6,750 square kilometres of which about 1,600 square kilometres is covered with lakes and marshes.

**Rusumo Falls**

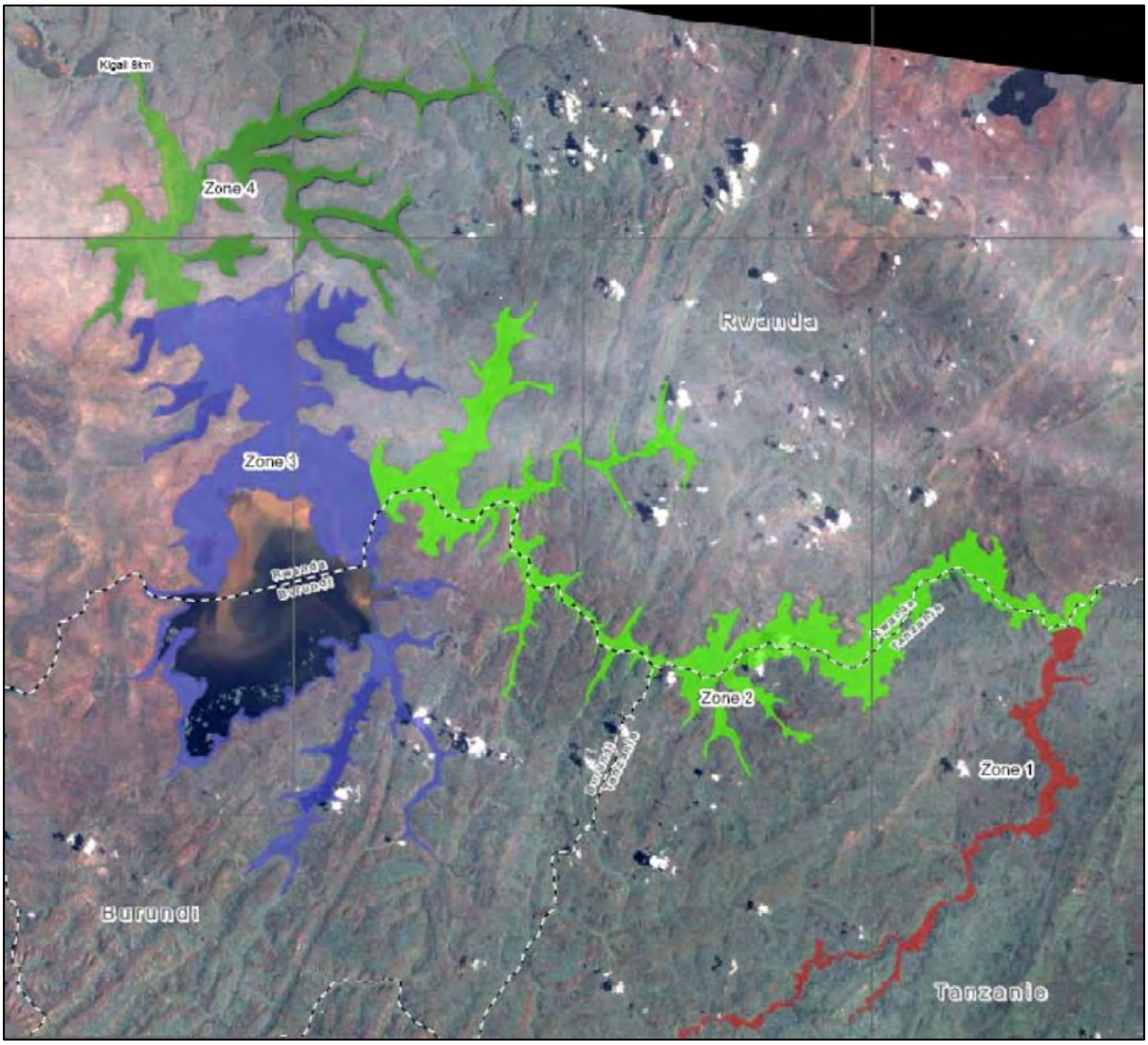
**View of the Stretch of River and rapids downstream from the Falls**

**View of the Stretch of River and rapids downstream from the Falls**

### 4.2.4. Topography

The topography and bathymetry of the area was established in 2009. A Digital Terrain Model (DTM) was constructed using topographic and bathymetric data obtained using a Light Detection and Ranging (LiDAR) survey conducted in 2009 and an Acoustic Doppler Current Profiler (ADCP) survey conducted in April 2009.

It was necessary to contuct a DTM in order to conduct hydraulic modelling to evuate the impact of the dam on hydrology. This is disussed in Chapter 6. The area covered by the survey is illustrated in the Figure below.




**Source: SLII, 2012**

**Figure 4-5 LiDAR Surveyed Area**

### 4.2.5. Geology

The Kagera River Basin consists mainly of detrital rocks, i.e. Precambrian shales and quartzites, folded and slightly metamorphic. These are Burundian age formations in Rwanda and Karakwe-Ankolean age formations in Tanzania and Uganda. These formations lie on late Archean granites and gneisses.

These formations make up the Kibarian chain that stretches from Shaba to Uganda, along Kivu, Rwanda and Burundi. The mountain chain was affected by three very ancient deformation phases, the most recent of which dates back to over 900 million years. This last phase, which lies on pre-existing structures, is cut by a phase of shears and fractures occurring at the end of an oblique deformation exposed by vertical plans oriented NE-SW-SE or NW depending on the region.

At the end of the Tertiary, about 10 million years ago, a peneplain folding and formation sequence resulted in the formation of the East African Rift. These deformations of the earth’s crust and volcanic activity are still present in the region.

Near the site of the future dam the geological formations encountered belong to the following groups:

- The metasedimentary schists and quartzophyllites;
- The basic intrusive rocks;
- Alluvium and laterite overburden.

***Schists***

The schists are mainly sandy, slightly metamorphic, light to dark grey, containing muscovite, biotite and quartz (associated to chloritoid and staurotide minerals), sometimes graphite. Locally, the schists are pelitic and sandy, gray-beige, weathered at surface and compact at depth.

***Quartzophyllites***

The quartzophyllites are slightly metamorphic and of light to dark grey color. They are composed of a micro-grained matrix (mostly quartz and potassic feldspar with muscovite in a smaller proportion) with feldspar, quartz and biotite phenoblasts with some chloritoïd and dark minerals. The phenoblasts are finely grained, millimetric to centimetric. The elongation of the matrix minerals (such as muscovite, quartz and chlorite) highlights the schistosity. In some area, finely bedded and folded quartzophyllites were observed (often micro-faulted and without preferential alignment of the biotite). Locally, homogenous coarse grained quartzophyllites without apparent bedding or preferential orientation with some centimetric biotite and chloritoid phenoblasts were also observed. The quartzophyllites are either sound and fractured or slightly weathered. Their metamorphism corresponds to the green schist metamorphism, characteristic of high temperature and low pressure, due to the intrusion of the granite in the area during the deformation phase.

***Intrusive Basic Rocks***

They are in the form of sills of dolerite or metagabbros, massive, fine to coarse grained, dark grey to black, locally amphibolitic, they are fractured and crossed by north-south and east-west orientation faults. They are composed of plagioclase, quartz and amphibolite (actinote-hronblende) with a small proportion of mafic minerals.

***Superficial Formations***

Superficial formations are composed of:

- Alluvium in valley bottoms, of low and high terraces;
- Old alluvium terraces;
- Old silty alluvium;
- Slopewash deposits;
- Gravely laterite generally at schistose hilltops overlooking the site.

***Conclusions Regarding Geology with Respect to Design and Construction of Project Structures***

The geological formations encountered within the perimeter of the dam and the reservoir, near the foothills of the Kibaran range belong to four large groups:

- Schists and quartzophyllites, locally folded and faulted, slightly metamorphic;
- Basic intrusive formation composed of local amphibolites outcrops;
- Limited granite; and
- Alluvial, colluvial and eluvial formations.

The Project site is traversed by 19 faults that have limited impact on civil structures. All civil structures should be founded on sound quartzophyllites, the quarries may be located in amphibolites or granite and the borrow area for impervious material will be located in laterite soils made of completely decomposed rocks. Sand and gravel is not available in the vicinity and will have to be fabricated from quarry material.

### 4.2.6. Seismic Activity

Within the framework of the feasibility study of Rusumo Falls Project an analysis of the seismicity and seismotectonics of Eastern Africa was carried out by SLII. A preliminary seismic analysis conducted during the preliminary design phase concluded that considering the geographic location of the Rusumo Falls Project near the western branch of the East African Rift and the fact that the earthquakes which may affect the Project are located on old readjustment faults, generally of a small span, the value of 0.1 g may be retained as a conservative value for the Project maximum design earthquake (i.e., the maximum level of ground motion for which the Project structures will be designed). In 2009, SLII appointed an international consultant in Seismology and Engineering Geology to conduct a complementary seismology assessment of the Project area using a probabilistic method. The assessment confirmed that the Project area is characterized by a moderate seismicity ($M \leq 6$) and low PGA values ($PGA \leq 0.1g$).

### 4.2.7. Soils

The soils in the project area comprise the following:

*Lixisols*: found on the plateau and on the hilly part of the watershed. They have a variable depth, very often limited by the presence of laterite armor or hardened fine gravels which constitute a constraint to their agricultural development. Nevertheless, they are cultivated with cassava, banana trees, corn, coffee-trees, etc. In the majority of the cases they are affected or threatened by water erosion induced by agricultural activities.

*Gleysols*: characteristics of marshes, bottom of hills with sharp escarpments, transitional glacis and wet lowlands more or less flooded during part of the year. They are often deep, with a sandy loam to clay texture, massive structure, and moderate to poor drainage. In alluvial areas, they are very fertile with a high organic matter rate and a high saturation base due to fertile silts and humus content.

*Vertisols*: characteristics of the narrow depressions with high clay deposit contents subject to frequent process of flood and dryness in the dry season, resulting to vertic properties.

*Lithosols*: Found on the eroded areas of the plateau on the top of the hills and watershed, with sometimes the presence of laterite armor laid at the soil surface.

*Fluvisols*: characteristics of the river banks and terraces where they are constantly renovated by deposits of sandy loam alluvia during the floods.

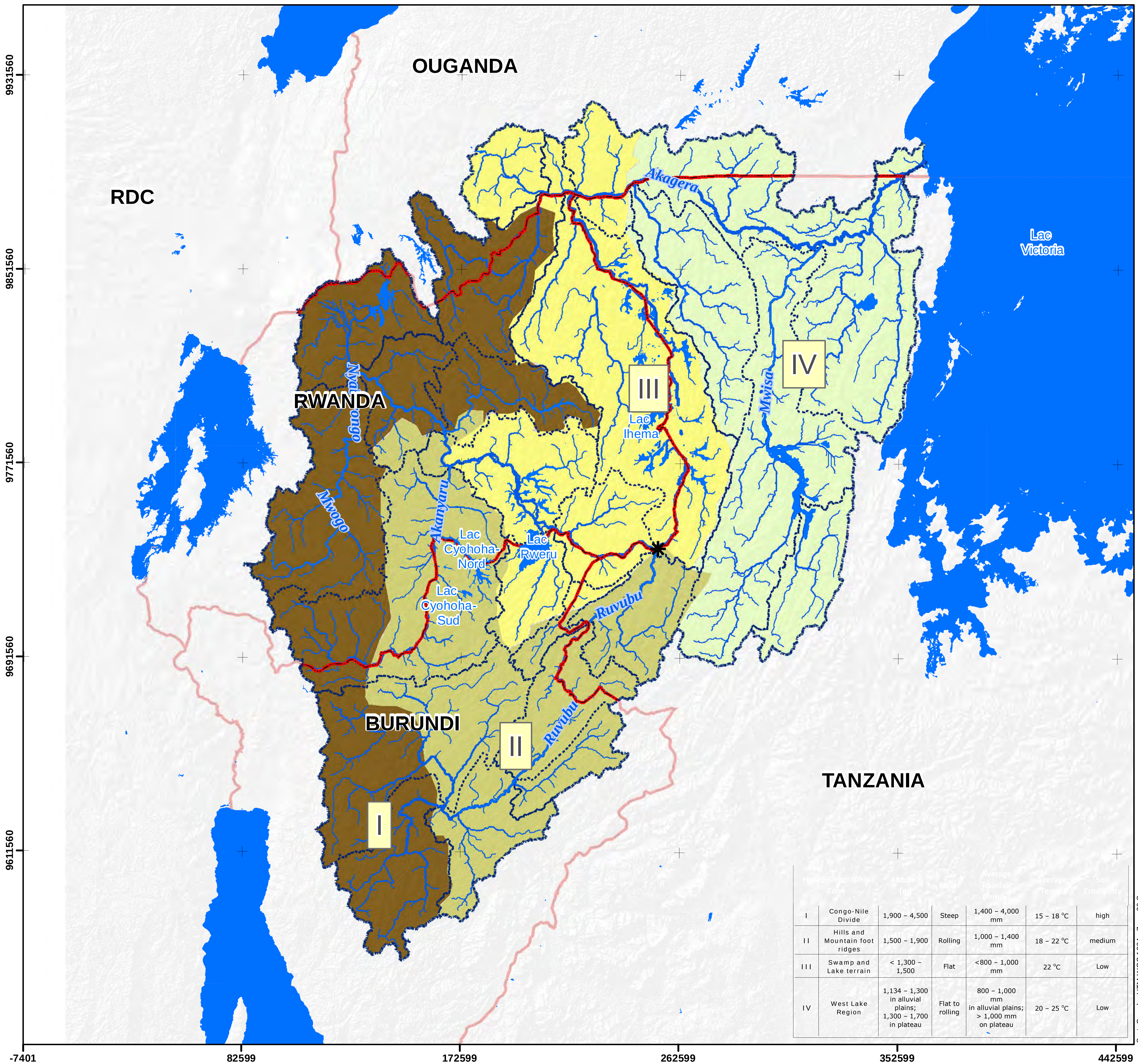
*Peat soils (Fibric Histosols)*: Found inside the lakes and on the edges of the rivers. They are peats made up of vegetative matter fossilized and more or less mineralized and derived from the decomposition of cyperaceous biomass. In the Lakes Rweru and Ilhma, they often have a floating vegetation of papyrus.

*Organic soils (Terric Histosols)*: Found in marshes area and sometimes on the edge of the river and lakes. They differ from the peat soils by the strong mineralization of the organic matter, with an organic matter rate generally higher than 3%.

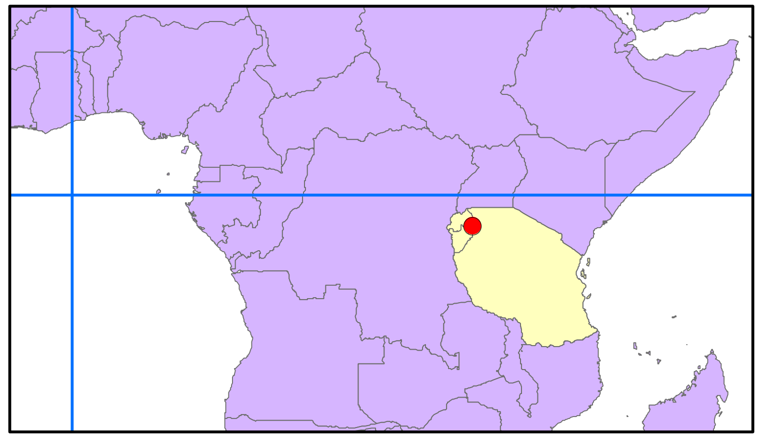
### 4.2.8. Hydrogeology

The Kagera River Basin with the exception of the area West of Lake Victoria is characterized by discontinuous aquifers overlain by unconsolidated deposits and areas of fractured rock.

The continuous aquifers are mainly located in the sandy alluvial deposits located in the valley bottoms of the major tributaries. There are also continuous aquifers in the colluvium pockets located at the base of the hills.




| Hydro-Geographic Zone | | Altitude (m) | Relief | Average Rainfall (mm/y) | Average Temp. | Soil Erodibility |
|---|---|---|---|---|---|---|
| I | Congo-Nile Divide | 1,900 – 4,500 | Steep | 1,400 – 4,000 mm | 15 – 18 °C | high |
| II | Hills and Mountain foot ridges | 1,500 – 1,900 | Rolling | 1,000 – 1,400 mm | 18 – 22 °C | medium |
| III | Swamp and Lake terrain | < 1,300 – 1,500 | Flat | <800 – 1,000 mm | 22 °C | Low |
| IV | West Lake Region | 1,134 – 1,300 in alluvial plains; 1,300 – 1,700 in plateau | Flat to rolling | 800 – 1,000 mm in alluvial plains; > 1,000 mm on plateau | 20 – 25 °C | Low |





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RUSUMO FALLS HYDROELECTRIC PROJECT
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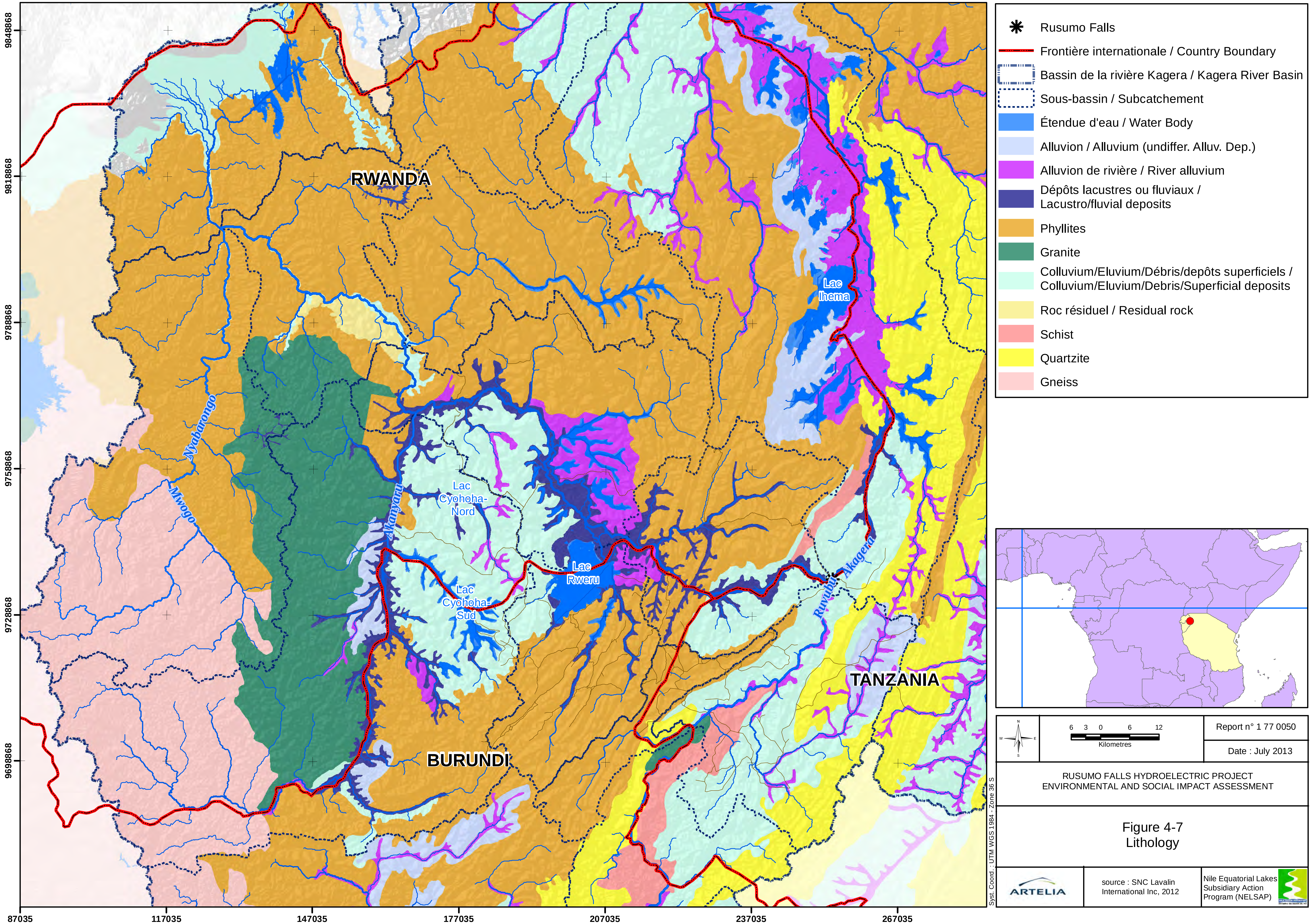
Figure 4-6
Hydrogeographic zones of the Kagera River

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Figure 4-7
Lithology

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

### 4.2.9. Hydrology

This section provides key information for the understanding of the ESIA, additional information is provided in Appendix C.

***Hydrographic Network***

*Overview of the Kagera River Catchment Basin*

The Kagera River catchment basin is located in the Great Lakes region between the Lakes Victoria, Tanganyika and Kivu. The Kagera River drains a total area of 59,800 $km^2$ encompassing areas in Burundi, Rwanda, Tanzania and Uganda (see Table below and Figure 4-6 above).

**Table 4-4 Kagera River Catchment Basin**

| Country | Basin Area ($Km^2$) | % of the Basin's Total Area |
|---|---|---|
| Burundi | 13,060 | 22 |
| Rwanda | 20,550 | 34 |
| Tanzania | 20,210 | 34 |
| Uganda | 5,980 | 10 |
| Total Basin | 59,800 | **100** |

**Source: WWAP 2005**

*Nyabarongo River Basin*

The Nyabarongo River basin is situated upstream of Lake Rweru, the Nyabarongo River drains an area of 16,000 square kilometres. It stretches more than 300 kilometres from its source in western Rwanda and flows south down to Lake Rweru in the South-East of Rwanda along the border with Burundi. This river originates from the junction of the Mwogo and Mbirume Rivers. Its other tributaries are the Lukarara, Statinsyim and Mukungwa Rivers, the base of the Nyabugogo and Akanyaru Rivers that flow from the uplands of the Nyungwe National Park on the Congo-Nile section located in the province of Ruhengeri, on the border between Rwanda and Burundi down to the junction with the Nyabarongo, some 50 kilometre south of Kigali.

*Ruvubu River Basin*

The Ruvubu River drains an area of approximately 12,300 square kilometres in central and northern Burundi. Its main tributary is the Ruvyironza River, which flows from Burundi to Rutovu in the province of Bururi. It meanders in the central highlands and collects the waters of the Mushwabure, Waga and Mubarazi Rivers which are its major tributaries.

*Kagera River Sub-basin*

From the outlet of Lake Rweru, the Nyabarongo River changes its name to Kagera and meanders through papyrus-dominated wetlands down to its confluence with the Ruvubu River. It then flows into the gorge of the Rusumo Falls before mixing with lakes and wetlands in the Akagera National Park along the Rwanda-Tanzania border. Upstream of the junction with the Kagitumba River (which marks the border between Uganda and Tanzania), the Kagera River changes direction and flows eastward down to Lake Victoria. The area of the Kagera River catchment basin area at Rusumo Falls is 30,200 square kilometres

***Hydrological Data***

As part of the ESIA study, the hydrometric station at Rusumo was reactivated and limnimetric scales were installed at Lake Rweru and Lake Ihema in the Akagera National Park in early 2008 in order to supplement the data already available.

The essential components of the hydrological database of the Kagera River which was then then established were: (i) monthly flow time series; (ii) flood flows; and (iii) sediment transport.

*Annual Flows*

The Figure below shows the annual flow histogram corresponding to the final time series of monthly flows at Rusumo Falls for the 70 years period from 1940 to 2009.

**Table 4-5 Kagera River at Rusumo Falls – Monthly Flows**

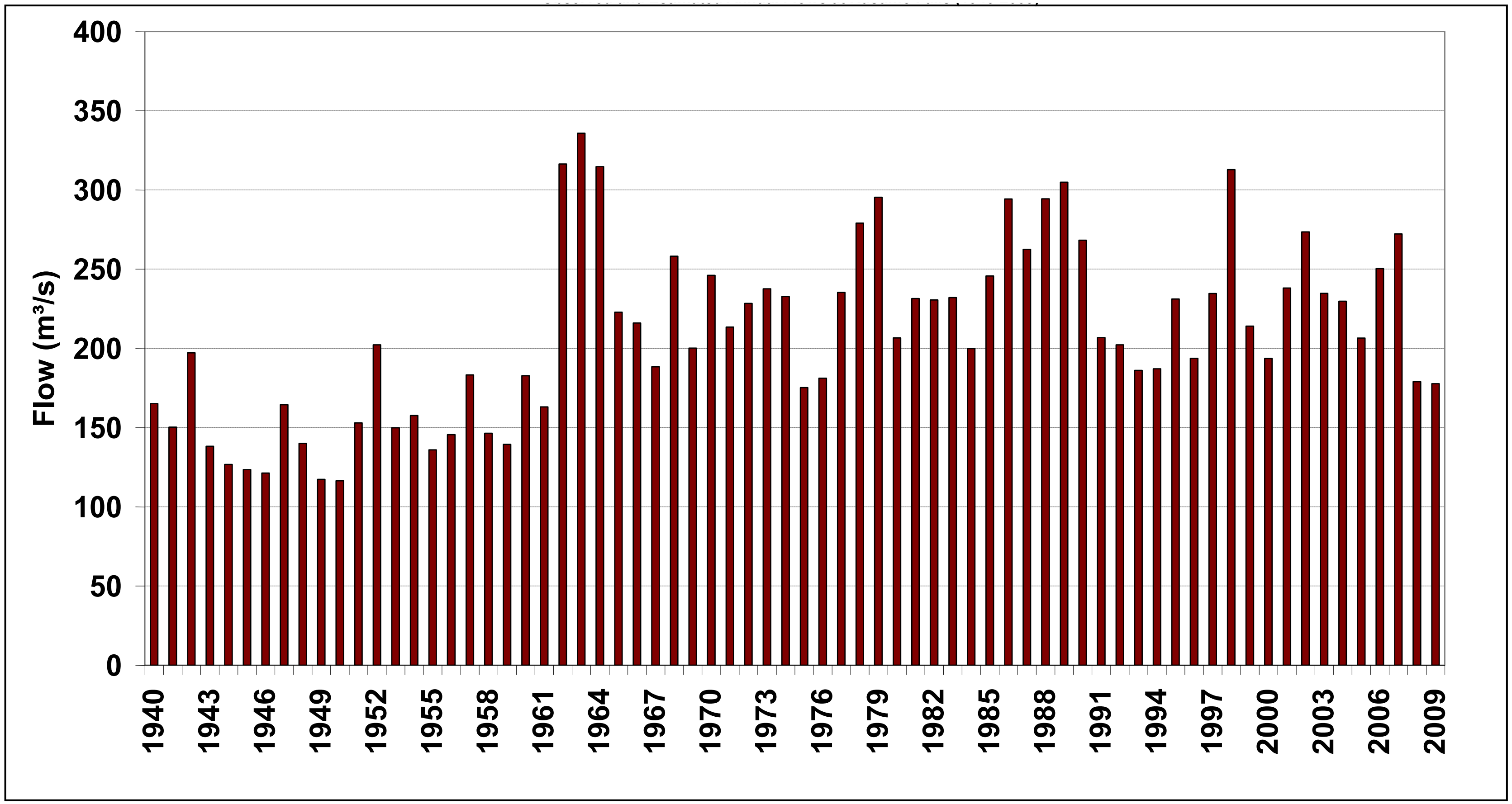
| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 204 | 215 | 226 | 264 | 301 | 259 | 212 | 169 | 148 | 149 | 172 | 201 | 210 |
| Max | 470 | 401 | 427 | 495 | 615 | 531 | 552 | 348 | 240 | 229 | 284 | 384 | 336 |
| Min | 113 | 117 | 123 | 145 | 171 | 138 | 119 | 95 | 82 | 80 | 72 | 114 | 116 |

**Values are for the period 1940 – 2009, units are $m^3/s$.**

Data collected show a remarkable increase of the average runoff from 1961. This increase is linked to a corresponding increase in precipitation. The following long-term averages were observed:

- Period from 1940 to 1961: average of 151 m3/s;
- Period from 1962 to 1984: average of 238 m3/s, and
- Period from 1971 to 2009: average of 233 m3/s.

The indications are that the increased flow, due to a corresponding increase in precipitation, is likely to continue in the predictable future.




**Source: SLII, 2012**

**Figure 4-8 Kagera River at Rusumo Falls – Annual Flow Histogram**

*Flood Events*

Characteristic flood flows were determined in the context of the feasibility studies for the FDS and IDS. The results are presented in the following table.

**Table 4-6 Kagera River at Rusumo Falls – Peak Flood Flow**

| Return Period (Years) | Flood Peak (m3/s) Log-Pearson III | 95% Lower Confidence Limit ($m^3/s$) | 95% Upper Confidence Limit ($m^3/s$) |
|---|---|---|---|
| 2 | 369 | 344 | 397 |
| 5 | 476 | 441 | 522 |
| 10 | 542 | 497 | 604 |
| 20 | 602 | 547 | 683 |
| 40 | 659 | 593 | 758 |
| 100 | 732 | 650 | 857 |
| 500 | 854 | 744 | 1,027 |
| 1,000 | 905 | 783 | 1,101 |
| 5,000 | 1,023 | 872 | 1,273 |
| 10,000 | 1,074 | 909 | 1,348 |

**Source: SLII, 2012**

Rainfall data for the Probable Maximum Flood (PMP estimate came from the following stations selected for their appropriate location within the Rusumo Falls catchment and the length and reliability of their daily records:

- Kigali located in Rwanda;
- Gitega Aerodrome located in Burundi; and
- Muyinga located in Burundi.

The PMF peak flows obtained were the following:

- 1979: maximum flow = 1,498 m3/s ;
- 1986: maximum flow = 1,620 m3/s, and
- 1988: maximum flow = 1,583 m3/s.

***Natural Regulation of the Kagera River***

In the lower course of the Nyabarongo and Ruvubu Rivers as well as upstream and downstream Rusumo Falls, large expanses of marshes and lakes play an important role in the hydrology of the Kagera Basin by providing transitional storage for seasonal runoff, by providing a buffering effect for strong flood flows and by maintaining low flows in the dry period. The marshland systems store large quantities of water during the rainy season. The water then flows more slowly into rivers during the dry season and at the beginning of the next rainy season, making water available to natural and farming ecosystems over a longer period. The marshland systems therefore act as buffers.

### 4.2.10. Sediment Transport

***Sediment Data and Interpretation from Previous Studies***

Samples were taken in 1986 by Tractebel (Tractebel, 1992), and the AQUALIUM database also lists the concentration for samples collected from 1975 to 1978 for the Kagera River at Rusumo Falls and the Nyabarongo River at Kigali.

Appendix D provides a summary of the data for suspended solids together with the associated flows.

The data shows a trend of increased sediment concentration over the past 30 years, though there is no clear relationship between flow rate and sediment concentration. The average sediment load at the Rusumo Falls is 800 ppm. Most of the sediment is transport by the Ruvubu River (average of 500 ppm), and the rest is trabsported by the Kagera River (300 ppm).

The Nyabarongo River upstream of the Lake Rweru has a sediment load in the range of 3,000 to 4,000 ppm on average. However the sediment load of the Kagera River downstream of the Lake Rweru is 300 ppm on average, indicating that most of the sediment is deposited in Lake Rweru and the marshlands of the Kagera valley between Rusumo Falls and Lake Rweru.

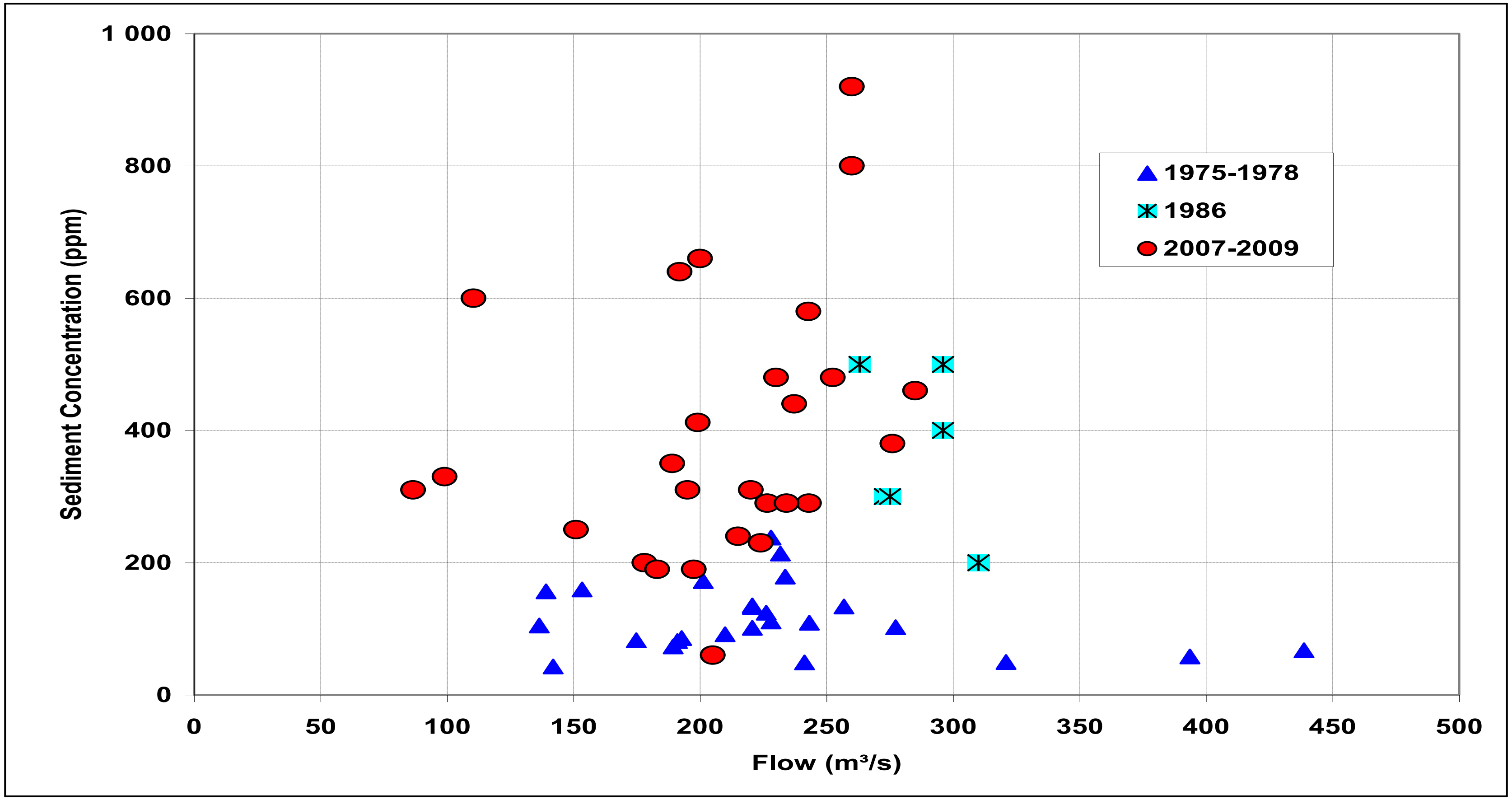
***New Data Collection***

A water and sediment sampling programme was carried out from February 2008 to June 2009 in the Kagera River at Rusumo Falls, the Ruvubu River just upstream of its confluence with the Kagera River and the Nyabarongo River near Gashora. The grain size distribution of the suspended solids was measured and shows that 80% of the solids consist of grains of equivalent diameter less than 0.05 mm and that 100% of the grains are smaller than 0.1 mm.

Sediment concentration rating curves were developed for strategic locations and are provided in Appendix D, an example is provided in the Figure overleaf.

***Soil Erosion***

The Kagera and Ruvubu River Basins are facing slope erosion problems related to the fragility of the natural soils, deforestation and agricultural practices. Eroded particles migrate gradually towards the bottom of the slopes and in the lowlands and can be carried into water streams during heavy rains. These sediments are carried by rivers when the flow rate is sufficient but accumulate in swamps and lakes, where flow velocities are reduced, thereby facilitating sedimentation.




Source: SLII, 2012

**Figure 4-9 Suspended Sediment Concentration vs. Flow at Rusumo Falls**

### 4.2.11. Water Quality

See also sediment (§ 4.2.10) and invasive plant species such as water hyacinth (§ 4.3.8).

***Sampling Campaign***

In December 2007 and in 2012, a water quality sampling campaigne of the Kagera and Ruvubu Rivers and its main tributaries located in the study area was carried out. The localizations of the sampling sites are presented in figure below. A total of 7 sampling stations were sampled: 3 in the Ruvubu River, 3 in the Kagera River upstream from Rusumo Falls and 1 station in the Kagera River downstream from Rusumo Falls. Water quality was assessed in January 2012 in the Ruvubu River, and in the upstream and downstream sections of the Kagera River near Rusumo Falls. pH, conductivity and water temperature were measured with a multimeter probe. Transparency was evaluated with a secchi disk. The type of substrate was also evaluated.

***Interpretation of Results***

*Comparison with Previous Studies*

In comparison with previous studies undertaken in lacustrine areas in the Bugesera region, the mineralization level (conductivity) and phytoplanktonic primary productivity (demonstrated by Chlorophyll *a* and algal biomass) highly increased during the last two decades. An increase in pH and a reduction of water transparency was also noted.

*Physico-Chemical Analysis*

The water temperature ranges between 21 and 23°C for the samples collected in the River Nyabarongo and Kagera while the River Ruvubu varied between 24°C and 26°C. However, the small Rivers Rwagitugusa and Muhembuzi were both at less than 20°C. The samples collected in the West and East bays (sites W8 and W14) of Lake Rweru were much warmer than the other samples collected in the lake (Sites W11, W12, W13).

In January 2012, water from Ruvubu River was brownish in color and had a low transparency (0.1-0.3 m). Intensive agriculture, mainly in the Bunrundian portion of the watershed, promotes erosion and can explain the high turbidity and water color observed. Conductivity varied between 42 and 43 µS/cm and pH varied between 7.2 and 7.4. In the Kagera River upstream from Rusumo Falls, transparency was 0.7 m, pH was slightly basic (7.3-8.3) and conductivity varied between 150 and 153 µS/cm. Values downstream from the falls were intermediate to those of the Ruvubu and Kagera Rivers upstream, see table below.

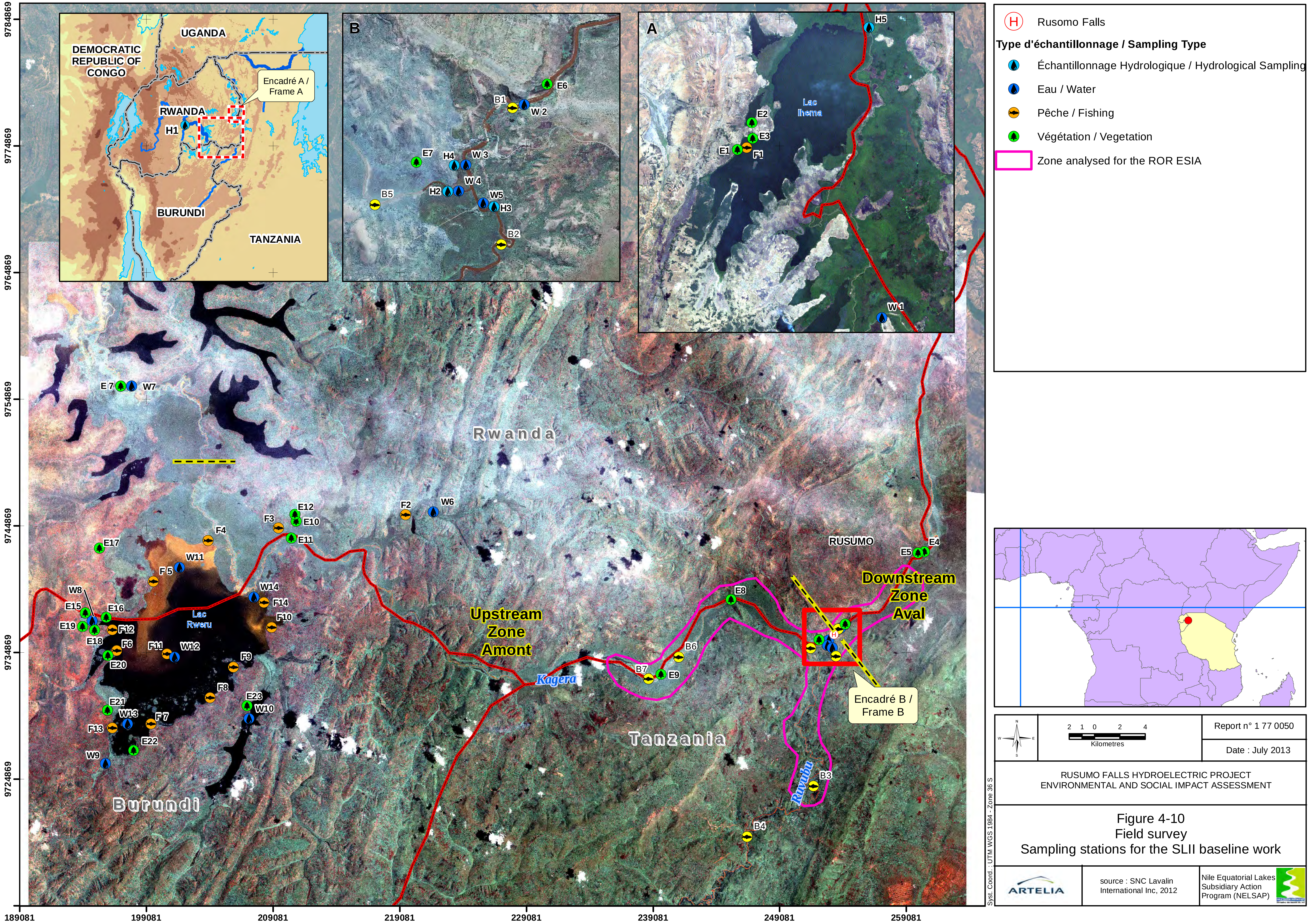



Figure 4-10
Field survey
Sampling stations for the SLII baseline work

### Table 4-7 Physico-Chemical Parameters Recorded in January 2012

| River | Ruvubu River | | | Kagera River upstream from Rusumo Falls | | | Kagera down-stream |
|---|---|---|---|---|---|---|---|
| Sampling site | Nyamko | Kambwana | Nyakahang a | Rwagatarati | Maranyund o | Kakiro | Mitako |
| Temperature (°C) | 24.5 | 24.8 | 24.3 | 21.6 | 21.9 | 22.1 | 23.4 |
| pH | 7.4 | 7.2 | 7.3 | 6.8 | 6.9 | 6.8 | 7.7 |
| Conductivity (µS/cm) | 43.1 | 42.7 | 42.4 | 153.4 | 156.3 | 150.4 | 98.2 |
| Width (m) | 30.0 | 32.5 | 35.0 | 35.0 | 35.0 | 35.0 | 40.0 |
| Depth (m) | 6.2 | 6.2 | 7.0 | 7.3 | 8.3 | 7.5 | 8.1 |
| Transparen-cy (m) | 0.1 | 0.1 | 0.3 | 0.7 | 0.6 | 0.7 | 0.4 |

**Source: SLII, 2012**

The pH values are directly correlated with the dissolved oxygen concentrations: lowest pH values corresponding to lowest dissolved oxygen concentrations. Variation of pH and oxygen concentration can be caused by the following factors:

- Reoxygenation of waters at interface air-water;
- Photosynthetic activity during the day which lowers the quantity of CO2 and increase pH;
- Decomposition of organic matter which consumes oxygen in water;
- Presence of humic acids from biodegradation of dead organic matter.

Highest oxygen concencentations and higher pH values are found downstream of Rusumo Falls (station W2), in the Ruvubu River (station W5) and in the Rweru Lake (stations W11 to W13).

For the majority of sampling sites, the concentration in dissolved oxygen is high and is close to saturation which is essential and favourable to biological productivity. At certain sites, an obvious decrease in dissolved oxygen was recorded near the bottom due to the presence of organic sediments that are decomposing.

The iron and chlorides values are relatively high at all sites, resulting from intense human activity and its waste, and could degrade the area for the development of biological life.

*Microbiological Analysis*

The microbiological analysis showed that samples from the sites at the Nyabarongo, Kagera and Ruvubu, located near agglomerations, have pathogenic germs such as E.coli. Surface water does not meet standards for the consumption of drinking water.

*Water Pollutants*

The pollutants that enter in the water courses are derived from a wide variety of human activities. Eight groups of pollutants has been identified and classified in two categories:

Physico-chemical pollutants:

- Organic residues, such as sewage, brewery wastes;
- Inert suspensions - soil sediment, mine wastes;
- Fertilizers and detergents;
- Inorganic reducing agents - sulphides, sulphites;
- Petroleum products - waste oil, tanker spills;
- Toxic wastes - heavy metals, pesticides.

Biological pollutants:

- Micro-organism - faecal coliforms, cholera bacilli;
- Macro-organisms - parasitic worms, exotic fish species and aquatic weeds.

Water pollution comes from different sources such as domestic wastes, septic tanks and latrines, agriculture and industries. The contamination from the domestic wastes, septic tanks and latrine may cause outbreaks of typhoid, cholera, gastro-intestinal diseases, dysentery, etc. Pollution from agriculture comes from the use of fertilizers, pesticides and herbicides.

Appendix E provides in-situ and laboratory analysis results of water quality sampling.

### 4.2.12. Noise and Vibration

There are no industrial activities and agglomeration of importance present in the immediate vicinity of the power plant site. However, the road bridge over the Kagera River at Rusumo being a crossing point that is very frequented by trucks carrying cargoes between Rwanda and Tanzania, this activity appears to be the main source of noise and vibration in the area.

### 4.2.13. Air Quality

There is no historical air quality data in the region. It’s a rural area with no significant industrial activities and rather low road traffic. Therefore the most common air pollutant would be particulate matter, especially during the dry season.

# 4.3. BIOLOGICAL ENVIRONMENT

The information the biological environment has been collected from:

- Meetings with national experts from different technical departments of the countries concerned, agencies specialized in the field of nature protection, conservation of natural resources (soils, water, wildlife, parks, etc.), biodiversity and infrastructure management (climate, land use, etc.), agricultural development, as well as the populations of the project area.
- Review of bibliographic data, and
- A number of field surveys carried out by the ESIA consultants during the period November 2007 – February 2013.

The survey work carried out in the context of the preparation of the ESIA can be summarised as follows:

- In December 2007 and the beginning of 2008, an inventory of the aquatic and terrestrial vegetation and a detailed inventory of the fish fauna found in the study area was carried out. At that time the study encompassed the area impacted by the Full Development Scheme and was significantly larger than the area impacted by the Run-of-River scheme and included Lake Rweru;
- In January 2012, a field survey was conducted in the Ruvubu River and the section of river immediately downstream from the Rusumo Falls in the Kagera River. A total of 616 fishes for a total biomass of 13,806 kg were captured using gillnets. An inventory of fish habitat and fish species found in the area was prepared from observations made by the survey team and interviews with the local fishermen. The ecological requirements of the major species in the study area were established.
- In November 2012 a Rapid Biodiversity Assessment of the Rusumo Falls spray zone was made by observing the habitat from the bridge 50 metres downstream, sampling at the Falls being problematic because of difficult access, and
- In February 2013 an additional survey was made of the Rusumo Falls spray zone, using ropes survey team members scrambled down into the spray zone and completed a sampling programme and characterised the ecology of the zone.

In order to reflect the project area of influence, the study area has been divided into four areas, each of which is addressed separately in the descripton of the baseline situation and in the assessment of impacts: (i) The Falls, (ii) the stretch of river immediately downstream from the falls (1 kilometre stretch), (iii) the immediate stretch of the river upstream from the Falls where the power plant construction and dam are planned, and (iv) the wetlands extending up to 20 kilometres upstream from the falls along the valleys of the Kagera and Ruvubu rivers. The administrative boundries with respect to the different parts of the project area of influence are described in the description of each biological component below and in section §4.4.1.

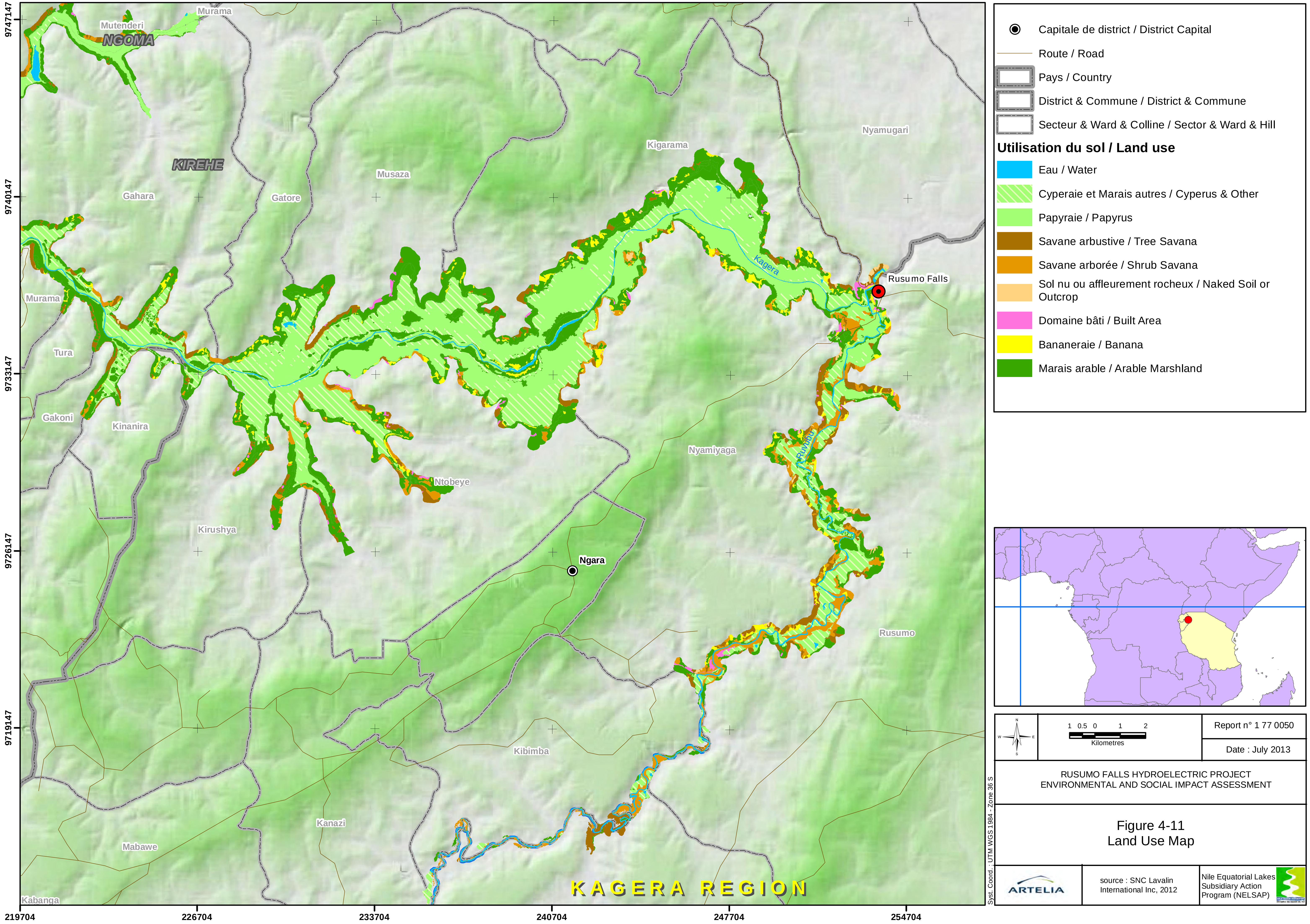


Figure 4-11
Land Use Map

### 4.3.1. Vegatation and Land Use in Study Area

The general land use and types of vegetation in the study area is presented in the Figure overleaf. The main land uses are: natural marshland (papyrus), arable marshland (cleared marshland used for crops and pature), intermediate land (private arable land used for banana plantation and other crops); natural terrestrial vegetation (tree and shrub savannah), residential area, roads, river.

### 4.3.2. Ecology of the Rusumo Falls Spray Zone

The Rwanda side of the Falls and downstream rapids is located in the area of the Rusumo East village (Nyamungali Sector, Kirehe district). The Tanzania side of the Falls and downstream rapids is an area known as Mitako, and is located in the area of the Rusumo village (Rusumo Ward, Ngara District).

***Flora***

In February 2013 a specific survey was made of the Rusumo Falls spray zone, using ropes survey team members scrambled down into the spray zone and completed a sampling programme and characterised the ecology of the zone.

The dominant feature of the area is the Rusumo Falls, which is a waterfall with a vertical drop of approximately 30 meters (see photos overleaf). The spray zone is the area in the vicinity of the Falls where there is a permanent mist of spray. This zone is characterized by steep rocky banks of about 10 metres in height and which are permanently wet from the spray of water. The harsh conditions in the spray zone explain the low species diversity in that area. The herbaceous vegetation of the steep banks is particularly dominated by the *Tristicha trifaria* (Podostemonacea). Other vegetation includes lichens (*Philonotis sp.*) as well as several species of algae. A few individuals of other species characteristic of permanently inundated areas include *Carralluma schweinfurthii*, *Achyrantes aspera*, and *Hypoestes verticularis* are also visible.

All the species present in the spray zone are represented in other ecosystem within the region and do not have any particular protection status. Although particularly adapted to the spray zone humid conditions, it is anticipated that the plant species would resist and adapt should the conditions change as a result of the project (less spray and reduction of water levels).

*Rusumo Falls*

*General view of Rusumo Falls*

Bordering the spray zone, where there is less humidity, the vegetation is characteristic of gallery forest. The vegetation is dominated by shrubs such as: *Uvaria schweinfurthii*; *Uvaria welwitchii*, *Crossopteryx febrifuga*, *Securinaga longipedonculata, Canthium lactescens* and *Euclea shimperi*. Trees are dominated by the species: *Sapium ellipticum, Blighia unijugata, Cordia Africana, Ficus toningii, Ficus valis choudae, Markhamia lutea, Dracaena fragrans, Erythrina abissinica,* and *Eckebergia capensis*. Two CITES protected species the *Impatiens irvingii* and *Eulophia guineensis (an orchid)*[4]) have also been recorded in this part of the vegetation and are represented by a few individual specimens. As is common, they are represented by a few isolated individuals scattered among the rest of the vegetation. These species are not spray conditions dependent and are quite common as part of the savannah vegetation of the eastern part of Rwanda (Cf Fischer E. in *La Nature du Rwanda, aperçu sur la Flore et la Faune rwandaise*). It is not expected that this vegetation would be affected should the spray conditions be reduced following the construction of the power plant.

The complete list of flora identified during the survey is as follows:

- *Tristicha trifaria* (Podostemonacea);
- *Philonotis sp* (Lichens);
- *Algues* (var sp);
- *Cyanotis barabata* (uruteja);
- *Achyrantes aspera*;
- *Asplenium stuhlmanii*;
- *Hypoestes verticularis*;
- *Dolichos kilimandscharicus* (Fabacee), and
- *Carralluma schweinffurthii*.

***Fauna***

With respect to fauna, there are no indications of species of particular interest. Regarding protected and rare birds, one or two individuals were spotted; African fish eagle (*Haliaetus vocifer*), the long crested eagle (*Lophaetus occipitalis*), the common black kite (*Milvus migrans*). However it is emphasised that these species are not dependent on the spray zone habitat and are also observed further downstream. No reptiles or amphibians were observed. Local people report the occasional presence of the Nile Varan (*Varanus niloticus*); python (*Python sebae*), both of which are protected, but which are not spray zone dependent as they are also observed occasionally both upstream and downstream from the Falls

[4] See ESMP PAE-02 Biodiversity Monitoring.

### 4.3.3. Ecology of the Downstream Rapids

The area immediately downstream of the Falls is a narrow valley characterised by a sequence of rapids that stretch along the river for 800 metres and which represents an additional drop in altitude of 6 metres. Along this stretch of the river the water flow changes from that of extremely turbulent to a very slow flow regime.

In terms of aquatic and riverine flora this stretch of river does not represent any particular environmental interest. There is a transition zone with the spray zone, where the species that populate the spray zone are replaced by tree and shrub savannah typical of the area.

However, this stretch of river is important for fish. In terms of the ecological needs of fish species in the Kagera River it should be noted that the Kagera River upstream and downstream of Rusumo Falls and its associated lakes are populated by a fish fauna that is mainly fluviatic, and that need running water and marshland for food, breeding and growth of juvenile fish.

In January 2012, a field survey was conducted in the Ruvubu River and the section of river immediately downstream from the Rusumo Falls in the Kagera River. A total of 235 fish representing by 7 species were captured in the downstream rapids section. See also Appendix G – Flora-Fauna Inventories.

The following species (and number captured) were identified. Out of the 7 species captured 3 species (indicated by *) are also found upstream of the Falls.

- *Schilbe intermedius* (129)*
- *Labeo victorianus* (1)*
- *Tilapia rendali* (16)
- *Oreochromis niloticus* (5)
- *Barbus paludinosus* (81)
- *Oreochromis leucostictus* (1)*
- *Brycinus cf, imberi* (2)

None of the species captured are protected or endangered.

The Rapid Biodiversity Assessment conducted in November 2012 allowed to observe several species of birds which were also seen near the Falls and include: the African fish eagle (*Haliaetus vocifer*), the long crested eagle (*Lophaetus occipitalis*), the common black kite (*Milvus migrans*), the pin-tailed whydah (*Vidua macroura*), the grey heron (*Ardea cinerea*), the speckeled mousebird (*Collius striatus*); as well as mammal species: Blue and grivet monkeys (*Cercopithecus mitis* and *C. Aethiops*). However it is emphasised that these species are not dependent on this stretch of river and are also observed further downstream.

Local people report the occasional presence of the Nile Varan (*Varanus niloticus*); python (*Python sebae*) and common crocodile (*Crocodylus niloticus*).

*Rapids downstream from Rusumo Falls*

*Rapids downstream from Rusumo Falls*

### 4.3.4. Ecology of Areas Immediate Upstream from the Rusumo Falls

Upstream from the Rusumo Falls to the area of the Confluence with the Ruvubu River, is a large depression through which flows the Kagera River from the West and the Ruvubu River from South West.

The Rwanda side of this area includes the village of Rusumo East (Nyamugali Sector, Nyankurazo cell) and Rusumo West and Nyakwsi (Kigarama Sector, Nyankurazo cell)

The Tanzania side of this area includes the Nyakahanga and Migombani localities around the Rusumo villages (Rusumo Ward, Ngara District).

The topography in this area forms a vast plain colonized by papyrus beds largely dominated by *Cyperus papyrus* and where silting due to local soil erosion and sedimentation from the Kagera River have produced an organic soil that is flooded for much of the year.

The open water supports also aquatic vegetation composed of invasive species, in particular, water lilies (*Nymphea nouchalii*), water hyacinths (*Eichornia crassipes*) and in some places *Azolla pinnata* floating on the open water.

At the bottom of the hills and along the edge of the papyrus marshland, there are several cultivated areas where banana and other fruit trees, sugar cane, sweet potatoes and beans are grown during the dry season.

Birds observed in this area include the common sandpiper (*Actitis hypoleucos*), the goliath heron (*Ardea goliath*), the pied kingfisher (*Ceryle rudis*), the black sunbird (*Chalcomitra amethystina*), the southern red bishop (*Euplectes orix*), the red billed firefinch (*Lagonostica senegala*), the Golden Weaver (*Ploceus xanthops*) and the garzet egret (*Egretta garzetta*).

The people from the villages of Rusumo (Tanzania) and Rusumo East (Rwanda) confirmed the presence in this area of the Speke's antelop (*Tragelaphus spekei*), usually hunted in the Tanzanian side. Hunting is prohibited in Rwanda. The peopme also report having seen dead specimens of Nile Varan (*Varanus niloticus*); python (*Python sebae*) and common crocodile (*Crocodylus niloticus*).

*Kagera River – view upstream from Rusumo East village*

*Kagera River – view upstream from Rusumo East village*

### 4.3.5. Ecology of Stretch of the River Further Downstream from the Falls

This stretch of river is located 1 kilometre downsteam from the Falls and starts at the end of the narrow valley and the end of the sequence of rapids.

The Rwanda side of this area includes is located in the Nyamugali Sector. The Tanzania side of this area is located in Rsumo Ward.

This stretch is characterised by calmer zones which may constitute habitat for aquatic fauna. The river's width in this zone varies from between 20 and 50 metres and the depth varies from 6.5 and 9.3 metres in its center.

The topography is characterized by the presence of a fairly large plain starting at the banks of the Kagera River. The banks are dominated by reed beds of *Echinochloa pyramidalis* and which is bordered by a vast plain of tree savannah.

In this area, the main vegetation is shrub and tree savannas composed of combretaceae or legumes dominated by *Acacia sp.*, *Combretum molle* associated with *Comerina Africana*, *Sida cordifolia, Siranom nigrum, Conyza sumatrensis, Conyza dibentcuroza, Parenia spp, Lantana camara, Markhamia actifolia, Stebrela erata, Asparadis africana,* etc.

*Leersia hexandra* and *Panicum coloratum* are two aquatic plants found in river channels and depressions with shallow water.

This area is known to be rich in fish and fishing activities take place in Mitako area (Rusumo village, Tanzania) where a local fishing cooperative is operating. Different fish species occurring in this area include: Cyprinniidae (*Labeo victorianus, Barbus sp, Tilapia sp*), Clariidae (*Clarias aluaudi, Clarias gariepinus*), Protopteridae (*Protopterus aetiopicus*).

It was reported by local people that animals from the Akagera National Park located further downstream are known to occasionally migtate to this zone. Animals include Hippopotami (*Hippopotamus amphibious*) and crocodile (*Crocodilus niloticus*); which often causes costly damages to fishing activities (destruction of nets) as well as regular fatal accidents of serious injuries and even death to local fishermen.

### 4.3.6. Ecology of Upstream Marshlands

***Kagera Valley***

The Rwanda side of this area is located with the Kigarama Sector –Nyankurazo, Kiremera, Kigalama, Nyakerera and Cyanya cells). The Tanzania side of this area lies within the Nyamiyaga ward.

*Marshland*

Marshlands extend upstream from the Rusumo Falls along the Kagera valley. The area that lies between the Rusumo Falls and the Conflence of the Kagera and Ruvubu Rivers is described in §4.3.3. The marshland further upstream is described in the following paragraphs.

For about 80 kilometres between the Rusumo Falls and the Lake Rweru, the Kagera River flows through a vast area of marshland delimited by the hilly sides of the valley. The marshlands fill the bottom of the valley and in the project area of influence the valley is 3 to 4 kilometres wide and most of valley bottom is occupied by marshes, however, there are some ponds, which are depressions filled with water and some loamy sand raised hillocks and embankements along the river which constitute favourable habitats for the development of vegetation and wildlife communities.

The dominant vegetation is *Cyperus papyrus*, though the open water supports aquatic vegetation composed of invasive species, in particular, water lilies and water hyacinths.

In terms of wildlife, the marshlands provide the habitat for a restricted range of species including water turtles, crocodiles, lizards, snakes and a variety of water birds including herons, egrets, ducks. Bird fauna is one of the most important wildlife communities and species that are of particular interest include Carruthers's Cisticola, the white-winged swamp warbler, the near threatened Papyrus Gonolek and the vulnerable Papyrus Yellow Warbler.

The natural terrestrial vegetation along the edge of the marshland is limited to a fringe less than 20 meters wide. It is dominated by *Brachiaria humidicola*, *Markhamia actifolia, Combretum molle, Acacia hokii, Lantana camara*, and *Albuzia abiantifolia*, associated with other species such as *Conyza sumantrensis*, *Vernonia amygdalina, Bidens pilosa*, sometimes with the presence of *Phonix sp* and palm trees (*Elais guineensis*) or tree plantation, especially *Grewia bicolor*.

In some areas where the valley becomes narrow, wooded fringes can be observed on the immediate edges of the marshand. The characteristic trees in these wooded fringes are *Anthocleista schweinfurthii, Syzygium cordatum, Alchornea cordifolia, Sapium ellipticum* and *Newtonia buchananii*.

*Arable Marshland*

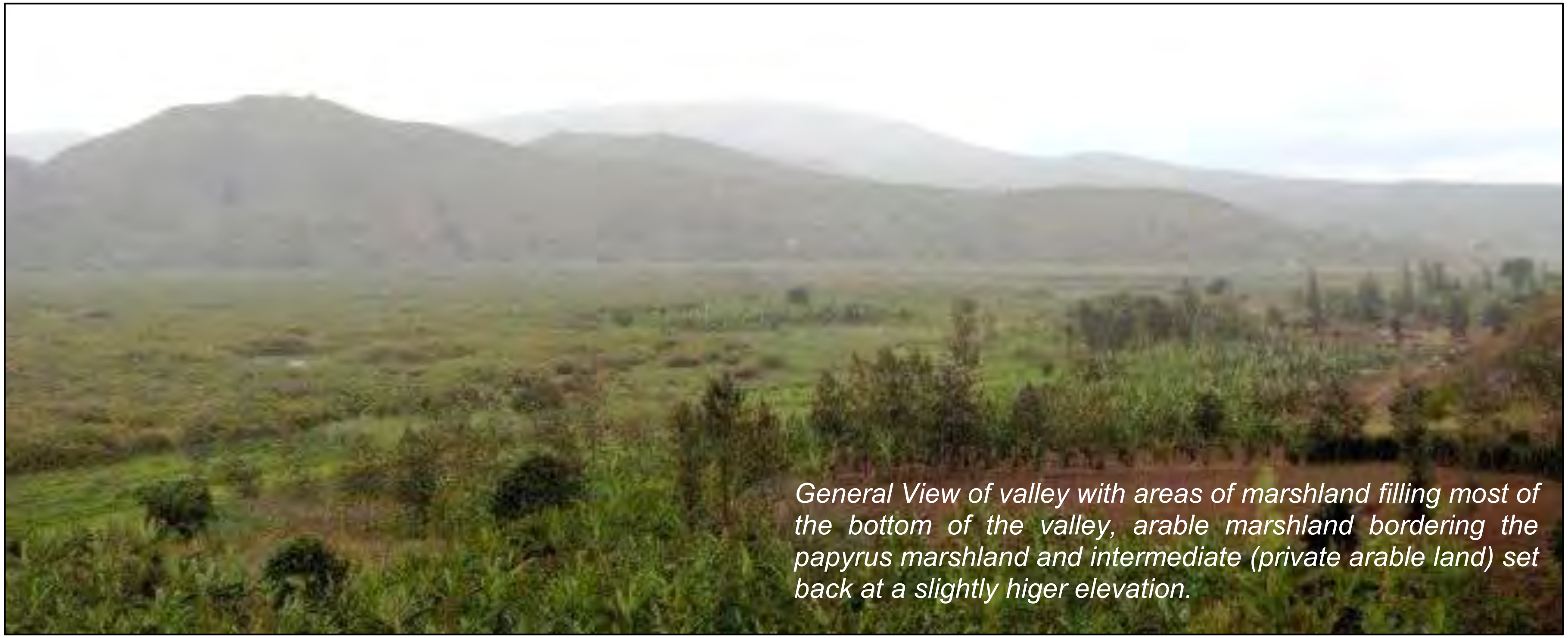
At the edge of the marshland, the local people clear the papyrus to create a narrow band of arable marshland. Under natural conditions, this land is flooded during the wet season and during the period May – October, the water slowly recedes, allowing the land that is dry for more than 3 months to be used for agriculture and the land that is dry for less than 3 months is used for pasture. During the wet years, this arable marshland does not dry out and cannot be used for agriculture and pasture.

*Intermediate Land (private arable land)*

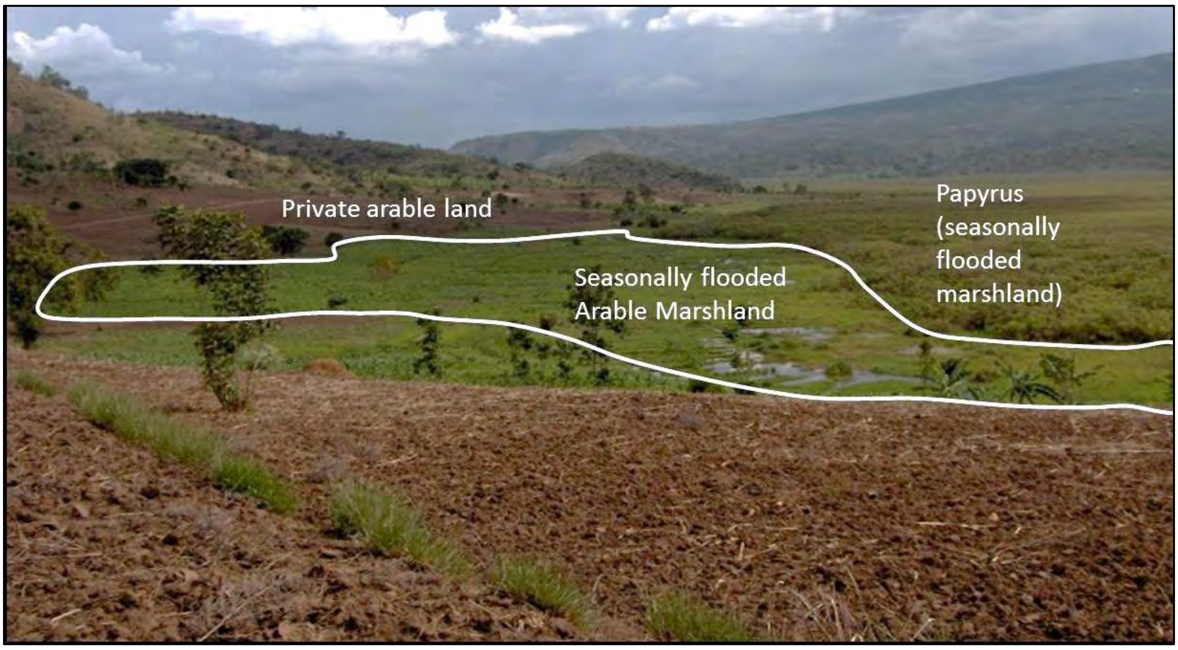
The land that is at a slightly higher elevation than the arable marshland and which is deliminated by the high water level of the natural seasonal flooding of the marshland is referred to in this report as 'intermediate land" as it is located between the area of marshes and the hilly sides of the valley. The intermediate land is fertile private arable land that is cultivated by the local people. The crops that are grown include, sweet potatoes, sugar cane, tobacco, Eleusine, and sorghum). The interediate land is not affected by the project.

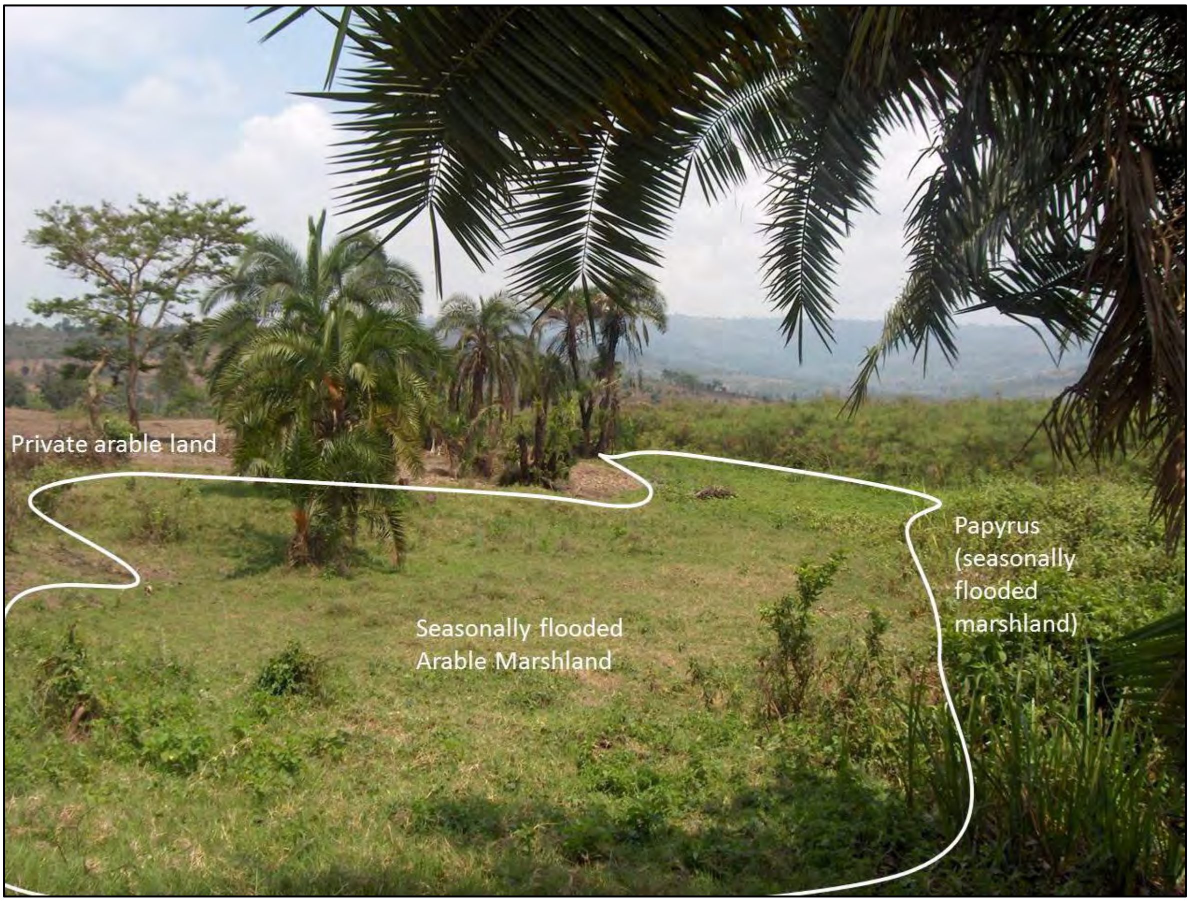
*Hillsides*

On the hill slopes which extend uphill from the intermediate land the vegetation belongs to the phytogeographical area known as the Sudano-Zambezian area. The vegetation is made up of tree and shrub savannas dominated by *Acacia sp*. and open forests dominated by *Brachystegia sp*. with a carpet of discontinuous gramineae. The hillside zones are not affected by the project.



*General View of valley with areas of marshland filling most of the bottom of the valley, arable marshland bordering the papyrus marshland and intermediate (private arable land) set back at a slightly higer elevation.*


Private arable land
Papyrus (seasonally flooded marshland)
Seasonally flooded Arable Marshland


Private arable land
Papyrus (seasonally flooded marshland)
Seasonally flooded Arable Marshland

***Ruvubu Valley***

The Ruvubu valley is located entirely within Tanzania (Nyamiyaga ward). The Ruvubu River meanders along two steep hill chains in a narrow valley.

The vegetation on the berms by the riverside is largely dominated by thickets of Mimosa pigra, a plant which has apparently become very invasive in the alluvium deposited by the Ruvubu River.

The most distinctive characteristic of Ruvubu River vegetation is the presence of wooded fringes some 80 metres wide which border the edge of the marshland filling the river's flood plain. Three different types of forest are observed in the woody fringe: (i) *Macaranga spinosa* and *Anthocleista schweinfurthii* swamp forests; (ii) *Alchornea cordifolia* and *Syzygium cordatum* floodplain forests and, *Sapium ellipticum* and *Newtonia buchananii* mesophyll forests in the dryer areas.

There are some agricultural activities between the small berm located between the foot of the hills and the forested riparian vegetation. These areas are seasonally flooded favouring the development of the *Mimosa pigra* thickets which have invaded a large stretch of land along the Ruvubu River.

### 4.3.7. Fauna Occuring in the Marshland

Review of the bibiliographic data has identified that the marshland is considered as an important habitats for fauna, especially birdlife. The area supports a number of globally threatened species and a restricted range of species such as water turtles, crocodiles, monitor lizards, snakes, otters and variety of water birds, including herons, egrets, ducks, warblers and weavers. In addition, some 180 bird species have been identified including six European migrants.

The following sections provide a review of different animal taxa (birds, mammals, reptiles, amphibians) with highlights on species of particular conservation status.

***Birds***

*Marshlands extending upstream from the Rusumo Falls to Lake Rweru*

In the complex formed by the Kagera River and associated marshes, bird fauna is one of the most important wildlife communities. Inventories from 1966 and 1989 identified 146 species.

The birdlife is distributed in the different ecological zones which comprise the permanent water bodies, the seasonally flooded sectors of cyperus papyrus and wooded hillocks and embankements that are not seasonally flooded.

Among the species found in the water bodies, there are several species of *Ardeidae, Anatidae* and *Threskiornithidae* most of which also use the cementsments for their breeding sites. Flotting papyrus rafts which are found in the the area of Lake Rweru are also important sites for resting and nesting activities, though in the project area of influence there are no such floating papyrus rafts.

There are many bird species in the papyrus beds relying on this ecosystem for different stages of their life cycle and the highest species richness of birds in marshland is associated with the areas where papyrus and natural vegetation are plentiful. Some species are specific to this type of habitat and include the Carruthers's Cisticola (*Cisticola carruthersi*), White-winged Swamp Warbler (*Bradypterus carpalis*), the near threatened Papyrus Gonolek (*Laniarius mufumbiri*) and the vulnerable Papyrus Yellow Warbler (*Chloropeta gracilirostris*). The threats to the marshland habitat make the Papyrus Gonolek a species which requires careful monitoring even if it is not immediately threatened (IUCN, 2011). Papyrus Cyperus papyrus bird communities are thought to be amongst the least well protected birds in East Africa and, in many places, their habitat is under immediate threat of degradation or loss (Maclean and al., 2006)[5].

The birds most commonly observed in this area are the African jacana (*Actophilornis Africana*), the cattle egret (*Bubulcus ibis*), the kingfisher (*Ceryle rudis*), and the cormorant (*Phalacrocorax africanus*). Those birds were observed during the 2012 survey in addition to the giant kingfisher (*Megaceryle maxima*), malachite kingfisher (*Alcedo cristata*), *Plectropterus gambensis, Scopus umbretta, and Dendrocygna viduata.*

Local endemism is relatively low although according to the organization Birdlife International, the marshes of the Kagera River harbor endemic species of the forest-savanna mosaic zone located in the Lake Victoria Basin. These species include *Cisticola carruthersi*, *Bradypterus carpalis, Turdoides sharpei, Ploceus castanops, Nesocharis ansorgei, Serinus koliensis, Laniarius mufumbiri and Chloropeta gracilirostris*.

Some bird species observed in the area are threatened and mentioned on the IUCN Red List (2011). They are the near threatened *Laniarius mufumbiri, Polemaetus bellicosus and Rynchops flavirostris* and the vulnerable *Chloropeta gracilirostris, Baleaniceps rex and Falco naumanni*.

[5] The moniotoring rmeasures regardings these species are described in the Environmental and Social Management Plan Chapter 7 – PAE-02: Monitoring of biodiversity.

*Rusumo Falls Spray Zone area of rapids Immediately Downstream*

Several CITES protected species were sighted around the rapids area. These comprise: African Fish Eagle (Haliaetus vocifer); Long Crested Eagle (Lophaetus occipitalis), Black Kite (Milvus migrans), and Common Egret (Egretta garzetta).

***Mammals***

An inventory carried out by SOGREAH in 1989 (which included the areas around Lake Rweru and the region of Mugesera) identified five ungulates, eight carnivores and other taxonomic groups such as rodents, primates, Lagomorphs and Insectivores. The ungulates include the hippopotamus (*Hippopotamus amphibious*), which is the largest mammal in the area, the bushpig (*Potomochoerus porcus*) and three Bovidae including the Speke's gazelle (*Tragelaphus spekei*).

During the rapid survey carried out by Artelia, mammals that werer observed comprised Blue Monkeys (*Cercopithecus mitis*), and Green Monkeys (*Cercopithecus aethiops*). Villagers have also reported the presence of Speke`s gazelle (*Tragelaphus spekei*), bush pigs (*Potamochoerus porcus*), hippopotamuses (*Hippopotamus amphibious*), as well as mongooses (*Herpestes sp*).

Among the five species of special status mammals status identified in the upstream area, *Hippopotamus amphibious* is vulnerable and is mentioned on the IUCN Red List (2007) and is also protected internationally by the CITES (1973). The other three species protected by the CITES are Carnivores (*Aonyx capensis*, *Hydrictis maculicollis* and *Civettictis civetta*).

***Reptiles***

The information gathered on reptiles is based on a review of the previous studies and some observations made during Artelia's field survey.

Appendix G lists the the species of reptiles (crocodiles, lizards, snakes and turtles) identified in the study area by local fishermen and during inventories carried out by Mughanda (1989), Experco (2003) and SLII in 2012.

During Artelia's field work, local people reported that a Seba Python (*Python sebae*) was recently killed in the Nyakwisi cell, at the edge of the marshland and that in general there is the death of one local fisherman per year, caused by crocodiles in the river downstream downstream from the Rusumo Falls. This area lies within the Mitako cell (Rusumo village, Tanzania).

In addition to these species, Experco (2003a) has also identified a species of lizard (*Varanus niloticus*), several other snakes of the Viperidae and Elapidae family as well as turtle species unidentified along the Kagera marshes.

***Amphibians***

Thus far, no specific inventory has been carried out on the amphibian fauna living within the upstream area of the Rusumo falls. The only survey that has been undertaken on this taxa took place in Lake Rwihinda in North Burundi near Kirundo, about 30 km from Lake Rweru. On the shores of Lake Rwihinda, a dozen species distributed in 3 families have been identified and the most abundant species in the marshes were *Ptychadena frontalis, Ptychadena grandisonae*, and *Hyperolius boccagei*. Due to the proximity of Lake Rwihinda, these species are likely to be found in the marshes within the Project's area of influence.

### 4.3.8. Ecology in the Marshlands

The characterization of the aquatic biological environment is based on the review of available studies and the field survey carried out in December 2007 and beginning of 2008. An inventory of the aquatic vegetation as well as a detailed inventory of the fish fauna found in the study area was established (See Appendix G). An additional survey was conducted in January 2012 in the Ruvubu and Kagera Rivers.

***Aquatic Vegetation***

Aquatic vegetation with the project area of influence can be found in open stretched of water. The vegetation is usually composed of invasive species, in particular, water lilies (*Nymphea nouchalii*), water hyacinths (*Eichornia crassipes*) and in some places *Azolla pinnata* floating on the open water and *Hydrocotyle ranunculoides* that sometimes outgrows the water hyacinth. *Leersia hexandra* and *Panicum coloratum* are sometimes found in depressions with shallow water.

In January 2012, during a period of high flow for the season, SLII team estimated the floating vegetation accumulation composed of hyacinths drifting near Kakiro, upstream from Rusumo Falls in the Kagera River at around 126 per hour or 3,024 per day. Those accumaulations of floating vegtation are expected to pass the falls and settle in calmer areas downstream from Rusumo Falls.

***Phytoplanckton***

The climatic and physico-chemical conditions of the environment determine the composition of its phytoplankton species, their distribution, abundant seasonal fluctuations and the relative importance of different groups of algae. The composition of phytoplankton in the study area determines the biological cycles within the aquatic environments. Phytoplankton is consumed by primary consumers (e.g. shellfish, worms, fries, adult fish), which in turn feed secondary and tertiary consumers as such as humans.

The closest sampling of phytoplankton species to the project area of influence was in Lake Rweru carried out in 1981 by Ntakimazi (1985). In this study, 76 taxa were identified in the littoral zone and 66 in the open area of the lake. Phytoplankton density was slightly higher in the open area (153 million units per litre) than in littoral areas (9.5 million units per litre). These phytoplankton species are Cyanophycae (blue algae), which was quantitatively the most important phytoplankton species, followed by Chlorophycae. The total concentration of phytoplankton was comparable to other lakes in Africa and was in sufficient quantity in order not to be a limiting factor for species that feed on it.

Data on the composition of phytoplankton downstream from Rusumo exists of Lake Ihema. The phytoplankton has an average density of 815 million units per litre measured in 2003 by Experco.

The study also revealed that phytoplankton is distributed homogeneously into the lake and that, as with Lake Rweru, *Cyanophyceae* and *chlorophyceae* dominate the lake's phytoplankton population. The study conducted in 1984 enumerated 66 taxa while that carried out in 2003 listed 37 taxa.

In 2003, Experco determined the dosage of Chlorophyll at four sites on Lake Ihema, in order to assess biotic activity and more precisely assess the lake's phytoplankton biomass. The average levels were 77.35 microgram per litre ± 25.7).

***Zooplanckton***

Zooplankton is one of the key links in the food chain of aquatic ecosystems and like phytoplankton. Its distribution depends largely on the physical, chemical and biological environment.

Appendix G presents the qualitative composition of zooplankton species present in the study area during the inventories carried out by Dr. Ntakimazi (1985) at Lake Rweru and Kiss (1976) and Experco (2003b) in Lake Ihema.

Sampling of zooplankton in Lake Rweru revealed that the specific composition of zooplankton in the lake was relatively poor and that biomass was relatively low. Cyclopoids, with a density of 3 to 181 individuals per liter, dominated other groups, which is relatively low. Inventories in Lake Ihema found 645,750 individuals per cubic metre in the North Bay and 198,332 individuals per cubic metre in the South Bay. As in Lake Rweru, cyclopoids were the most numerous.

**Aquatic Vegetation in a Reed Zone of *Echinochloa pyramidalis***

**Aquatic Vegetation of Water Hyacinth (*Eichornia crassipes*)**

***Benthos***

Ntakimazi studied the benthic fauna of Lake Rweru in 1981 and found that it was very poor in quality and in quantity. This was explained by the nature and instability of the substrates as well as by the poor conditions of oxygenation of the lake's bottom. Invertebrates listed in the lake's sediments include Diptera, Odonatas, Hydracarians, Copepods, Ostracodes, molluscs, Oligochaeta, Hirudinea and Turbellaria.

At Lake Ihema, mollusks are the only aquatic invertebrates that have been studied. However, *Limnocnida victoriae* and a small shrimp (*Caridina nilotica*) were also observed (Kiss 1976).

The two classes of shellfish that have been identified are Gastropods and Bivalves. Among the Gastropods, the family of Planormidae includes host species of *Schistosoma haematobium*, one of the vectors of bilharzia. Two other largely abundant species are Bellamya unicolor and *Melanoides tuberculata*, which were found in the area northwest of the lake.

During the January 2012 survey, a few macro-invertebrates were observed near Mitako, downstream from Rusumo Falls in the Kagera River. Observations included oligochaetes, annelids (leeches), flat worms, dipterous larvae, beetles (*whirligig beetle*), and winged insects.

***Fishlife***

*General*

In addition to gathering information already available on the fish fauna of the study area, In January 2012 an additional survey was carried out to establish an inventory of fish habitat and fish species found in the area and compile information gathered from fishermen and fish surveys with gillnets (See Appendix G). A summary of the results and the ecological requirements of the major species in the study area are presented in the following paragraphs.

The Kagera River upstream and downstream of Rusumo Falls and its associated lakes are populated by a fish fauna that is mainly fluviatic, and that needs at least running water and marshland for food, breeding and growth of juvenile fish. The communication between river and lakes and the extensive marshlands are the vital conditions for these ecosystems. The presence of more than 30 different species has been documented from previous studies.

It is estimated that the fish community downstream is richer than that of upstream due to the presence of the Falls and rapids, which prevent fish from migrating from the richer downstream Lake Victoria to the further upstream lakes. Initially ecosystems were rather poor in species diversity and population numbers, but the successive introductions that have occurred in recent decades have increased fish populations. Fish fauna from the Kagera River basin can be classified as follow:

- Omnivorous such as *Barbus acuticeps*, *Barbus altianalis, Synodontis ruandae, Clarias gariepinus, Haplochromis, Schilbe intermedius, Protopterus aethiopicus* and *Pseudocrenilabrus multicolor*;
- Insectivorous such as *Mastacembelus frenatus, Amphilius jacksonii, Amphilius uranoscopus* and *Clarias alluaudi*;
- Benthos-eating such as *Pollimyrus nigricans*;
- Herbivorous such as *Tilapia rendalli*;
- Algae-eating such as *Labeo victorianus*.

Several fish species frequent the area upstream Rusumo Falls where virtually the same species found in the Kagera River are found in Lake Rweru. The list of species recorded during our inventories and those carried out by SOGREAH (1991), De Vos (1986) and Experco (2003a) is shown in Appendix G. The three families with the most abundant species are Cichlidae, Claridae and Cyprinidae. The low biodiversity of the upstream area is partly attributable to the Rusumo Falls which represent an obstacle migratory fishes cannot go beyond.

The biomass of the major plankton-eating species (Tilapias) has significantly decreased in recent years possibly due to increased fishing pressure.

Most species listed are fluviatic species and their distribution depends largely on their diet, reproduction and need to escape predators. Most Cichlideae species prefer spawning areas in the sheltered and shallow waters of the lake which have a sandy substrate with a bit of gravel. The shores of the small lakes, ponds and pools are other potential spawning areas in the upstream zone. During the rainy season Clariidae and Cyprinidae species leave waters of the lakes and rivers to go to spawn in flooded alluvial plains (Experco 2003a).

Thus, young fish and juvenile species use vegetation cover provided by the papyrus plants for food and shelter from possible predators like fish-eating birds. However, some piscivorous fish such as the African lungfish (*Protopterus aethiopicus*) have specialized and mainly feed on fry and juveniles in these areas. The multiple channels, natural drains, lakes, ponds and papyrus beds therefore harbor a significant fish fauna and offer a multitude of potential sites for breeding (Experco 2003a).The physical conditions limiting the area's benthic fauna affect fish because the oxygen deficit limits the number of species using organic matters in the water bottoms which are too soft to be used as spawning areas (Ntakimazi 1985).

The species observed in the Akagera sub-basin include 12 indigenous species (INECN 2005).

The Lake Rweru and the other aquatic ecosystems which are interrelated within the sub-basin are host of some threatened species, as the endangered *Barbus acuticeps* and the vulnerable *Synodontis ruandae* (IUCN 2007). These are both endemic species from the Akagera River system and have suffered from the wetlands regression and the pressures on the reed and grasses that constitute the main vegetation types of these ecosystems (IUCN, 2011). A pressure specifically related to *Barbus acuticeps* populations regression is the increased water turbidity due to erosion on the watershed and the decrease in dissolved oxygen. This species occurs primarily during the high waters period when Lake Rweru is in direct contactwith the Akagera and the Nyabarongo.

Typically a river species, it is not usually found in lakes.Individuals of Barbus acuticeps were inventoried but there was no individual of *Synodontis ruandae*. The absence of this species might be due to the time of the year when the inventories were carried out or to the fact that there is only a very small population of this species left in the study area, essentially in the riverswhere it reproduces in the riparian vegetation.This species has been eliminated from the lake by *Clarias gariepinus* an introduced species (G. Ntakimazi, personnal communication).

The ecosystems are rather poor in fish species, but successive introductions of new species in recent decades have increased fish populations currently using the nutritional resources that were then under exploited. Related to this, *Oreochromis macrochir* had been introduced into Burundi and Rwanda Lakes after it escaped from fishing farms in the 1950. Nevertheless, this species is threatened by the alien species *Oreochromis niloticus* and is displaced by it in areas where the two species occur together (both as aliens) on the Zimbabwean plateau. This species had been inserted in the Red List as vulnerable. The invasion of *O. niloticus*, may lead to a major decline in *O. macrochir* in the next years. The preferred habitat of this species is the calm shallow bays of lakes covered with vegetation (G. Ntakimazi, personnal communication).

*Rusumo Falls and the Downstream Stretch of Rapids*

In the Kagera River, the 1 kilometre section downstream from Rusumo Falls is characterized by a high slope and rapids on the first 500 m. After this fast flowing water section, calmer zones are observed that may constitute refuge for aquatic fauna. The river width varies between 20 and 50 m and depth varies between 6.5

and 9.3 metres in its center. The river bed is mostly rocky (90%) near the falls. Bedrock is progressively replaced by dispersed large rocks, decreasing in proportion on the downstream end of the section. The other portion of the substrate is dominated by sand, and in smaller proportion by gravel. Loam dominates the section upstream from the falls but is rare in the downstream section.

**Table 4-8 Substrate Type - Ruvubu and Kagera River**

| River | Ruvubu River | | | Kagera upstream from Rusumo Falls | | | Kagera down-stream |
|---|---|---|---|---|---|---|---|
| Sampling site | Nyamko | Kambwana | Nyakahanga | Rwagatarati | Maranyundo | Kakiro | Mitako |
| Loam | x | x | x | x | x | x | |
| Sand | x | x | x | x | x | x | X |
| Gravel | x | | | | | | X |
| Big pebble | x | | | | | | X |
| Rock | | | | | | | X |
| Banks | Mixt | Mixt | Herb | Herb | Herb | Herb | Mixt |

*Upstream Waters*

In the Ruvubu River, pools are flooded only during the wet season and thus are constituted of oxygen-poor stagnant water, a habitat not suitable for fish. In January 2012, water depths varied between 6 and 9 metres and substrate is mainly composed of loam and sand.

The Rusumo Falls limit fish passage between the upper and the lower sections of the Kagera River.

### 4.3.9. Invasive Species

***Invastive Plants***

The floristic composition along and within the hydraulic system comprises some invasive species as the widespread Common water hyacinth (*Eichhornia crassipes*) in open water areas. This species is abundant within the Akagera basin and invaded lakes up to Lake Victoria. Rusumo fall fragments water hyacinth islands and plants which then disperse through the Kagera basin. The Lake Ihema ecosystem is seriously affected by water hyacinth which has taken advantage on local flora and had considerably changes physico-chimic characteristics of this lake (Global Nature Fund, 2011). *Echinochloa pyramidalis* and *Vossia cuspidata*, which are grass plants, are recognized as invasive species (Bemigisha, 2000; Invasive Species Specialist Group, 2006; Invasive Species Compendium, 2011). *Mimosa pigra* forms dense, thorny impenetrable thickets particularly in wet areas. It has been listed as one of the world's 100 worst invasive species.

Compared to papyrus, these species are more adapted to physical conditions related to flooding, as a total immersion of roots on a long period and a strong and quick power of recolonization of flooding area.

The study of vegetation showed, in all the wetlands and aquatic areas within the study area, the presence of species with a great ability to proliferate to the point of becoming a serious threat to other species even if they are not recognized as invasive species (MINAGRI, 1998, Experco 2003a, WSP and al. 2003, FAO 2005, ORTPN 2005, BRL 2007). These include P*olygonum pulchrum, Hydrocotyle ranunculoides, Phyla nodiflora* and *Echinochloa sp*. Wherever the open water is more or less stable, these species tend to invade the area with the risk of clogging up some ponds and flood channels. Therefore, the environment becomes deficient in dissolved oxygen which is harmful to aquatic life and micro-organisms living and breeding in these environments (Ntakimazi, 1985).

The same is true in cultivated areas where a trend towards the emergence of species taking advantage of the the land when left in fallow.

Cultivated areas (sandy banks in the marshes and glacis) are being invaded by herbaceous and graminean plants due to the cultivation of the land. The main species are *Cyperus dives, Polygonum pulchrum, Leonotis nepetifolia, Galisonga parviflora, Eleusine indica, Ageratum conyzoides* and *Leonotis nepetifolia*.

Although at this level, these species have not had any direct influence on water quality, it should be noted that their proliferation is likely to significantly change, in some places, the normal functioning of ecosystems with consequences for ecosystem biodiversity.

***Invasive Animals***

In Lake Rweru, the proliferation of termites is a problem to such an extent that eucalyptus cannot be used to reforest the area. Other species causing problems are domesticated species such as cows, sheeps and goats which graze on the edge of the marshes, where they feed on natural vegetation species.

Some fish species introduced in the area's water bodies are also harmful to other native species. This is the case of the African lungfish (*Protopterus aethiopicus*) which, after being introduced into Lake Muhazi by the EPALM project in 1989 spread across several lakes and rivers, including the Lake Rweru and the Nyabarongo River. This predator that is native of Lakes Victoria and Edward has a high reproductive capacity and feeds on shellfish and other fish species threatening these populations. However, the decrease in fish populations could also be caused by the introduction of *Clarias gariepinus* in Lakes Muhazi, Kigembe, and Ruganwa and the Nyabarongo River. This ichthyophagous species is believed to have caused a decrease in stocks by direct predation causing the disappearance of *Clarias liocephalus* that it has now outnumbered in rivers (Experco 2003a).

*Astatoreochromis alluandi* and *Schilbe mystus* were also introduced into Lake Muhazi and is now found in the water bodies of the ANP. The consequences of these introductions are currently unknown, but they could cause a competition with other species, as it was the case for tilapia in Lake Ihema. Indeed, Tilapia species such as *Tilapia variabilis* and *Tilapia esculenta* have not been observed in the area after 1972 following the introduction of other species of tilapia with which there could have been competition for food and spawning sites (Experco 2003a).

### 4.3.10. Rare, Threatened and Protected Species

Several species of fauna and flora that have been identified in the study area have conservation status at the national or international level.

Although these species were mentioned in the previous sections Appendix G presents a complet list synthesis of species listed on the IUCN Red List and the categories in which they were registered (IUCN 2007).

Those listed in categories of species that are not threatened (minor concern, insufficient and unverified data) are not included in this summary.

The Table overleaf provides a list of protected and endangered species and also indicates in which area they have been observed and gives an indication of the frequency of presence and population numbers.

**Table 4-9 Summary of Protected and Endangered Species in the Project Area of Influence**

| Group | **Species** | **Common name** | **Status** | **Area** | **Presence** | **Numbers** |
|---|---|---|---|---|---|---|
| | | | Protected/Endangered | Falls; Rapids downstream, Marshland<5km, Marchland>5km | Permanent, Frequent<br>Occasional, Rare | Isolated individuals,<br>Many individuals |
| **MAMMALIA** | | | | | | |
| Amhibian | *Hippopotamus amphibius* | Hippopo-tamus | IUCN (VU)/CITES/GoR | M<5; R; M>5 | O | I |
| Ungulate | *Tragelaphus spekii** | Sitatunga | CITES / GoR | M<5; M>5; | R | I |
| Carnivores | *Aonyx capensis* | African Clawless Otter | CITES | M>5; | R | I |
| | *Hydrictis maculicollis* | Spotted-necked Otter | CITES | M>5; | R | I |
| | *Civettictis civetta* | African Civet | *CITES* | M>5; | R | I |
| **REPTILIA** | | | | | | |
| | *Crocodylus niloticus* | Nile crocodile | CITES /GoR | M<5; R; M>5; | O | I |
| | *Varanus niloticus** | Nile monitor | CITES | M<5; M>5; | R | I |
| | *Python sebae* | African rock python | CITES /GoR | M<5; M>5; | R | I |
| | *Viper aspis* | | GoR | M>5; | R | I |
| | *Turtoides* | | GoR | M>5; | O | I |
| **BIRDS** | | | | | | |
| | *Balaeniceps rex* | | IUCN (VU)/CITES | M>5; | R | I |
| | *Falco naumani* | | IUCN (VU)/CITES | M>5; | O | I |
| | *Rynchops flavirostris* | | IUCN (NT) | M>5; | O | I |
| | *Sarkidiornis melanotos* | | CITES | M>5; | O | I |
| | *Buteo buteo* | | CITES | M>5; | O | I |
| | *Circus macrourus* | | CITES | M>5; | F | I |

**Table 4-9 Summary of Protected and Endangered Species in the Project Area of Influence** *(Continued)*

| Group | Species | Common name | Status<br>Protected/Endangered | Area<br>Falls; Rapids downstream, Marshland<5km, Marchland>5km | Presence<br>Permanent, Frequent<br>Occasional, Rare | Numbers<br>Isolated individuals,<br>Many individuals |
|---|---|---|---|---|---|---|
| | *Circus ranivorus* | | CITES | M>5; | O | I |
| | *Elanus caeruleus* | | CITES | M>5; | F | I |
| | *Haliaetus vocifer* | | CITES | F; M>5; | P | I |
| | *Hieraetus penatus* | | CITES | M>5; | O | I |
| | *Lophaetus occipitalis* | | CITES | F; M>5; | P | I |
| | *Milvus migrans* | | CITES | F; M>5; | P | M |
| | *Polemaetus bellicosus* | | IUCN (NT)/CITES | M>5; | P | M |
| | *Terathopius ecaudatus* | | CITES | R; F; M<5;M>5 | F | I |
| | *Balearica regulorum* | | CITES/GoR | M<5; M>5; | P | M |
| | *Agapornis pullarius* | | CITES | M>5; | O | I |
| | *Poicephalus meyeri* | | CITES | M>5; | P | M |
| | *Tyto capensis* | | CITES | M>5; | R | I |
| | *Asio capensis* | | CITES/GoR | M>5; | R | I |
| | *Bubo lacteus* | | CITES/GoR | M>5; | R | I |
| | *Ardea alba* | | CITES | M>5; | F | M |
| | *Bubulcus ibis* | | CITES/GoR | M>5; | P | M |
| | *Egretta garzetta* | | CITES | M<5; M>5; | P | M |
| | *Ardea melanocephala* | | GoR | M>5; | P | M |

**Table 4-9 Summary of Protected and Endangered Species in the Project Area of Influence** *(Continued)*

| Group | **Species** | **Common name** | **Status** Protected/Endangered | **Area** Falls; Rapids downstream, Marshland<5km, Marchland>5km | **Presence** Permanent, Frequent Occasional, Rare | **Numbers** Isolated individuals, Many individuals |
|---|---|---|---|---|---|---|
| | *Ephippiorhynchus senegalensis* | | CITES | M>5; | O | I |
| | *Leptoptilos crumeniferus* | | CITES | M>5; | O | I |
| | *Bostrychia hagedash* | | CITES | M<5; M>5; | O | M |
| | *Plegadis falcinellus* | | CITES | M>5; | P | M |
| | *Threskiornis aethiopicus* | | CITES | M>5; | O | I |
| | *Scopus umbretta* | | GoR | M>5; | P | M |
| | *Alopochen aegyptiaca* | | CITES | M>5; | O | M |
| | *Anas acuta* | | CITES | M>5; | P | M |
| | *Dendrocygna viduata* | | CITES | M>5; | P | M |
| | *Nettapus auritus* | | CITES | M>5; | O | I |
| | *Plectropterus gambensis* | | CITES | M>5; | O | M |
| | *Hieraetus pennatus* | | CITES | M>5; | O | I |
| | *Porphyrio porphyrio* | | CITES | M>5; | O | I |
| | *Streptopelia senegalensis* | | CITES | M>5; | P | M |
| | *Treron calvus* | | CITES | M>5; | O | M |
| | *Turtur afer* | | CITES | M<5; M>5; | O | M |

**Table 4-9 Summary of Protected and Endangered Species in the Project Area of Influence** *(Continued)*

| Group | **Species** | **Common name** | **Status** | **Area** | **Presence** | **Numbers** |
|---|---|---|---|---|---|---|
| | | | Protected/Endangered | Falls; Rapids downstream, Marshland<5km, Marchland>5km | Permanent, Frequent<br>Occasional, Rare | Isolated individuals,<br>Many individuals |
| | *Laniarius mufumbiri* | | IUCN (NT) | M>5; | R | I |
| | *Chloropeta gracilirostris* | | IUCN (VU) | M>5; | O | I |
| | *Cossypha caffra* | | GoR | M<5; M>5; | P | I |
| | *Turdoides jardinei* | | GoR | M>5; | P | M |
| | *Nectariniidae (ALL)* | | GoR | M<5; M>5; | F | M |
| | *Meropidae (ALL)* | | GoR | M>5; | P | M |
| | *Phoeniculidae (All)* | | GoR | M>5; | P | M |
| | *Hirundinidae (ALL)* | | GoR | M>5; | O | M |
| **FISH** | | | | | | |
| | *Marcusenius victoriae* | | IUCN (EN) | R | O | I |
| | *Barbus acuticeps* | | IUCN (EN) | M>5; | O | I |
| | *Synodontis ruandae* | | IUCN (VU) | R | R | I |
| **PLANTS** | | | | | | |
| | *Ficus thonningii* | | GoR | F; | P | M |
| | *Pentadesma reindersii* | | GoR | F; R | P | M |
| | *Myrianthus holstii* | | GoR | R | P | M |
| | *Hypoestes trifolia* | | GoR | R | P | I |
| | *Aloe sp* | | GoR | R | P | I |
| | *Orchidaceae (ALL)* | | GoR | R; F; M<5; M>5 | P | I |

### 4.3.11. Protected Areas, Valued Ecosystems and Game Reserves

The location of the protected areas, valued ecosystems and game reserves presented in the following paragraphs are illustred in Figure 4-12.

***National Parks and Protected Areas***

The nearest national park to the project site is the Akagera National Park located 60 kilometres downstream from the Rusumo Falls. The park includes the largest protected wetland in central Africa formed by the river/lake depression of the Kagera River. This area represents a typical immersion ecosystem where lakes and marshes cover an area of about 100,000 ha. On a national scale the Akagera region is an important area for large mammals in the country as it is the only protected savannah environment in Rwanda. Four species of mammals that have been listed under CITES include African elephants (*Loxodonta Africana*), buffaloes (*Sincerus caffer*), leopards (*Panthera leo*) and marsh buck (*Tragelaphus oryx*) are founded there. The Akagera River feeds a complex of lakes linked by vast papyrus swamps, which are home to one of the most important populations of sitatunga (*Tragelaphus spekii*) in Africa. Due to its wide diversity of habitats, Akagera is an important ornithological site with bird species in exceeess of 500. In this sense, the area has been identified as an Important Birds Area by Birdlife International (2007). Like for these wetlands, Experco (2003a) recommended that the ANP wetland become a Ramsar site, but no steps in that direction have been taken so far by the Rwandan government. Lake Ihema is the biggest lake in the park, with an area of about 90 square kilometres, with a depth varying from 5 to 7 metres depending on the area and the season.

It is emphised here that the project is not expected to have any detectable effects on the Park.

***Wetlands***

*Rweru-Mugesera Complex (Project for Ramsar site)*

Eighty (80) kilometres upstream from the Rusumo Falls dam site (and ouside the projects area of influcene in the Lake Rweru. The lake is part of a complex of lakes and wetlands connected with the Kagera river trough a system of channels disseminated within the agroclimatic zone of Mayaga, in South-East of Rwanda. At least 5 relatively small lakes are part of this system. These lakes are currently threatened by siltation due to massive sediments resulting from hillside erosion caused by anthropic interventions through deforestation and agricultural practices. These lake ecosystems and associated marshlands are part of the wetland areas that have been described as important areas for biodiversity in the Kagera basin. The vegetation is mainly composed of vast areas of papyrus *Cyperus papyrus* and *Vossia cuspidata* a long the Kagera river. Present are also in small associations: *Typha dominguensis, Leersia hexandra, Echinochloa pyramidalis, Polygonum pulchrum, Echinochloa pyramidalis* and *Aspilia Africana*. Individual water bodies support also aquatic vegetation composed mainly by par *Nymphea nouschalii, Pistia stratioides* and *Lemna perpusilla*. Water hyacinth *Eicchornia crassipes*) is also visible along the Kagera River.

These wetlands support a number of globally threatened species and restricted range of species such as water turtles, crocodiles, monitor lizards, snakes, otters and variety of water birds, including herons, egrets, ducks, warblers and weavers. In addition, some 180 bird species have been identified in the wetland habitats, including six European migrants (FAO, 2000). In addition to this, Lake Rweru plays an important role for populations living in its vicinity thus providing goods and services.

The bird species of interest include CITES concerned species *Bubulcus ibis, Egretta garzetta, Bostrychia hagedash* and *Threskiornis aethiopicus*. Several mammals species of conservation importance have also been recorded in these areas, and include *Hippopotamus amphibious, Tragelaphus spekei, Aonyx capensis* and *Lutra maculicilis* (IUCN, CITES)

With regard to the icthyofauna, Lake Rweru complex is host of some threatened species, as the endangered *Barbus acuticeps* and the vulnerable *Synodontis ruandae* (IUCN 2007). These are both endemic species from the Kagera River system and have suffered from the wetlands regression and the pressures on the reed and grasses that constitute the main vegetation types of these ecosystems (IUCN, 2011). A pressure specifically related to *Barbus acuticeps* populations regression is the increased water turbidity due to erosion on the watershed and the decrease in dissolved oxygen. This species occurs primarily during the high waters period when Lake Rweru is in direct contact with the Akagera and the Nyabarongo.

Based on the above described biodiversity importance as well as the high level of threats that are affecting the lake Rweru complex and associated wetlands, the Government of Rwanda through the Rwanda Environment Management Authority (REMA) has introduced an application to grant the Rweru complex ecosystem a RAMSAR status. As signatory of the RAMSAR Convention related to the protection and sustainable conservation of wetlands areas and associated birdlife, Rwanda proposed the Rweru complex (along with several other sites) in order to better recognise its global biodiversity significance and also secure the global attention and have raise its conservation profile.

With the assistance of the World Bank supported Integrated Management of Critical Ecosystem (IMCE) Project, several steps have been achieved, including the assessment of the biodiversity and environmental concerns for this ecosystem, the preparation of legal framework in relation to the wetland protection, and the preparation of the technical file for the application process for the RAMSAR status. However, according to the concerned authority (RAMSAR Convention Focal Point in REMA), this process is yet to be completed as there is still need to review information in relation to RAMSAR criteria for site listing. This exercise is still underway.

*Kagera Wetland*

This area adjacent to the Akagera National Park on the Tanzanian side of the study area is recognized as an important area for birds by Birdlife International (2007), since the same species as those found in the ANP are likely to be found there. This territory is not protected.

***Game Reserves***

*Kimisi Game Reserve*

The Kimisi Game Resreve is situated on the Tanzania side of the Kagera River, 20 kilometres downstream from the Rusumo Falls. It was established in 2003 and supports important populations of the shoebill and the sitatunga antelope and is also an area of outstanding scenic beauty. It is a potential touristic area. Because the project is not expected to change the downstream river hydrology, no detectable effects on the Game Reserve are expected.

*Burigi Game Reserve*

Burigi Game Reserve is located to the east of the Kimisi Game Reserve and the reserve is about 20 kilometres from the Kagera River, and is thus not in the Project's area of influence.

*Ibanda and Rmanyika Game Reserves*

The Ibanda and Rmanyika Game Reserves are located on the Tanzania side of the Kagera River, 150 kilometres downstream from the Rusumo Falls. No detectable effects on the reserve are expected.

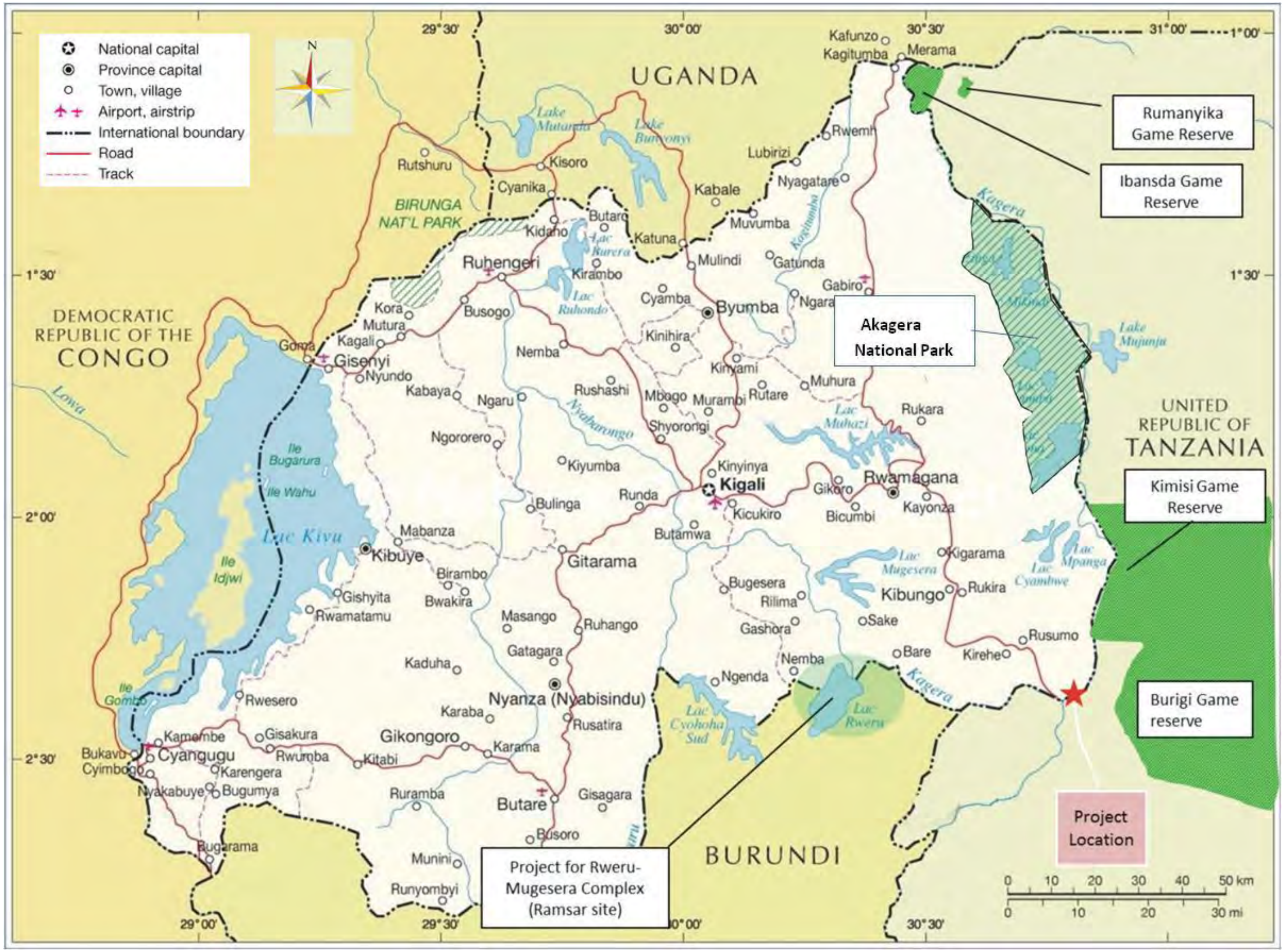



Figure 4-12 Protected Areas, Valued Ecosystems and Game Reserves

## 4.4. SOCIOECONOMIC BASELINE SITUATION

### 4.4.1. General Background

The area affected by the Project is located towards the South-East of the Rwandan capital of Kigali, within the District of Kirehe (capital: Kirehe) of the Eastern Province (capital: Rwamagana).

The morphology of the landscape is characterized by gentle hillsides gradually converging into marshlands. The villages are usually established on the hilltops, often with scattered houses on the slopes. All available land is intensively used by agriculture, extending over the hillsides to the edge of the marshlands. A transitional zone (“the intermediate zone”) between marshlands and hillside lands is usually observed in much of the study area. The intermediate zone can be occasionally flooded in the rainy or high water season. The existence and extension of this zone depends on the slope of the hillside lands bordering the marshland. It is a critically important area for agriculture as the soil is better drained than in marshlands and the issues that impede agriculture on hillsides do not exist (erosion, poor fertility). The extension of agricultural cultivation to the seasonally flooded marshlands was often a response to food and fodder shortages in the dry seasons or to drought periods as the population levels increased. Successive government policies have had a direct influence on wetland agricultural use. The use of marshland has therefore been influenced more by political and socio-economic factors than by individual farmers. The Rwandan Government currently sees marshland as providing an important opportunity for improving food security and income through the production of rice. In the Rwandan context, ‘marshland’ is defined as all lowland and comprises the entire valley bottom, which includes both areas that are permanently under some water and areas that are inundated on a temporary basis only. Marshland is colonized by a specific type of natural vegetation such as Cyperus papyrus and Echinochloa pyramidalis, associated with other species.

In Tanzania, due to the availability of hillside land, the cultivation of marshland is not such a frequent phenomenon. East Rusumo in Rwanda and Rusumo in Tanzania are border villages and the closest ones to the construction site. Separated by the Kagera River, the two villages share a similar lifestyle, even including a common language. However, trade is not significant enough to generate opportunities in trade-related services. These villages are similar to other villages along the Kagera River, all relying on subsistence agriculture economy. Yet Rusumo on the Rwandan side and Rusumo on the Tanzanian side differ from other communities of the study area in their relation to this project, since they are located in the immediate area of the construction site. Baseline information was mostly gathered from District development plans and household surveys. Household surveys included Rusumo (Kirehe, Rwanda), Rusumo and Mitako (Ngara, Tanzania).

### 4.4.2. Administrative Subdivisions

***Overview on Administrative Units-Rwanda***

*District:* District is an autonomous administrative structure with a legal status and financial autonomy. The District Council elaborates the District policy, approves the District budget, mobilizes the population for development, and controls the activities of the Executive Committee of the District..

*Sector:* Sector is the next level of the democratic local government, and it includes, several Cells. Cells development plans are coordinated by the Sector Development Committees, who have been elected by members of the Cell Community Development Committees (CDCs). Members of the Sector CDCs elect their representative in the District CDC.

*Cell:* Cell is the grass-roots local government organization, administered by a freely elected Executive Committee. Each Cell elects a Cell CDC responsible for planning social and economic development activities. Cells are usually comprised of 100 to 200 households.

*Umidugudu:* Villages in the project area have been created and settled relatively recently following a villagisation program (Umidugudu) launched by the government in 1996. The overall objective of this program was to overcome the traditional disperse settlement pattern and to enhance the development of coherent settlements in order to be able to provide easier access to social infrastructure. Today, Umudugudu represent grassroots administrative unit under the cell, comprising at least 50 households.

*Affected Villages – Administrative Units*

The affected area in Rwanda is entirely located in Kirehe District.

Except Rusumuo East, which belongs to Nyamungari Sector, all the other affected villages are part of Kigarama Sector.

***Overview on Administrative Units - Tanzania***

Tanzania has 26 regions or administrative divisions. The levels below the regions are:

- Districts;
- Divisions;
- Wards;
- Villages.

Rural areas in Tanzania have a two-tier system for local government with local government councils operating at both the district and the village levels. In addition, the Tanzanian local government system has administrative committees at both the ward, street (mtaa) and sub-village levels. Local government authorities have a broad spectrum of responsibilities, including primary education, primary health care, rural water supply, local government roads.

In addition to these local government structures, Tanzania also has a network of decentralized Regional Administrations, which include secretariats at the regional level and staff at the district and divisional levels. The Regional Secretariats have oversight over matters like local budgets, and monitoring responsibilities with regards to local government authorities.

*Affected Villages-Administrative Units*

The Kagera region of Tanzania is comprised of six districts. Rusumo Village is part of Ngara District, which is itself divided into 4 divisions, 17 wards, and 72 villages. Ngara is further divided into 359 sub-villages. Rusumo village belongs to Kiyanzi Division and of Rusumo Ward.

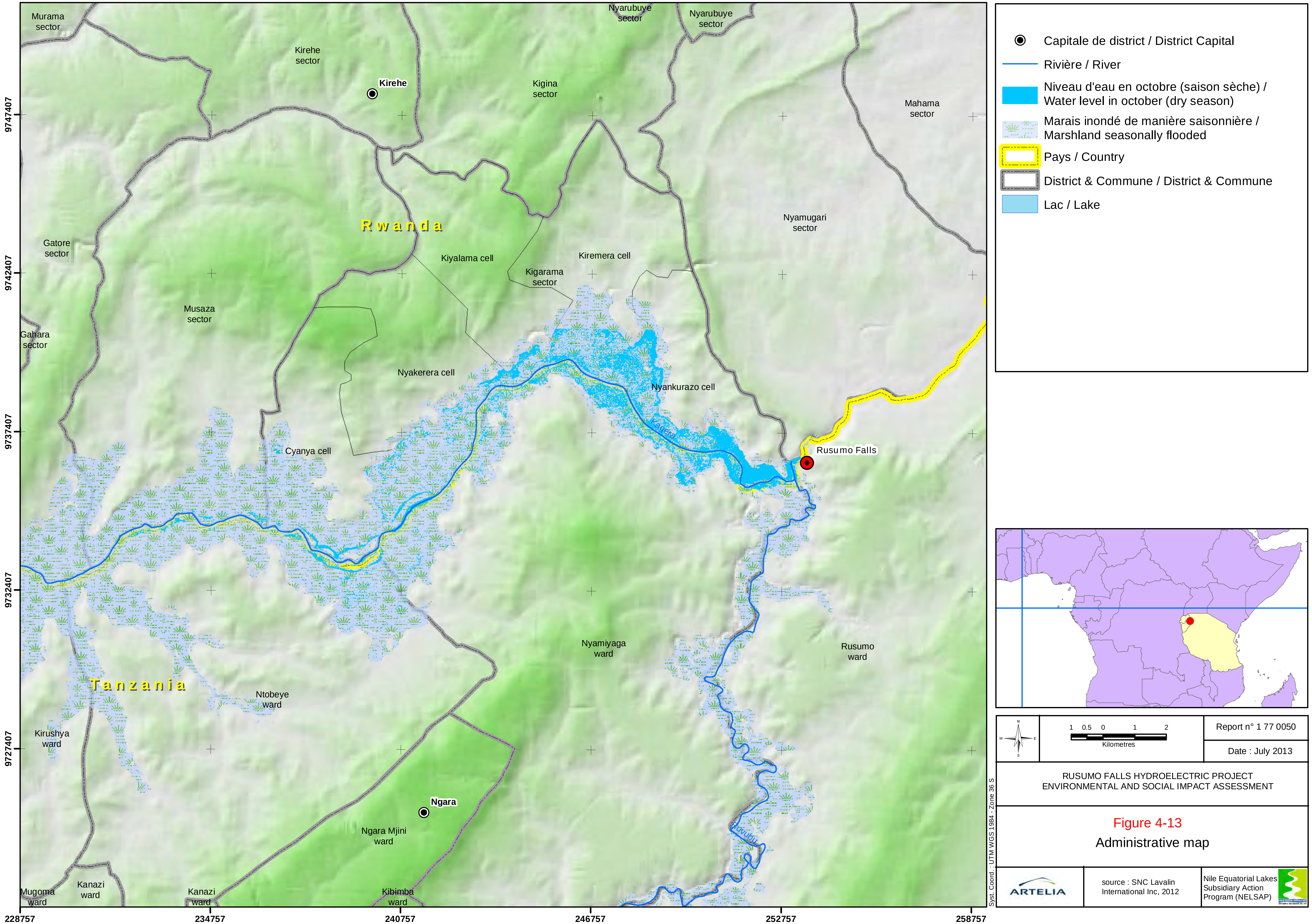



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Figure 4-13

Administrative map

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

### 4.4.3. Demographic Characteristics

**Table 4-10 Demographic Characteristics**

| Demographic Aspect | Rwanda | Tanzania |
|---|---|---|
| Population Density | Kirehe District is one of the most densely populated districts in Rwanda, with 320 people/km2. | The Kagera Region has a population of over 2 million and a population density of 71 people/km2, much lower than the Kirehe District in Rwanda. |
| Population Growth | Over the past ten years, average population growth was 2.3%/year, which is slightly below the national average of 2.7%. | The Ngara district, which contains the impacted area, had a population of 334,409, and an annual population growth rate of 5.3%. Ngara's population constitutes approximately 16% of the Kagera region's population. |
| Age Structure | The age structure is that of a young population, characterized by high fertility and high mortality. A decline in the age groups 20-24 and 25-29 for both sexes is due to the circumstances of the mid-nineties. | The age pyramid structure is that a roughly equal number of males and females and is typical of a young population age structure characterized by high fertility and mortality. |
| Gender Ratio | In general, male population figures are lower that of female population. The ratio of male per 100 females was already low in 1991 (95.1 males for every 100 women in rural Rwanda), but dropped consistently after the genocide. The ratio is particularly low among the population subgroup aged over than 20-24 years, what can be attributed to higher male mortality during the genocide.<br>Single-parent households are frequent in the wider Project Affected Area, whereby 20% of the households in the Project Affected Area are headed by women. | The Ngara Poverty Survey (2006) indicates that approximately 4 out of 5 households of the district are headed by males. SLII 2011 survey data also indicated that 75% of the households in the survey area were headed by men, and only 25% by women. |
| Household Size | The average household size for Kirehe District is 4.3 individuals per household. The age of most of the heads of households is between 18 and 55 years. | According to the Ngara Poverty Survey (2006), the mean household size is 5.1 individuals. SLII's household survey indicated that most households have 5 or more members. Only 9% of the households had only one member.<br>SNC's household survey indicated that the average age of male heads of households is 41years and the average age of female heads of households is 40 years. According to the Ngara Poverty Survey, most heads of households fall within the 50-59 age group and the 60 and above group. |

## Table 4-9 Demographic Characteristics *(Continued)*

| Demographic Aspect | Rwanda | Tanzania |
|---|---|---|
| Education Levels and Access to Education | The results of the household survey undertaken by SLII (2011) suggest that the literacy rate of the heads of household in the project area is generally low: 33% of the male heads of households indicated not to have any formal education, while 44% had not finished primary school and 4% had not finished secondary school. Out of the surveyed woman headed households, 26% had not finished primary school and 61% did not have any formal education.<br>According to the survey results, 52% of the heads of households are illiterate and only 48% of children (both sexes) aged 5 years or older are enrolled in primary school.<br>Generally, the highest education level completed by both heads and other members of households is primary school. Access to secondary education is impeded by long distances between most villages from secondary schools (usually from 3 to 7 km). Access to primary education is easier, with primary schools relatively close to residential areas (max 2 km). | The SNC household survey suggests a low education level of males in the study area . 14% of males in the sampled households seem to have started but not completed primary education, but 61% have and 17% are currently attending primary school. Only 5% have completed secondary schooling. Although 1% have graduated from university and 1% have completed some form of vocational-technical training. , In general, the highest education level completed by males is primary schooling. |
| Migration | A noticeable characteristic of the villages in the Project Affected Area is that only 41% the affected households<br>had been living in their actual village for more than 10 years. After 1994, large numbers of returning families, especially from Tanzania and Uganda, settled in the Kirehe District. | The majority of the individuals from the surveyed households in Ngara district were originating from the same district; only 4% had migrated from other districts within Tanzania, and 3% were from other countries in East Africa.<br>There is a refugee population in Ngara district, mainly from Burundi, and according to the 2002 census, 30% of Ngara's population was comprised of refugees (SLII RAP Tanzania, p. 32). |

#### 4.4.4. Agriculture and Land Tenure

***Rwanda: Agriculture and Animal Husbandry in the Project Area***

The prevailing farming system in the Project area is a livestock based mixed farming system based on family labour on small plots, using traditional tools (hoe and machetes). Agricultural production is essentially by smallholder farmers who cultivate on average 1 ha of land with simple farm implements and very low inputs use, growing traditional food crops primarily for self-consumption and secondarily for marketing, and keep small numbers of livestock. Production is characterized by an intensive organic system and involves the combination of food, fodder and tree crops.

Food crops account for 92% of the cultivated area and 95% of affected household source their food primarily from their own cultivation. High value crops such as tea and coffee are grown by only a small number of farmers.

Bananas and beans are the main crops on hillside plots. Banana is the key staple as in other areas of Rwanda. In the Project area, bananas are typically grown around homesteads and on the foot of slopes in the “intermediate zone”. In addition to banana, a large variety of crops is cultivated on hillsides (beans, maize, sweet potatoes, sorghum, and cassava). Intercropping is widespread, allowing for minimization of risks and for a flexible mix of subsistence and commercial production. Such systems also allow households to synchronize household labor requirements, access food for household consumption, and generate small income with sales throughout the year.

***Rwanda: Land Tenure in the Project Area***

*General*

In the Project area, land tenure can be formal, customary and informal.

Formal tenure corresponds to land that was allocated by the State. There is no standard size for formally allocated plots. Since many of the returning families resettled after 1994 were livestock keepers, plot sizes were allocated according to herd size. Other formal tenure holders hold land for agricultural use.

More recently, there has been a large effort to sanction customary occupation by a formal, registered title and corresponding cadastral mapping. This process is now completed in the Kirehe District and all customary land owners have now been turned into formal holders under a lease hold regime.

District authorities have also awarded lease hold titles to cooperatives, particularly to a number of cooperatives operating irrigated schemes in the marshland for rice cultivation. In this case, cooperatives are the entities that hold the title, while cooperative members are registered at the cooperative level but do not hold title as such.

Leasehold tenure involves a contract and a grant of an estate in land for a specific period of time; plots of land are leased out to the public by the government. In freehold tenure, the interest in land goes on in perpetuity; the advantage of this type of tenure lies in the fact that it encourages investment, due to security of the holding.

Informal holders include two categories: people encroaching informally on individual land belonging to others, and people using state-owned land without formal permission to do so. This situation appears to be of marginal significance in the Project area, where an overwhelming majority of the land is held either formally under a registered leasehold title.

The Table below shows information on land ownership, plot sizes, and their spatial distribution in Kirehe District. Most of the plots are located on the hillside and intermediate zone areas which have historically been obtained as a result of distribution by the government following the Imidugudu process in the late 1990s. Few local farmers have bought additional land but some farmers came from outside the region and bought land for settlement.

**Table 4-11 Characteristics of Household Land Holdings in Kirehe District**

| Land Issue | Description | Situation in Kirehe District |
|---|---|---|
| Total Land Size/Household | Average (ha) | 1,1 |
| No. Plots/Household | Average No | 3 |
| Ownership | Owners % | 93 |
| | Tenants % | 7 |
| Tenure Type | Inherited | 11 |
| | Allocated by State | 21 |
| | Purchased | 61 |
| | Rented | 7 |

**Source: SLII, Household Survey (2011); SLII Land Tenure Focus Groups (2011)**

Some people, such as younger couples and women, lease land because they cannot afford to purchase land. It is important to notice that 11% of the surveyed households did not own any land for cultivation at all, including many youth who cannot obtain any land partly because the law abolished land subdivision into plots of less than one hectare. Members of these households typically work for others as casual laborers, or they rent land for cultivation from those with larger landholding. These households often have no livestock at all. They are bound to be food insecure during certain periods of the year.

*Average Size of Household Land Holdings*

Land distribution and tenure in the Project affected area have been constrained in the last decade by a combination of local demographic dynamics, historical context, legal framework, market situation and institutional capacities. The land holding sizes are on average of 1,0 ha of arable land per household. The density of the rural population has increased significantly in the last couple of decades; and as a result the average size of household agricultural land holdings decreased by 32 % between 1990 and 2012 in the Kirehe district (SLII, 2012: RAP Rwanda, p. 46).

Plots in marshlands are usually of small dimension, with an average of 0.05 ha.

*Marshland Tenure*

While much agricultural land is held by individuals in leasehold, the exception is marshland, which according to the Organic Land Law is vested in the State and administered by District authorities. The agricultural use of marshland has significantly increased in the last decades, as result of demographic pressure and gradual deterioration of hillside lands.

Apart from use by cooperatives (see para below), most if not all marshland cultivation is essentially informal and tolerated by authorities in spite of an environmental prohibition to harvest wetlands and to keep a buffer zone of 20 to 50 meters from the riverbank or the lake shore.

Informally held and traditionally farmed marshland is managed either by individuals or by families, and each farmer chooses which crops to plant. In the Project area it was observed that, during cultivation and sowing periods, when labor demand is high, informal groups are formed within which farmers help each other.

*Cooperatives Using Marshland*

To cultivate marshlands, farmers should in theory obtain a specific authorization from District authorities. According to information from field surveys (SLII 2012), this appears to be the case for cooperatives, which usually apply for a long term leasehold title. 15 agricultural cooperatives have been observed in Kirehe district, mainly cultivating vegetables for sale in local markets. Cooperatives have to agree on a planting, regime, weeding and harvesting schedule and on the application of agricultural inputs such as fertilizers and pesticides.

A cooperative is aiming to facilitate access to specific services that meet a common need of the members. for farmers from joining a cooperative are:

- Access to markets;

- Managing irrigation systems and securing access to land, and
- Obtaining technical support from government or private service providers.

*Gender Aspects of Marshland Use*

For Kirehe District, it has been observed that female heads of households generally cultivate more plots in the marshland and less on hillside as compared to men (SLII: 2012, RAP, Rwanda, p. 47).

In the villages along the Kagera River, in Rwanda, from 8 up to 15 kilometres upstream from the dam site on average 28% of marshland users are female headed households. From those households entirely depending on marshland, an average of 21% is female headed. More than a quarter of marshland using households are female headed, but the average portion of female headed households who are entirely depending on marshland is lower than the average share of female headed households in the total of marshland using households.

The table overleaf presents the situation in the villages along the Kagera River in Rwanda, that were visited during consultation and self-validation in Nov 2012. The Project affected villages are shaded in blue. The share of female headed households who cultivate marshland in the affected villages ranges between 18% and 36%.

*Marshland Utilization*

In the last decade, land scarcity on hillsides has led to broader resorting to wetland cultivation. Marshlands play a crucial role in the provision of household food security and income. They are used for additional food production during the dry seasons, usually on small to very small plots using traditional farming methods. Maize and sorghum are cropped in rotation with legumes or root tubers (Irish potato, sweet potato, yam and cocoyam).

In general, marshlands are utilized in three different ways:

- Vegetables and other crops, such as sweet potato and beans, grown on raised on mounds to avoid submersion of the root system;
- For small-scale rice cultivation, single or double cropped according to water availability;
- For larger-scale rice cultivation within gravity schemes, including cultivation of other crops after the harvest of the rice.

**Table 4-12 Female Headed Households: Marshland Cultivation**

| Village | Total N° HH cultivating marshland | Female headed HH | % of total | No HH entirely depending on marshland | N° female headed HH entirely depending on marshland | % of total |
|---|---|---|---|---|---|---|
| Rusumo East | 12 | 4 | 33 | 5 | 2 | 40 |
| Nyakwisi | 84 | 30 | 36 | 14 | 5 | 36 |
| West Rusumo | 48 | 12 | 25 | 11 | 3 | 27 |
| Nshungeruzi | 57 | 10 | 18 | 5 | 1 | 20 |
| Nyakabungo | 28 | 6 | 21 | 3 | 0 | 0 |
| Ruhuha | 122 | 42 | 34 | 5 | 2 | 40 |
| Marembo | 104 | 38 | 37 | 3 | 0 | 0 |
| Nyagahanga | 31 | 10 | 32 | 1 | 0 | 0 |
| Nyakigera | 51 | 13 | 25 | 2 | 1 | 50 |
| Kaguriro | 82 | 20 | 24 | 2 | 1 | 50 |
| Bweranka II | 41 | 13 | 32 | 4 | 4 | 100 |
| Kimeshu | 94 | 18 | 19 | 5 | 0 | 0 |
| Nyarutojo | 76 | 22 | 29 | 8 | 4 | 50 |
| Gahindu | 89 | 25 | 28 | 10 | 4 | 40 |
| Gasenyi | 77 | 21 | 27 | 15 | 3 | 20 |
| Gatari | 95 | 24 | 25 | 5 | 2 | 40 |
| Ryamukaza | 71 | 19 | 27 | 8 | 1 | 13 |
| Kabuga | 98 | 25 | 26 | 14 | 7 | 50 |
| Kabimba I | 43 | 20 | 47 | 5 | 3 | 60 |
| Nyamirambo I | 147 | 41 | 28 | 27 | 9 | 33 |
| Nyamirambo II | 284 | 66 | 23 | 44 | 20 | 45 |

**Source: village self-validation Nov 2012**

The dry season from June to August is dedicated to marshland cultivation.

Households are usually engaged in agriculture activities in the three zones concurrently (hill, intermediate and marshland). However, 19% of affected households engage only in marshland cultivation, essentially because they hold no land in other zones.

Starting from 2000, the Government of Rwanda has been developing marshlands in Kirehe District for cultivation of rice, with large gravity schemes.

*Animal Husbandry*

The Government has been promoting stronger agriculture-livestock integration to improve both farmers' livelihood and soil fertility management. A program called "Gir'inka project" ("one poor family – one cow") was implemented throughout Rwanda. This program aims at enabling every poor household to own and manage an improved dairy cow which would help the family to improve their livelihood through increased milk and meat production and to improve soil fertility of their land for their crops using the available manure. The program is based on a zero-grazing policy (the cow should be kept in a stable and fed with fodder gathered either from cultivation or in the bush or marshland and crop stubble).

71% of surveyed households (SLII household survey 2011) in the project area own livestock, higher than the national average of 60%. Since 2006, there has been a noticeable increase in the proportion of households owning livestock. 43% now own goats, 35% poultry, 15% pigs and 7% cows. Kirehe is the lead district in Rwanda for goats and sheep possession (about 30% of the total goat population in Rwanda).

***Tanzania: Agriculture and Animal Husbandry in the Project Area***

*General*

The SLII Household Survey (2011) highlighted that the main crops cultivated in the Project area are yam, plantain banana, cassava, sugarcane, sweet potato, Irish potato, sorghum, and coffee.

Rain fed agriculture depends on short vuli rains from October to December, and long masika rains from March to May. The vuli rains provide a minor cropping season with planting in usually November and harvesting in late January/February. The masika rains provide the main cropping season with planting in late February/March and harvesting in July/August.

*Utilization of Marshland*

Different from the situation in the Project area in Rwanda, there is no shortage of land in Ngara District in Tanzania. Hence, there is no intensive marshland use (see more information on marshland use in sections below).

*Gender Aspects of Marshland Use*

In the villages along the Kagera River, in Tanzania (up to 15 kilometres upstream), on average 13% of marshland users are female headed households. From those households entirely depending on marshland, less than 1% of the total households is female headed. The share of female headed households in the total of marshland users is lower than in Rwanda. Only 1 female headed household in the affected area is entirely depending in marshland (affected sub-villages shaded in blue in the following Table). These results, compared to the figures from Rwanda, reflect the overall land scarcity in Rwanda.

**Table 4-13 Female Headed Households and Marshland use, Tanzania**

| Village | Sub-Village | Total N° marshland users | Total N° female headed HH on marshland | % of total | N° HH entirely depending on marshland | N° Female headed HH depending on marshland |
|---|---|---|---|---|---|---|
| Ntobeye | Burambira | 64 | 0 | 0 | 0 | |
| Ntobeye | Kumurenge | 47 | 5 | 11 | 1 | 0 |
| Ntobeye | Mukatokatoke | 70 | 5 | 7 | 0 | 0 |
| Ntobeye | Mukirarama | 42 | 8 | 19 | 0 | 0 |
| Ntobeye | Rwintuku | 29 | 8 | 28 | 4 | 1 |
| Nyakiziba | Kabuye | 24 | 8 | 33 | 1 | 0 |
| Nyakiziba | Kagali | 143 | 10 | 7 | 1 | 0 |
| Nyakiziba | Kyenda | 66 | 3 | 5 | 3 | 0 |
| Nyakiziba | Ruhembe | 122 | 6 | 5 | 17 | 0 |

**Source: self-validation in affected villages (No 2012)**

*Animal Husbandry*

51% of the livestock owned by households in the area consists of goats, followed by cows at 21% and fowl at 20%. Pigs are owned by only a few households.

According to the Ngara Poverty Survey, 85% of households did not own any cattle, and only 2% of households owned more than 10 heads of cattle. Households in remote villages and poor households were less likely to own cattle. Conversely, large households (seven or more members) were more likely to own between 2 and 10 heads of cattle at 21% compared to households with only one or two members at 14%.

*Agricultural Infrastructure*

Under the District Agriculture Sector Investment Project (DASIP) being executed by the Ngara District Council, efforts are underway to rehabilitate Ngara district's agricultural infrastructure. For instance, in 2009-2010, eight cattle dips were rehabilitated and one dip was constructed. In several villages within the district, large numbers of cattle are brought in for dipping at regularly scheduled intervals each month. Another example is that more feeder roads have been constructed in villages, and existing roads in villages have been rehabilitated, making the trip between the villages and the main market easier. Vehicles can also now pass on these roads to carry products from the community. Two market sheds were also constructed in Keza and Mugoma, which can accommodate 85 people and 100 people, respectively. The DASIP commenced in 2006/2007, and is expected to conclude in 2011-2012. The social benefit of this project includes improved food security, human nutrition and income, which will contribute to the reduction of poverty.

***Tanzania: Land Tenure in the Project Area***

*Average Size of Household Land Holdings*

According to the Ngara Poverty Survey, around 37% of all households own less than 2 acres of land (including 4% of landless households). However, 41% own between 2 and 4 acres, and 23% own 4 or more acres.

The Ngara survey states that landless households tend to be more common in accessible villages, while the reverse holds true in remote villages; there, households owning large portions of land are more common. As well, larger households tend to own larger pieces of land than households with fewer members. Finally, male-headed households tend to have larger holdings of land than female-headed households.

*Land Tenure – General*

All land in Tanzania is state property, but customary rights are respected under new land laws, with the responsibility of land allocation of district administrations and villages. The Land Act (1999) confirmed land tenures that were introduced under colonial rule, such as customary tenure, which applies to village land and other forms of land like urban land and peri-urban areas.

Village councils administer village land, they have to ensure that village land administration is maintained with effective participation of villagers and that gender balance in land administration and ownership is secured.

It is the Ministry of Land that is responsible for overseeing implementation of the National Land policy and the Village Land Act, with Local Government playing a role in implementation of the Village Land Act.

A number of initiatives have been taken to formalize land tenure in Tanzania, including the Commission for the Legal Empowerment of the Poor, and the Strategic Plan for the Implementation of the Land Laws.

### 4.4.5. Marshland Cultivation in the Project Area

Information on marshland use up to 15 kilometres upstream from the dam site on both sides of the Kagera River use was obtained during village self- validation of actually affected and potentially affected villages by

- Interviews with resettlement committees;
- Community meetings in the context of self-validation of affected marshlands;
- On the spot interviews with affected people (in Dec 2012)
- Interviews with district authorities (Kirehe and Ngara districts) (Dec 2012).

In Rwanda, farmers in the Project area had been allocated land from the government under the 'Land sharing policy' as confirmed by the agronomist of Kigarama sector. Hence, the majority of households own one hectare of uphill land (private land).

In the villages in Rwanda up to 15 kilometres from the dam site, almost all young people have very small plots of hillside land which they received from their parents as an inheritance once they got married. As a consequence of this inheritance practise, the original one hectare plots owned by parent households, is being reduced according to the separation of plots.

People who own small plots of uphill land aim to supplement their production through development and cultivation of marshland.

According to information from residents, marshland is cultivated on the principal of "whoever initially cultivates a plot in a marshland owns it" determined by the capacity of the household to allocate labour for cultivation.Specific information was obtained on the reliability of income from marshland from

- Resettlement committees;
- Affected people, and
- Agronomists of Kirehe district.

According to information from sources as indicated above, every other year marshland cultivation is not possible due to flooding of the arable marshland strip.

Hence, production from marshland is not a reliable source of income. This was confirmed by several on the spot interviews with marshland users in the affected area in Dec 2012. Interviewees even indicated longer periods (several years) when marshland cultivation was not possible over the past decade.

According to interviews with resettlement committees, about three quarters of marshland users sell their marshland products on the market. The range of income from market sale of marshland production in a good year was indicated to be between 200,000 RWF and 3,000,000 RWF respectively (resettlement committees during self-validation). Whilst a range between 200,000 RWF up to 300,000 RWF, with 500,000 RWF in exceptional years was confirmed during interviews in the affected area in Dec 2012, the amount of 3,000,000 is considered significantly exaggerated and (not realistic. Participants of the

Consultative workshop in Kigali on 4 Feb 2013 considered the 200,000 to 300,000 RWF range as realistic.

Tanzanian resettlement committee members indicated the marshland income in RWF, too, because farmers use to sell their marshland produce in Rusumo East, Rwanda). .

It is noted that the income indicated for sale of production from marshland, significantly exceeds the total annual income of households in the project area as obtained by SNII (2011/2012).

Main coping strategies for the loss of marshland income in wet years are

- Borrow cash (less than a quarter to a quarter of households), and
- Purchase of additional food at the market (less than a quarter to a quarter of households).

For less than a quarter of the marshland users, loss of income from marshland is not indicated as a serious problem. From all resettlement committees it was indicated that at present there are still remaining marshland areas in their villages which would be available for cultivation. However, it was pointed out, that development of marshland needs considerable input of labour. As per information from on the spot interviews with marshland users in Kimeshu village (Dec 2012), marshland cultivation in the area is constantly decreasing since 2004, due to increased flooding of arable marshlands.

Only on two villages in the area, the average size of total land of marshland users exceeds 1 ha, in Nyakwisi and Nshungeruzi. The average size of private land of marshland users is 0.64 ha. The average size of marshland plots is 0.24 ha. The average size of plots of people entirely depending on marshland is 0.21 ha, smaller than the average marshland plots.

Households entirely depending on marshland, are characterised by

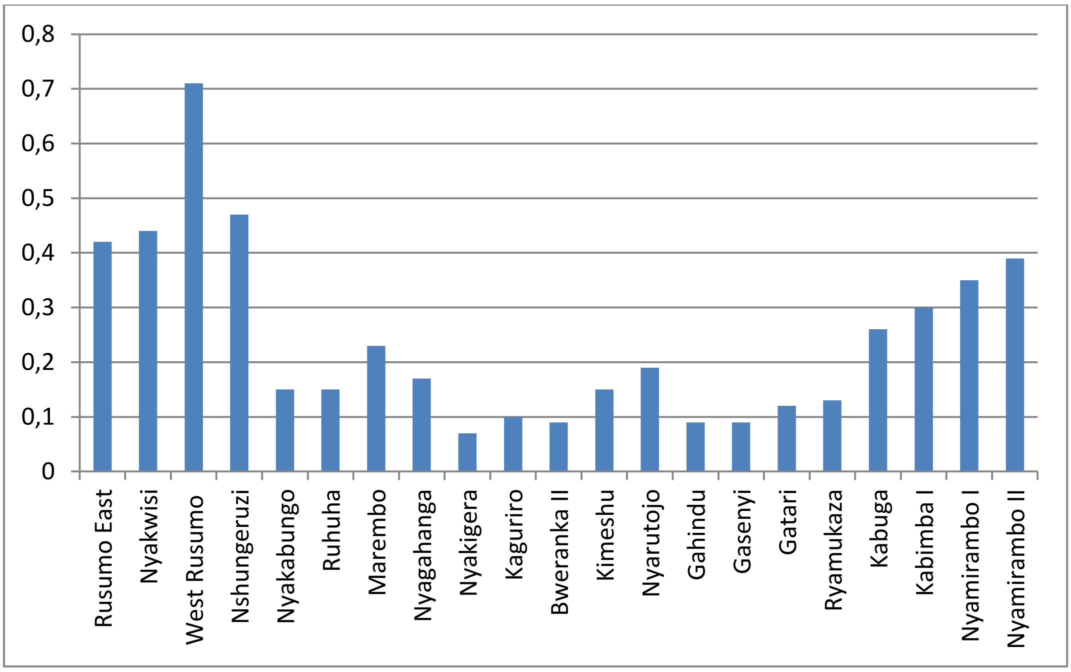
- Dependency on a non-reliable source of livelihood (flooding of arable marshland every other year)
- Cultivation of extremely small plots, resulting in amounts of annual income likely to be below the average indicated by the resettlement committees.

In the villages visited for self-validation in Tanzania, users generally had more land available for cultivation from both categories of land, private land and marshland.

## Table 4-14 Marshland Use Along the Kagera River, Rwanda (Villages up to 15 kilometres Upstream from the Dam)

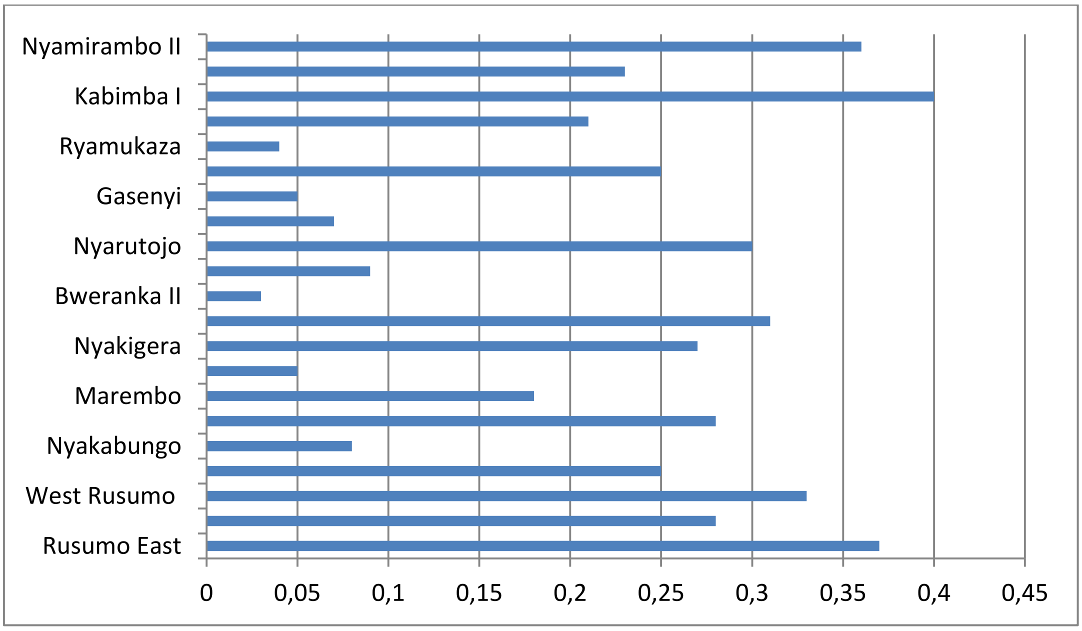
| Village | Total No. of HH* | HH using marshland | | HH entirely depending on marshland | | | HH using marshland for agriculture – average sizes of land of different types/HH | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No.* | %of total HH | No. | %of marshland users | % of total HH | Average size of total land (marshland plus private) (ha) | Average size of private land (ha) | Average size of marshland (ha) | Average size for users entirely depending on marshland (ha) |
| Rusumo East | 204 | 12 (15) | 7.4 | 5 | 33 | 16.2 | 0.71 | 0.5 | 0.42 | 0.37 |
| Nyakwisi | 89 | 84 (92) | >100 | 14 | 15.2 | 15.7 | 1.18 | 0.89 | 0.44 | 0.28 |
| West Rusumo | 163 | 48(64) | 39.3 | 11 | 17.2 | 6.7 | 0.89 | 0.49 | 0.71 | 0.33 |
| Nshungeruzi | 118 | 57 | 48.3 | 5 | 8.8 | 4.2 | 1.13 | 0.75 | 0.47 | 0.25 |
| Nyakabungo | 124 | 28 | 22.6 | 3 | 10.7 | 2.4 | 0.39 | 0.73 | 0.15 | 0.08 |
| Ruhuha | 148 | 122 (134) | 90.5 | 5 | 3.7 | 3.4 | 0.82 | 0.7 | 0.15 | 0.28 |
| Marembo | 93 | 104 | >100 | 3 | 0.33 | 3.2 | 0.85 | 0.62 | 0.23 | 0.18 |
| Nyagahanga | 185 | 31 | 16.7 | 1 | 3.2 | 0.5 | 0.92 | 0.78 | 0.17 | 0.05 |
| Nyakigera | 94 | 51(59) | 62.8 | 2 | 3.4 | 2.2 | 0.34 | 0.26 | 0.07 | 0.27 |
| Kaguriro | 131 | 82 (87) | 66.4 | 2 | 2.2 | 1.5 | 0.82 | 0.72 | 0.1 | 0.31 |
| Bweranka II | 100 | 41(43) | 43 | 4 | 9.3 | 4 | 0.59 | 0.65 | 0.09 | 0.03 |
| Kimeshu | 118 | 94(95) | 80.5 | 5 | 5.3 | 4.2 | 0.83 | 0.67 | 0.15 | 0.09 |
| Nyarutojo | 101 | 76 | 75.2 | 8 | 10.5 | 7.9 | 0.77 | 0.65 | 0.19 | 0.3 |
| Gahindu | 121 | 89 | 73.6 | 10 | 11.2 | 8.3 | 0.65 | 0.62 | 0.09 | 0.07 |
| Gasenyi | 120 | 77 (79) | 65.8 | 15 | 19 | 12.5 | 0.72 | 0.78 | 0.09 | 0.05 |
| Gatari | 147 | 95(97) | 66 | 5 | 5.1 | 3.4 | 0.71 | 0.63 | 0.12 | 0.25 |
| Ryamukaza | 66 | 71 | >100 | 8 | 11.3 | 12.2 | 0.81 | 0.77 | 0.13 | 0.04 |
| Kabuga | 123 | 98 (101) | 82.1 | 14 | 14.3 | 11.4 | 0.68 | 0.5 | 0.26 | 0.21 |
| Kabimba I | 124 | 43 (55) | 44.4 | 5 | 9.1 | 4 | 0.94 | 0.73 | 0.3 | 0.4 |
| Nyamirambo I | 134 | 147(151) | >100 | 27 | 18.4 | 20.1 | 0.72 | 0.45 | 0.35 | 0.23 |
| Nyamirambo II | 177 | 284 (287) | >100 | 44 | 15.5 | 24.9 | 0.9 | 0.6 | 0.39 | 0.36 |

The figures indicated in parenthesis are referring to the total number of marshland users, including users who were absent during self-validation




In Hectares

**Figure 4-14 Average Size of Marshland Plots in Villages up to 15 kilometres Upstream from the Dam, Rwanda**




In Hectares

**Figure 4-15 Average Size of Marshland Plots of Users Depending Entirely on Marshland in Villages Up to 15 kilometres Upstream from the Dam, Rwanda**

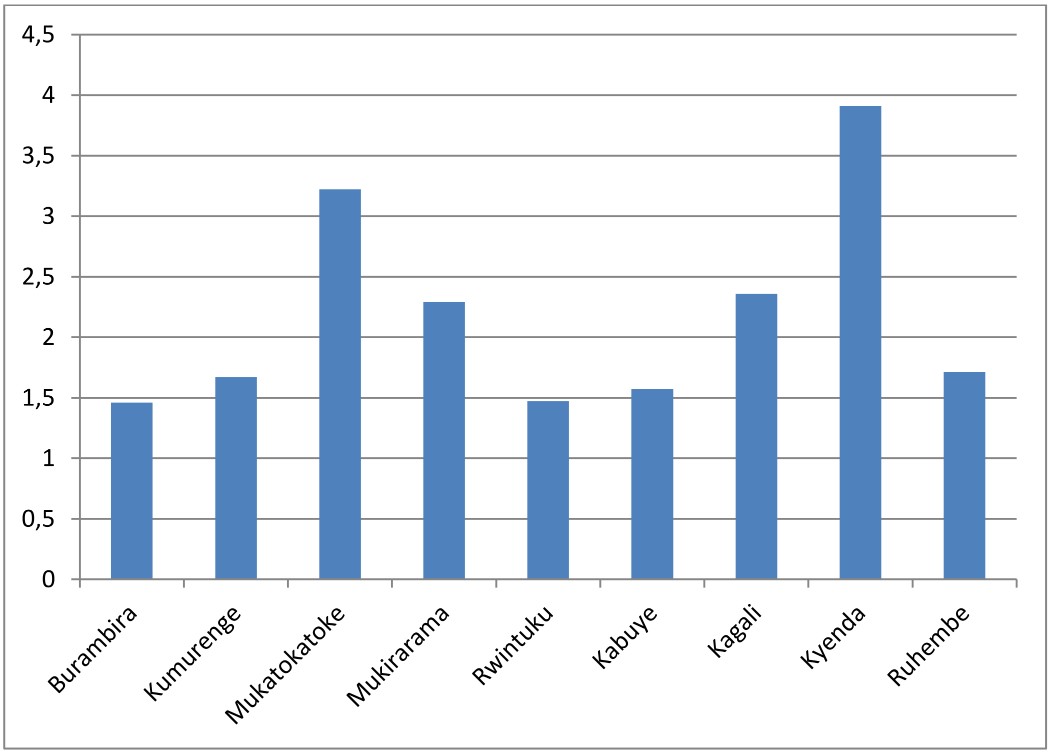
**Table 4-15 Marshland use in Villages Along the Kagera River up to 15 Kilometres Upstream from the Dam,Tanzania**

| Village | Sub-Village | Total No. of HH* | HH using marshland | | HH entirely depending on marshland | | | HH using marshland for agriculture – average sizes of land of different types/HH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *No.** | *% of total HH* | *No.* | *% of marshland users* | *% of total HH* | *Average size of total land (marshland plus private) (ha)* | *Average size of private land (ha)* | *Average size of marshland (ha)* | *Average size for users entirely depending on marshland (ha)* |
| Ntobeye | Burambira | | 64 | | 0 | 0 | 0 | 1.46 | 0.74 | 0.72 | |
| Ntobeye | Kumurenge | | 47 | | 1 | 2.1 | | 1.67 | 0.81 | 0.86 | |
| Ntobeye | Mukatokatoke | | 70 | | 0 | 0 | 0 | 3.22 | 2.5 | 0.72 | |
| Ntobeye | Mukirarama | | 42 | | 0 | 0 | 0 | 2.29 | 1.26 | 1.03 | |
| Ntobeye | Rwintuku | | 29 | | 4 | 13.8 | | 1.47 | 0.91 | 0.69 | 0.49 |
| Nyakiziba | Kabuye | | 24 | | 1 | 4.2 | | 1.57 | 0.84 | 0.76 | 0.5 |
| Nyakiziba | Kagali | | 143 | | 1 | 0.7 | | 2.36 | 1.71 | 0.65 | 0.35 |
| Nyakiziba | Kyenda | | 66 | | 3 | 4.5 | | 3.91 | 3.12 | 0.92 | 1.66 |
| Nyakiziba | Ruhembe | | 122 | | 17 | 13.93 | | 1.71 | 0.95 | 0.88 | 0.73 |
| | | | | | | | | | | | |
| **Ntobeye** | | **1,111** | **252** | **22.7** | **5** | **2.0** | **0.5** | **2.02** | **1.24** | **0.8** | |
| **Nyakiziba** | | **2,309** | **355** | **15.4** | **22** | **6.2** | **1.0** | **2.38** | **1.65** | **0.8** | |
| | | **3,420** | **607** | **17.7** | **27** | **4.4** | **0.8** | **2.2** | **1.45** | **0.8** | **0.8** |

In all villages visited for consultation in Tanzania, the average size of total land of marshland users exceeds 1 ha. This corresponds to the land scarcity in Rwanda and the availability of land for agriculture in Tanzania.

The average size of private land of marshland users is 1.42 ha. The average size of marshland plots is 0.8 ha. The average size of plots of people entirely depending on marshland is 0.74 ha, smaller than the average marshland plots.

Despite the larger areas of marshland under cultivation per household in Tanzania, resettlement committees indicated a range of income from marshland which corresponds to the income from smaller plots in Rwanda. It was not possible to get additional information on this issue up to present.




In Hectares

**Figure 4-16 Average Size of Total Land Holdings, Tanzania**

<u>Most Important Crops on Marshland</u>

Marshland in the visited villages is exclusively cultivated with annual crops. Resettlement committees were asked for the four most important crops in their village. Results are presented in the Figure below. In 8 villages, tomato, soja and maize are the most important crop respectively. Beans, irish potato and cabbage are most important in 1 village respectively.

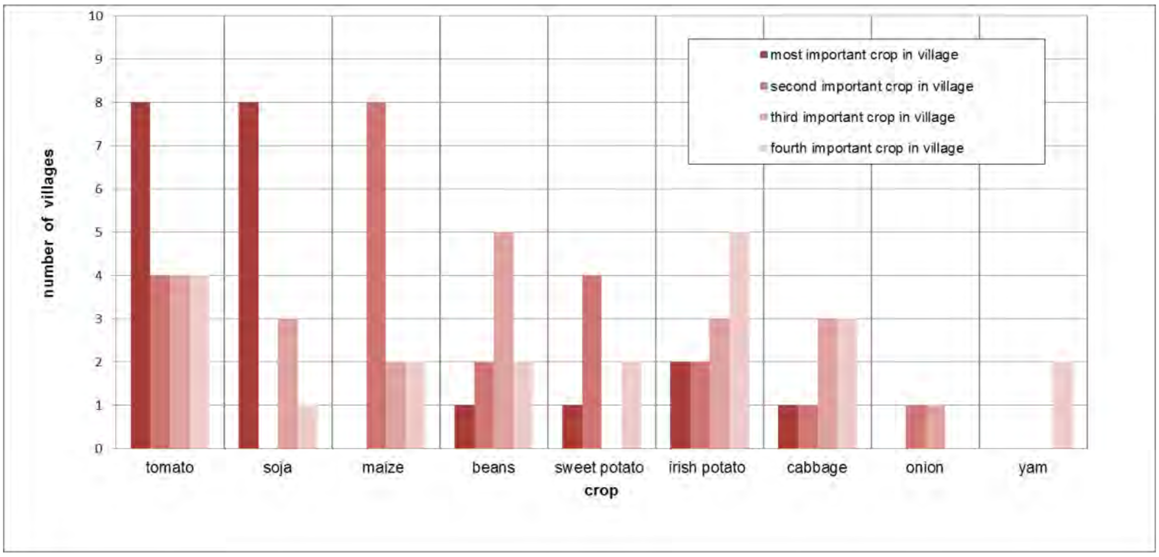



**Figure 4-17 Most Frequent Marshland Crops, Rwanda**

**Figure 4-18 Tomato Cultivation, Nyakwisi Marshlands, Rwanda**

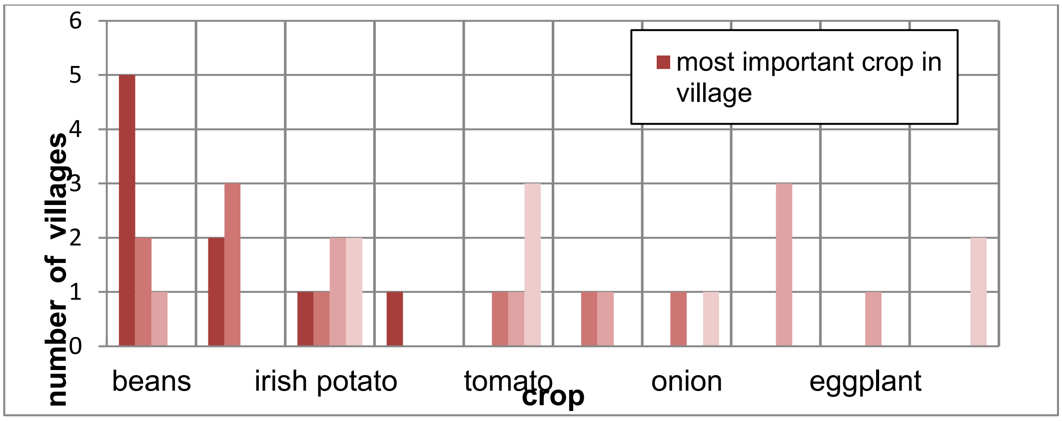



**Figure 4-19 Most Frequent Marshland Crops, Tanzania**

In 5 of the 9 villages, beans were indicated as the most important crop, in 2 villages irish potato is the most important crop. Tomato and onion are most important in 1 village respectively. Different from Rwanda, soja, sweet potato and maize are not amongst the most important crops. Tomato is much less important than in Rwanda.

### 4.4.6. Livelihoods

Most of the livelihood activities in order to provide additional income rely on marshland resources, such as:

- Fish stocks in marshland;
- Clay for brick-production or other handcraft products, and
- Reed for artisanal handcraft production.

Fishing activities are mainly practiced in marshlands. Fishing as a primary activity is performed by a tiny minority of rural dwellers in the Project area. Small-scale fish hatching is currently practiced near East Rusumo village and in two cooperatives in Kigarama sector. However, most of the households in the District practice some fishing during low agricultural seasons as a supplement to their livelihood. According to the Village Level Survey (SLII,2011), 78% of the fish harvested is sold and 28% is consumed by producers. This indicates that the primary goal of fish production is to earn income.

The Table below presents an overview on livelihoods in the Project area.

**Table 4-16 Livelihoods in the Project Area**

| Livelihood Aspect | Rwanda | Tanzania |
|---|---|---|
| Agriculture | Agriculture is the main activity for both male and female head of households, with 95% of male adults and 92% of female adults engaging in some form of smallholder farming. | Agriculture is the main activity for both male and female head of households, with 76% of male adults and 89% of female adults engaging in smallholder farming<br>According to the Ngara Poverty Survey, agriculture is the main livelihood for both male and female heads of households; approximately 4 out of 5 households are dedicated to agriculture. |
| Livestock | 4% of the male and 3% of the female heads of households engage in livestock breeding | 19% of the male and 5% of the female heads of households engage in livestock breeding |
| Casual Labor | 1% of the male heads of households engage in casual labour, with two peaks corresponding with the agricultural season | |
| Other Economic Activities | Almost one third of the heads of households engages in secondary occupations to provide income during the lean season before the harvest.<br>Activities such as pastoral work or commercial activities are pertained during the year.<br>Handcraft activities (including brewing local beer) for female heads of households and fishing and artisanal work for male heads of households are the only activities undertaken as income replacement for agricultural work | 19% of individuals are engaged in occupations such as in mining, manufacturing, energy, construction, and private/public service.<br>The Ngara poverty survey states that in the case of those self-employed in non-agricultural activities, the predominant economic activity is the provision of services.<br>For the Tanzanian part of the Project are, all the petty traders identified in the SLII survey (2011) were located in Nyakahanga subvillage within Rusumo village. Petty trading as economic activity was indicated by 5% of both, the male and the female heads of households (SLII survey, 2011)<br>A small portion of the female demographic (3%) also makes handicrafts for a living.<br>Fishing as economic activity was indicated by 2% of the male heads of household |

**Source: SLII 2012: RAP Rwanda and RAP Tanzania, Section 5**

A considerable number of brick making businesses are using the marshlands of Rusumo East village and Nyakwisi village in Rwanda and of Rusumo, Tanzania, as fabrication sites, 55 in Rwanda and 26 in Tanzania.

These businesses are either run by cooperatives or by private owners, with the support of casual workers. Accoding to flodding dynamics of marshland brickmaking is a seasonal activity.

Field survey results (SLII, 2012), confirm brick making as a seasonal activity intended to complement livelihoods during low agricultural season and an economic opportunity for landless households. They supply materials to local markets or to rural small business people in East Rusumo.

All facilities for brick making are located on marshland and not on privately owned intermediate zones. The brick kilns are the only permanent structure, while other structures, such as shields and workstations, are temporary and rebuilt each season.

**Figure 4-20 Brick Maker, Nyakwisi Village Marshlands**

**Figure 4-21 Brick Making Site, Nyakwisi Village Marshlands**

### 4.4.7. Poverty and Vulnerability

***Situation in Rwanda***

*Monetary Income*

Note: According to interviews with resettlement committees, about three quarters of marshland users sell their marshland products on the market. The range of income from market sale of marshland production in a good year was indicated to be between 200,000 RWF and 3,000,000 RWF respectively (resettlement committees during self-validation). Whilst a range between 200,000 RWF up to 300,000 RWF with 500,000 RWF in exceptional years was confirmed during interviews in the affected area in Dec 2012, the amount of 3,000,000 is considered significantly exaggerated and not realistic. Participants of the Consultative workshop in Kigali on 4 Feb 2013 considered the 200,000 to 300,000 RWF range as realistic.

Tanzanian resettlement committee members indicated the marshland income in RWF, too, because farmers use to sell their marshland produce in Rusumo East, Rwanda. Secondary data from the Comprehensive Food Security and Vulnerability Analysis (CFSVA, 2006) show that for households that derive more than 75% of their income from agriculture, the average yearly cash income is around RWF 60,000 (USD 100) As more than 97% of the affected households in the study area rely on agriculture to sustain their livelihood, they belong in this category.

Annual income is slowly higher (RWF 70,000) for the remaining 3% of households who have supplemental earnings from trade, daily labour (cash and in kind) and agriculture activities (CFSVA, 2006).

Food expenditure represents more than 71% of total expenditure. Maize, beans and peas alone accounts for more than 31% of total expenditures. Education and health expenditures represent respectively 14% and 11% of the total expenditure. The largest percentage of non-food items is soap (2%) and fuel (1%). In terms of mode of payment, 98% of the expenditures are made in cash and 2% through barter.

*Poverty*

Poverty is widespread in the Project area. Based on the 2012 national survey, some 43% of households live below the poverty threshold and 20 % below the extreme poverty line, which means they could not afford the basic food consumption basket even without spending anything on non-food items.

**Table 4-17 Definition of Poverty Status**

| Indicator | Group 1 Wealthier Household | Group 2 Average Household | Group 3 Poorer Household |
|---|---|---|---|
| Cow ownership | >2 | 1 or sharing | none |
| Land size (ha) | >1 | 0,4-0,9 | >0,4 |
| Hire/Sale of Labor | Hire labor | Sell labor against cash income | Exchange labor for crops |
| Household Assets | Bicycle, motorcycle, cellphone | Shared with other households | Poor housing |
| Non agricultural income | Most of the year (>50%) | seasonally | Agricultural labor for others |
| Production orientation | Surplus for market and/or commercial crops for sale (e.g. coffee, tea, rice) | Grains and bananas for subsistence, beans and vegetables for sale | Only food for subsistence |

**Source: SLII, 2012: RAP Rwanda, p. 58**

Based on these categories, 51% of surveyed households fall into the average category while 43% are poor and 6% in the “wealthy” category. The distribution is different if only female head of households are considered. Here, 77% are poor and 23% are average.

There is also widespread food insecurity as a large majority of farmers in Kirehe District report facing occasional periods of food shortages.

The largest group of rural poor is made up of households who have less than 0,4 ha of land (including the landless) and whose agricultural production does not cover the food needs of the family during the lean season. Within this category, the following specific groups can be distinguished:

- Female heads of household, who have no autonomous economic activity;
- Young landless people, who have little chance of obtaining land because of the prohibition to subdivide land into small pieces;
- Households with chronically ill members.

Virtually all affected marshland users who are entirely depending on marshland, cultivate plots smaller than 0.4 ha (see Table 12 Affected marshland users - Rwanda).

*Coping Strategies*

In addition to on-farm work, the poor part of the population goes for work in nearby mines, towns and across the border in Tanzania. Also, poorer households that lack the land and agricultural resources to produce and sell high value crops, opt to produce food crops selling a portion of their harvest to finance essential non-food items or preferred food items.

Poorer households also do not source all of their food from their own production alone. They also receive beans, cassava and maize as in-kind payment for working on better-off household's farms.

***Situation in Tanzania***

Note: According to interviews with resettlement committees, about three quarters of marshland users sell their marshland products on the market. The range of income from market sale of marshland production in a good year was indicated to be between 200,000 RWF and 3,000,000 RWF respectively (resettlement committees during self-validation). Whilst a range between 200,000 RWF up to 300,000 RWF, with 500,000 RWF in exceptional years was confirmed during interviews in the affected area in Dec 2012, the amount of 3,000,000 is considered significantly exaggerated and not realistic. Participants of the Consultative workshop in Kigali on 4 Feb 2013 considered the 200,000 to 300,000 RWF range as realistic.

Tanzanian resettlement committee members indicated the marshland income in RWF, too, because farmers use to sell their marshland produce in Rusumo East, Rwanda.

The economy of Ngara is heavily dependent on small-scale farming. Accordingly the estimated average income of rural households is very low and is estimated at TShs 165,000 – 170,000 (equivalent to less than USD 110.00) per annum compared to the district average income of TShs 750,000 (equivalent to USD 475.00, SNII, 2012, RAP Tanzania).

*Poverty*

In Tanzania, poverty tends to be a rural phenomenon. In rural areas, incomes tend to be lower and poverty more widespread and intense than in urban centers. The poor tend to be concentrated in the subsistence agriculture sector.

Tanzania faces severe income poverty, with the country having one of the world's lowest per capita national incomes. During the 1990s, there was virtually no economic growth in Tanzania, coupled with an increase in the number of people who fell below the national basic needs poverty line. In the same vein, hunger, malnutrition, and lack of food security are all serious problems in Tanzania, with many children under the age of 5 being malnourished and underweight. Declining soil nutrient quality and very low rates of mechanization have left agricultural productivity at a stagnant level. Since the majority of Tanzania's small-scale farmers rely on rain, annual agricultural output is highly variable and thus periodically leads to food shortages in parts of the country.

**Table 4-18 Poverty Levels in the Project Area**

| Administrative Divisions | Population | Surface ($km^2$) | Density1 | Poverty Levels2 |
|---|---|---|---|---|
| Tanzania | 45,039,573 | 947,300 | 48 | |
| Kagera Region | 2,033,888 | 29,241 | 70 | 29% |
| Ngara District | 334,939 | 3,744 | 89 | 58% |
| Rwanda | 10,227,212 | 26,340 | 388 | |
| Eastern Province | 2,141,174 | 9,462 | 226 | 50% |
| Kirehe District | 292,215 | 1,119 | 261 | |

**Sources: National Census (Tanzania 2002), MINALOC (Rwanda, 2006-2009), World Bank.**
Note (1) Total population per square kilometers.
Note (2) Percentage of households living under the poverty line.

### *Vulnerable Groups*

People who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be more adversely affected by the project/ by displacement than others and who may be limited in their ability to claim or take advantage of resettlement assistance and related development benefits. Vulnerability is considered with regard to the Project context.

<u>Identification of Vulnerable Groups in the Project Area</u>

Vulnerable groups were identified based on

- Consultations by SNII (2011/2012), aiming at the identification of vulnerable people
- Reference to the KWAMP Project Design Report (with a focus on Kirehe district), 2008
- Interviews with district officials in Kirehe district and Ngara district
- Interviews during the consultation period December 2012

Note: Based on the preliminary identification of vulnerable households below, the individual identification of vulnerable people will be done early in RAP implementation (start of year0), in order to ensure that their needs in the context of displacement are fully considered. Identification and surveys will be undertaken under the lead of PIU, through local resettlement committees.

<u>Female headed households</u>

20 % of heads of household are women, and of these, 68 % are widows; another 26 % are divorced or living apart. Other than land related issues, female-headed households face additional constraints, such as difficulties to engage in certain farming operations because of lack of physical strength and inadequate representation of their interests in community structures and farmers' organizations. They are likely to be among the poorest households (SNII 2011/2012).

For information on female headed households, see information above (gender aspects on marshland use).

Female headed households with small land holdings (less than 0.2 ha) are considered as especially vulnerable by the KWAMP Project Design Report. The social officer of Kirehe district also indicated female headed households as vulnerable. This information was confirmed during the Consultative Workshop in Kigali on 4 Feb 2013.

Amongst the affected marshland users in Rwanda, there are 104 female headed households, 13 of them entirely depending on marshland. These 13 households are considered as especially vulnerable to the loss of marshland plots.

Female headed households amongst the households affected by construction yet have to be identified.

For Tanzania, there are only a limited number of female headed households depending on marshland (3). Furthermore, availability of land is not a problem in Tanzania.

<u>Household heading orphans</u>

Household heading orphans are considered as vulnerable. They usually have no access to education, due to family obligations. Hence, their capacity to benefit from training measures, is considered to be limited as is their capacity to develop alternative livelihoods. The vulnerability of household heading orphans was confirmed by the social officer of Kirehe district and is also stated in the KWAMP report.

According to the results of the village self-validation in the project affected area, no orphans heading households were documented as affected. However, during RAP implementation, special attention will be given to the identification of orphan headed households.

Orphans heading households can be expected to be amongst affected people in Rwanda.

<u>Households with limited access to land, landless households</u>

9% of all households in the Project area do not own land for cultivation, including many young people who have failed to obtain any land partly because the law prohibits land subdivision into plots of less than one hectare.

Young people relying on small marshland plots are making up a large group within the affected marshland users in Rwanda. They entirely rely on marshland or they only have very small hillside plots. They would be vulnerable in the project context, due to the loss of marshland and hereby the loss of their main livelihood asset.

The vulnerability of young households with limited access to land was confirmed by the social officer of Kirehe district.

This category of vulnerable people is an issue for Rwanda. In Tanzania, there is no limited availability of land for young households.

HIV/AIDS affected households

HIV/AIDS affected households are an important subset of households with chronically ill members, who can face moderate to severe labour constraints, fall sick often and face high medical bills, are under threat to lose household assets and access to factors of production, and are often stigmatized in their community. Almost 11% of the affected households in the Project area fall into this category, with a “hot spot” in the area of the Rusumo villages, where HIV/AIDS incidence in the households is 28%. Vulnerability of HIV/AIDS affected households in the Rusumo area was highlighted during the Consultative Workshop in Kigali on 4 Feb 2013. The KWAMP report as well as district officers in Ngara and Kirehe districts indicate people with HIV/AIDS as especially vulnerable. In the project context, HIV/AIDS affected households are expected to have a limited capacity to fully benefit from livelihood restoration programs, unless they are provided with special assistance.

Elderly, Disabled or infirm Persons

Elderly, infirm or ill people might have limited access to project related information, unless they are considered with specific measures.

Women and children

Women and children might be at risk of being dispossessed of their immovable and productive assets as a result of the compensation process that may solely benefit the male household head.

From the representatives of Ngara district, it was indicated that especially in polygamous settings, partners would be at risk not to have access to the compensation money of the household. Polygamous settings occur in Tanzania.

### 4.4.8. Infrastructure and Services

Two main asphalted roads cross the Project area. The first road goes eastward from Kigali and then turns southward from Kayonza, continues near Kibungo, before crossing the Akagera and the Rwanda -Tanzania border at the Rusumo Falls Bridge. The road then proceeds to the South-East of Tanzania towards the town of Nyakahura. The second road, which is being rehabilitated, also starts in Kigali and follows a north-south axis through Nyabarongo and then the Bugesera district near the town of Kirundo in Burundi. There is also an extensive and well distributed network of dirt tracks that link all public services and most villages. Many tracks, however, are poorly maintained. In addition, the transportation of goods and people by water is well developed, particularly on Lake Rweru between certain Burundian and Rwandan villages.

***Health***

With a life expectancy of about 45 years, the population's overall health in the Project area is very poor. The most common diseases are malaria, respiratory infections, diarrhoeal diseases, AIDS and diseases caused by malnutrition and nutrition deficiency.

*Rwanda*

In Rwanda, access to the nearest health center is 7 km on average, which is a long distance for the rural population considering the poor condition of the roads and the lack of transport. About 75% of childbirths occur at home, and the infant mortality rate in the district is 126 per 1000 live births.

*Tanzania*

According to the Ngara Poverty Survey, households in remote areas have lower access to medical services (28%) than households in villages that are more accessible (59%). Both show similar ratings for use and satisfaction, but households in remote villages report higher need rates (31%) than households in accessible villages (27%). While Tanzania has made progress towards reducing infant and children mortality, and child malnutrition, maternal mortality is still an issue as well as the percentage of births attended by trained personnel. Positive contributing factors have included strengthened immunization and micronutrient supplementation, improved diagnosis and treatment of malaria among children, improved diagnosis and treatment of malaria and HIV/AIDS among pregnant women, and improved availability of drugs. Factors limiting progress in the health sector include continued shortages of qualified health workers, inadequate infrastructure, shortages of drugs and other medical supplies, and poor transport.

***Education***

The project area is characterised by insufficient teaching premises and personnel and above normal student-per-teacher ratios. Secondary and vocational education is very weak.

*Rwanda*

Access to primary school in affected communities is in line with national standards. Primary school can be found in a range of maximum 2 km from the residence village. Classes are usually overpopulated, with as many as 80 pupils per class and a teacher/student ratio of 1 to 74. Secondary schooling is less distributed and at further distance, from 5 to 10 km from the affected villages.

*Tanzania*

With regards to schools, the Ngara Poverty Survey states that almost two-thirds of primary school age children live within 30 minutes of a primary school. Primary school access is obviously significantly higher in accessible clusters than in remote clusters. Significantly more children aged 7 to 13 living in non-poor households lived within 30 minutes of the nearest primary school, when compared to children living in poor households. Interestingly, primary school access tended to be higher among children from female-headed households (70%) than that of children from male-headed households (57%). In terms of satisfaction, more than three quarters of all primary school pupils were satisfied with their schools. A higher share of pupils living in poor households reported satisfaction than those living in non-poor households; however, there was no marked difference in satisfaction rates between pupils living in remote and accessible areas.

***Markets***

*Rwanda*

Domestic markets for crops are generally underdeveloped. Marketing chains are informal and often fragmented, with produce changing hands several times as it moves from farm gate to the final consumer. Farmers sell produce to rural assemblers at the farm gate or to rural traders located in local markets, who then transport it to urban wholesalers. In turn the latter supply urban retailers, who break loads down into small lots for resale in market stalls or small neighbourhood shops. Marketing margins for domestically produced food crops are high compared with those of other countries in Africa, reflecting both a certain lack of competition among intermediaries and high transport costs.

During consultations in affected villages (Dec 2012), participants in on the spot group discussions raised the issue of lack of access to markets for affected communities, due to

- Distance to markets and lack of means of transport;
- Overall bad maintenance and quality of rural roads;
- Lack of storage facilities, and
- Overall lack of capacity to get organized for group based marketing of products.

*Tanzania*

In order to support trade and business transactions at the village level, each village in the Tanzanian part of the Project area has a central market square. On one day each week, a market day is held where agricultural product and other commodities are traded. These market days occur on rotation such that on every day of the week, there is an open market somewhere in the neighbourhood.

During consultations in affected villages (Dec 2012), participants in on the spot group discussions raised the issue of lack of access to markets for affected communities, due to

- Distance to markets and lack of means of transport;
- Overall bad maintenance and quality of rural roads;
- Lack of storage facilities, and
- Overall lack of capacity to get organized for group based marketing of products.

***Summary***

**Table 4-19 Access to Services and Means of Transport**

| Country | District | No. Bicycles per Household | Distance to Hospital (km) | Distance to Electricity Line (km) | Distance to Secondary School (km) |
|---|---|---|---|---|---|
| Rwanda | KIREHE | 0.2 | 15.6 | 21 | 4.8 |
| Tanzania | NGARA | 0.1 | 13 | 13 | 15 |

### 4.4.9. Housing and Other Assets

*Rwanda*

The vast majority of houses observed in the affected area are made from local material, including locally extracted earth or clay for walls without cement or plastering and local timber for the structure. Most roofs, however, are covered in corrugated iron sheets.

None of the residential structures has modern features such as an inside bathroom or toilet, or running water. Concrete floors are absent compared with clay floors which are found in 99% of the surveyed households. More than half the population use non-potable water from water springs, rivers, lakes or ponds. A small proportion of the population has access to public water taps.

The most common toilet facilities are traditional pit latrines (70%) and open pits (22%). Source of fuel for cooking is nearly exclusively charcoal (97% of households) and source of lighting is most frequently kerosene, oil or gas lamp (74%) or firewood (21 %). In East Rusumo, where many shops, restaurant and offices are located, 20% of households use charcoal and electricity while firewood still is the main source of energy for 80 % of the residents in the village. Information and communication equipment are still limited. Those households who own a radio are almost a quarter of the total number of households in the Project Affected Area. Cellular phone is pretty common with one head of households out of three owns at least a mobile phone.

*Tanzania*

According to the Ngara Poverty Survey, households in remote villages are more likely to use thatch as a roof building material than households in accessible villages, which would tend to use iron sheets. Poor households are also more likely to use thatch, and non-poor more likely to use iron sheets. As well, smaller households tend to use thatch, and bigger households more likely to use iron sheets. Those self-employed in agriculture are also most likely to use thatch for their roofs. Female-headed households use iron sheets more often than male-headed households.

With regards to building materials for the rest of the house, 95% of houses are built with mud or mud bricks. Burnt bricks take second place. Households in remot villages have a higher share of mud and mud bricks than households in villages that are more accessible. Likewise, poor households use mud or mud bricks more often than non-poor households.

With regards to the floor, households in accessible villages have more houses with concrete floors than households in remote villages. Poor households have a higher share of houses with mud or dirt floors than non-poor households, which have a higher share of houses with concrete flooring than poor households.

Overall, 59% of households have a safe source of water (such as treated pipes, boreholes, hand pumps, and protected wells), wheras 30% get it from an unprotected well. 70% of households in accessible villages have a safe source of drinking water, whereas the share of households in remote villages in merely 37%. With regards to unprotected wells, the numbers are 25% of households in accessible villages, and 41% of households in remote villages. Poverty status seems to be a key indicator. 67% of non-poor households use safe sources of water, compared to 35% of poor households. As well, 54% of poor households get their drinking water from unprotected well, compared with only 23% of non-poor households. With regards to toilets, only 27% of households have safe sanitation, whereas up to 69% use a covered pit latrine.

# 5. ALTERNATIVES

The World Bank's Operational Directive OD 4.01 on environmental assessment calls for an inter alia, systematic comparison of the proposed investment design, site, technology and operational alternatives in terms of their potential environmental impact. The process for analysis is performed as a number of steps:

- STEP 1: Define general context
- STEP 1: Define project objectives;
- STEP 2: Produce development proposal;
- STEP 3: Identification and screening of alternatives;
- STEP 4: Evaluation of alternatives;
- STEP 5: Comparative assessment of alternative, and
- STEP 6: Select preferred alternative.

## 5.1. GENERAL CONTEXT

Lack of electricity is a key constraint hampering economic development and livelihood improvement in Burundi, Rwanda, and Tanzania. Current electricity demand by far exceeds supply, load shedding is chronic. Most urban and rural households rely on biomass for their cooking and heating needs, leading to deforestation and soil erosion.

The lack of access to reliable power supply services hampers countries' growth potential, contributes to the poverty and isolation of rural population, and affects provision of other key services, such as water supply, health, and education. It is also a major constraint for commercial and industrial development. The deficit in power supply is rapidly increasing, despite governments efforts.

The investments in new power generation plans, transmission/distribution lines and substations as well as the rehabilitation of existing facilities are greatly needed. Regional power development and interconnections through the East Africa Power Pool and South Africa Power Pool along with national thermal and national hydro plants are expected to make major contribution to filling such significant and rapidly increasing deficits in power supply.

## 5.2. PROJECT OBJECTIVES

The objective of the Project is to enhance economic and social development in the region through productive multipurpose use of electricity through a project area development programme which will support investments in sustainable livelihoods.

## 5.3. DEVELOPMENT PROPOSAL

The development proposal includes the following elements:

- A hydroelectric powerplant of 80 MW over the Rusumo Falls;
- Transport facilities connecting the Rusumo Falls hydroelectric power plant to the electricity networks of Burundi, Rwanda and Tanzania;
- The mechanism for the co-management of electricity production facilities.

The Rusumo Falls Hydroelectric Power Development Project represents a critical opportunity for Western Tanzania, Rwanda & Burundi to access sustainable power for development, in a region characterized by poverty.

When completed, the Hydroelectric Power Project will contribute 80 MW to the national grids of the three countries and boost development in the areas that will have access to this electricity.

## 5.4. IDENTIFICATION AND EVALUATION OF ALTERNATIVES

### 5.4.1. No Project Alternative

The *“no project alternative”* would consist of perpetuating the actual situation with an important deficit of electricity production to face an increasing demand and reliance on fossil fuels for power supply, which is a diminishing resource. The no project alternative would result in the following:

- Slowed economic development;
- Continued use of fossil fuels for power supply;
- Continued and increase in the rate of diminishing forest resources to provide wood for fuel and heating;
- Continued increase in greenhouse gas emissions resulting from the combustion of fossil fuels and biomass in association with an increasing population.

### 5.4.2. Alternative Locations

The development of the Project, which dates from 1967 started with the identification of the most suitable location. The key milestones in the history of the project relating to the selection of the location are as follows:

- In 1967 Lahmeyer International made an evaluation of the hydropower potential at Rusumo Falls and identified 16 small and medium sized hydropower sites in Rwanda;
- The United Nations Development Program commissioned a pre-feasibility study of three potential hydropower developments on the Kagera River, namely Rusumo Falls, Kishanda Valley, and Kakono hydropower projects. This study was completed by Norconsult/Electrowatt in 1976 and concluded that Rusumo Falls was the key element in the power development program of the Kagera River;
- Between 1979 and 1995 Tractebel carried out pre-feasibility and technical and economic feasibility studies and concluded that the Rusumo Falls was the most attractive site.
- In 2005, a Study on Financing and Implementation Arrangements for Regional Hydro Power Generation and Multi-purpose Projects in the Nile Equatorial Lakes Region was conducted by Manitoba Hydro, in which the Rusumo Falls Project was selected for specific analysis. The modeling and sensitivity studies demonstrated conclusively that Rusumo Falls is financially competitive and economically attractive;
- In the period 2004 - 2006; a Strategic/Sectoral Social and Environmental Assessment of Power Development Options was undertaken by SNC-Lavalin International (SLII). The study included a comparative analysis of power development options. In terms of hydroelectric options on the Victoria Nile – Bujagali and Karuma (both in Uganda) as well as Ruzizi III (Rwanda/DRC) were deemed to have good performance with regards to Environmental criteria and all have a high energy payback ratio and relatively low land requirements and downstream effects. A second group of hydroelectric options – Ruhudji (Tanzania), Mutonga (Kenya), Rumakali (Tanzania), Kakono (Tanzania), Songwe (Tanzania/Malawi), Kabu 16 (Burundi) and Rusumo Falls – either have a lower energy payback ratio, higher land requirements or more significant downstream impacts. But they all have a higher overall performance with scores than the first group. The assessment recommendation that the Rusumo Falls Hydroelectric Project is the power option that should be implemented in the short to mid-term because of low cost and acceptable environmental and social impacts.

It should be noted that in terms of location, there are no alternative access roads. The Rusumo Falls are accessible by existing paved road and existing tracks and roads will be used for the construction activities.

### 5.4.3. Alternative Designs

The key milestones in the history of the project relating to the design of the Project are as follows:

- In 2003, Acres International Limited carried out a review of the Project. It was recommended performing an optimization study of Project alternatives prior to undertaking in-depth engineering, environmental, social, economic and financial studies;

- In 2008, SNC-Lavalin produced a Preliminary Design Report which included the assessment of three alternatives; Full Development Scheme (FDS), Intermediate Development Scheme (IDS), and Run-of-river (RoR).

- The FDS was eventually selected by the Member States as the preferred development option, but it was also recognized that a more precise analysis was required using the improved topography that would subsequently become available from a topographic survey of the flooded area.

- In the period 2009 to 2011 SNC-Lavalin carried out hydrological and hydrotechnical studies in support of planning and design of the Project on the basis of the topographic data.

- Also in the period 2009 to 2011 SNC-Lavalin carried out preliminary studies for the FDS, IDS and RoR schemes, including ESIA and RAP.

- In September 2011, based on the feasibility studies, the participating governments selected the IDS option as the preferred development option.

- In 2011 and early 2012, SLII prepared a full ESIA and RAP for the IDS.

- In February 2012, based on the ESIA for the IDS, the participating governments selected the RoR option at 1,320 metres asl as the preferred development option given that minimizes environmental and social impacts of the project, and provides for the least cost implementation of the ESMP and RAP.

***Summary Description of the Full Development Scheme***

The Full Development Scheme will create a reservoir that will extend from the dam in the Kagera branch up to Lake Rweru and in the Ruvubu branch.

At the dam site, the water level in the reservoir will fluctuate between 1,323.5 metres asl and 1,322 metres, depending on the hydrological conditions and operation modes.

The power facilities are located entirely on the right bank of the Kagera River in Tanzania, while the river diversion channel or tunnel is located on the left bank, in Rwanda. The main power features comprise: an intake structure, a headrace tunnel, a surge tank, a tunnel trifurcation, a surface powerhouse, a tailrace channel and a substation located on the Rwanda side. The main dam forming the reservoir is composed of an intake structure located on the right bank, a gated spillway structure adjacent to the intake, and two non-overflow concrete dam sections closing the left and right embankments.

Temporary diversion of the river during construction is achieved through an open cut canal excavated in the left abutment of the spillway dam. The canal is approximately 260 m long. Since the canal is located on the Rwandan (left) bank, it will cut off the international road leading to the existing bridge.

The dam/spillway structures are located just upstream of the main falls and are orientated perpendicular to the river channel. The Full Supply Level at the head pond is set at 1,323.5 metres asl.

The substation is located on the hill top on the Kagera River right bank in Rwanda. The rectangular shape of the switchyard measures 227 m by 127 m.

In addition to the dam, hydraulics facilities and the substation, the construction zone will include the staff temporary and permanent camps, contractor quarters and rock and sand borrow areas.

Three permanent access roads are required: a road about 750 m long linking the main highway to the powerhouse with a second road branching off to the switchyard and surge tank, and a road linking the main highway to the spillway and intake area.

***Intermediate Development Scheme – (IDS)***

The intermediate development alternative is essentially the same as the full development alternative but utilizes a lesser head of 33.5 metres. The maximum normal water level at the head pond is at an elevation of 1,323.5 metres and the minimum water level remains at an elevation of 1,322 metres asl.

In this alternative, the head pond level is controlled by a spillway structure that houses four radial gates each 9 m wide by 9.5 metres high. The top 2 metres of the gates include 9 metres wide built-in flap gates that allow passage of the lower flows without raising the main gate and the passage of floating debris. All other aspects of the project arrangement are the same as for the full development alternative.

***Alternative Design for the Temporary River Diversion***

The dam construction requires the total diversion of the river streams for the duration of upstream structures construction. Considering the area topography, such diversion works will have their shortest length on the left bank (Rwanda side). The adopted solution is for the construction of a deviation channel which requires that a temporary bridge be constructed for the road leading to the Rwanda side of the bridge and which encroaches on the current location of the border post offices (note that these offices will be moved as part of the One Stop Border Post Project). As an alternative to a diversion canal, a diversion tunnel was also considered. That would minimize the problems of relocation of the Rwanda Immigration facilities and interferences with the international road traffic while diversion works are constructed. A comparative cost estimate of diversion canal vs. diversion tunnel. Main quantities for canal, diversion tunnel portals and diversion tunnel were calculated from a 3D model. The cost of the diversion channel is estimated to be 5 million USD, whereas the cost of the tunnel is estimated to be 11 million USD. Because the principle advantage of the tunnel option is to avoid encroaching on the border post offices, which will have been moved before dam construction starts, the deviation channel is by far the most advantageous alternative.

### 5.4.4. Alternative Technology

The alternative would be to produce the equivalent of the Rusumo Falls project, between 400 and 500 GWh of energy, with thermal power plant(s), using hydrocarbon as a source of energy (charcoal, bunker C or diesel) with the corresponding consequences for air quality and GHG emissions (300,000 to 375,000 t CO2/y gross; 28,000 to 92,000 t CO2/y net – refer to Table 7.2). It should be recalled that those hydrocarbon resources are not available in the area and that the fuel for such a thermal power plant would have to be bought on the international market, adding to the impoverishment and the dependency to foreign resources of these countries, which are among the poorest in the world.

Moreover, without the project, the need for wood for household cooking and lighting will rapidly increase the environmental, health and social impacts of deforestation.

## 5.5. COMPARISON OF IMPACTS

This section explains, in a tabular form, the differences between the four development schemes in terms of their social and environmental impacts.

The Table 5.1 presents some characteristics of the various development schemes. The last column indicates for which environmental component this indicator is relevant.

## 5.6. SELECTION OF PREFERRED ALTERNATIVE

From the information provided in Table 5-1 and illustrated in Figure 5-1 it is evident that the scale and extent of the overall environmental and social impacts of the ROR scheme are significantly less that FDS and IDS. The RoR is also more favourable from and economic perspective because of the significantly reduced costs of managing the social impacts.

## Table 5-1 Comparison of Design Alternatives

| Criteria | RoR | IDS | FDS |
|---|---|---|---|
| **Maximum normal upper level (m.a.s.l.)** | 1,320 | 1,323.50 | 1,325 |
| Incremental difference (m) | 0 | 3.50 | 5 |
| **Area flooded by the reservoir excluding Lake Rweru (ha)** | 977 (a) | 17,118 | 28,053 |
| Incremental difference (ha) | 0 | 16,141 | 27,076 |
| **Area of marsh flooded (ha)** | 977 (b | 10,817 | 18,280 |
| Incremental difference (ha) | 0 | 9,840 | 17,303 |
| **Terrestrial forested and shrub land flooded (ha)** | 0 (b) | 575 | 837 |
| Incremental difference (ha) | 0 | 570 | 832 |
| **Total loss of agricultural land (ha)** | 187 | 2,228 | 9,152 |
| Incremental difference (ha) | 0 | 2,041 | 8,965 - |
| **Number of households affected by construction and reservoir impoundment** | 664 | 7,330 | 17,450 |
| Incremental difference (nb) | 0 | 6 ,666 | 16,786 |
| **Infrastructure (roads) affected (km)** | 0 | 14 | 18 |
| Incremental difference (km) | 0 | 14 | 18 |
| **Number of villages impacted** | 8 | 167 | 263 |
| Incremental difference (nb) | 0 | 159 | 255 |
| **Average annual power generation (GWh)** | 446 | 497 | 507 |
| Incremental difference (**GWh**) | 0 | 51 | 61 |

(a) For the RoR, there is no reservoir but an area of permanently flooded marshland of shallow depth.

(b) The RoR alternative only marshland is flooded

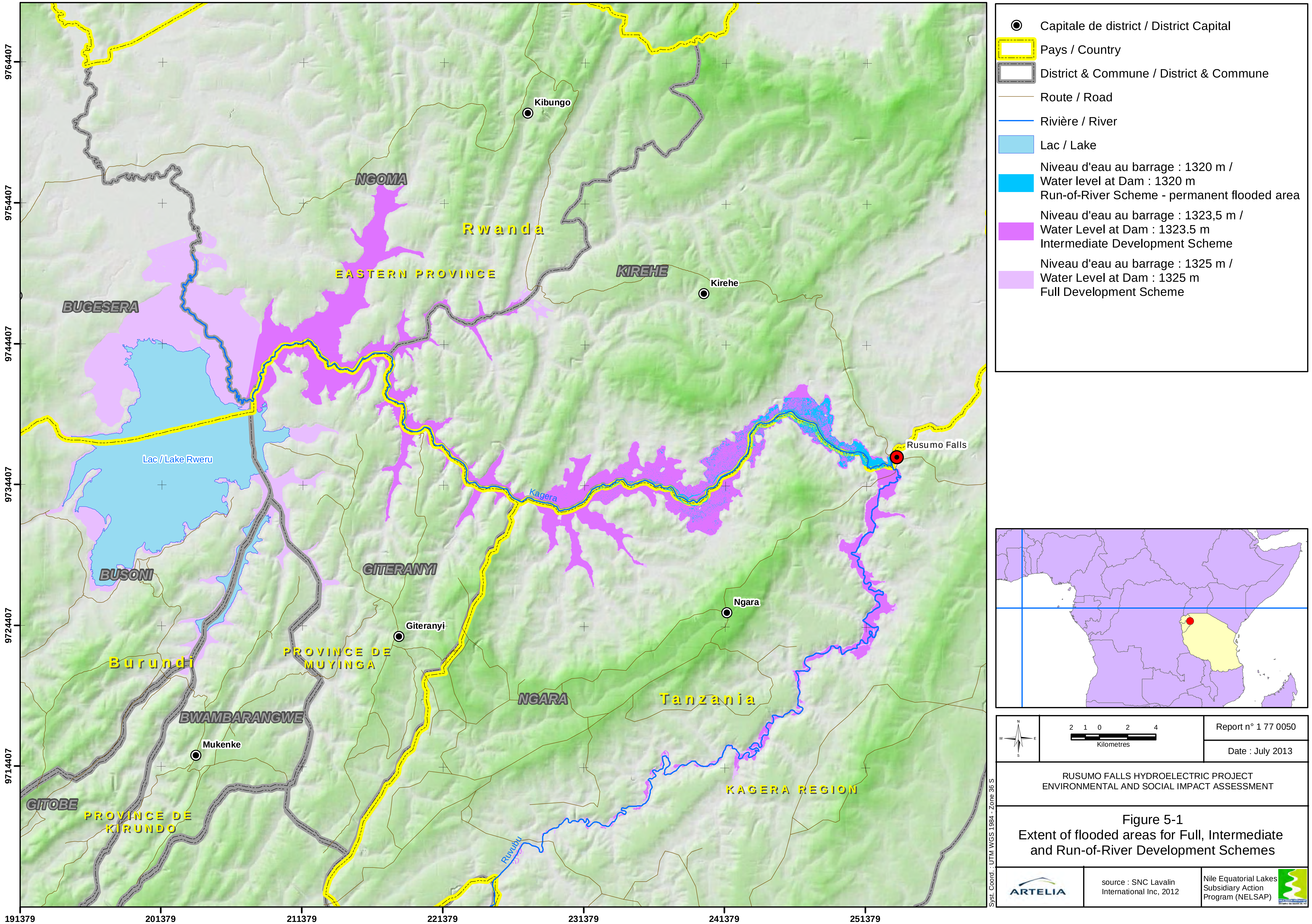



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Figure 5-1
Extent of flooded areas for Full, Intermediate and Run-of-River Development Schemes

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

# 6. ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

## 6.1. INTRODUCTION

This chapter presents a qualitative and quantitative assessment of the impacts of the proposed Project on the different components of the physical, biological and socioeconomic environments. Its objective is to provide a description of the impacts, analyse the impacts, recommend mitigation and compensation measures to minimize or offset these impacts.

For each of the environmental components considered, the impacts anticipated during the pre-construction, construction, deconstruction and operation of the facilities are identified, described and discussed on the basis of the impact caused by the Run-of-River Development Scheme.

## 6.2. METHODOLOGY

This section describes the methodology adopted for the assessment of impacts beginning with the first stages of key issue identification through the identification of potential impacts, magnitude and the determination of significance. The assessment comprises the following steps:

- Identification of key issues and potential impact by comparing project activities with environmental and socioeconomic components;
- Description of the potential impact characteristics in terms of nature, magnitude, extent, duration time;
- Evaluation of the environmental sensitivity or value of the impacted resource;
- Identification of control and mitigation measures;
- Determination of impact significance, by taking into account the impact characteristics (magnitude) and impact importance (value).

### 6.2.1. Identification of Key Issues and Potential and Impact

The first step in the assessment process is to identify the key environmental and social issues that require evaluation. This is carried out considering the various activities associated with the Project (see Chapter 3) and the impacts they could have on the receiving natural and human environment (see Chapter 4).

The key issues were identified by looking at the aspects of the environment receiving the elements of each stage of the project. For every interrelation between Project operations and the pertinent environmental component, probable impacts have been identified and evaluated. The assessment has used to the following:

- The findings of the environmental and social baseline situation study (bibliographic studies and the different field studies);
- The list of potential impacts of hydroelectricity projects drawn up by various international financial organizations (World Bank, African Development Bank, Asian Development Bank) as well as other major players in the sector, including the World Commission on Dams and the International Hydropower Association, and
- The Consultancy's experience based on the environmental monitoring of numerous major hydropower construction sites.

Key environmental issues for the pre-construction, construction and deconstruction phases have been identified as:

- The bypassing of the Rusumo Falls and the 100 metre section of river downstream from the Falls is necessary for the construction of project structures in the river bed. River hydrology is impacted and consequently flora, fauna and fishing activities in these zones are also affected. The Rusumo Falls spray zone is of particular environmental sensitivity and there are some species of flora and fauna that are of conservation concern in the project area of influence;
- The change in land use resulting from the terrestrial pre-construction and construction activities affects natural vegetation, agriculture and farming activities in the areas where permanent and temporary facilities are constructed;
- The change in land use resulting from construction and deconstruction activities affects carried out in the river bed affects flora and fauna in the affected areas;
- Water quality issues related to discharge of wastewater and increased risk of accidental pollution associated with the presence of work camps and construction activities;
- Increased sediment associated with rainwater runoff work site zones;
- Waste management;
- Visual impact from the physical presence of the work activities and structures;
- Impacts from noise and vibration resulting from the works;
- Air quality issues related to dust emissions and fuel combustion exhaust emissions;
- Socioeconomic issues which positive impacts related to employment, economic development, improved quality of life and negative impacts including: (i) need for resettlement of people living in the areas that need to be taken for the Project (ii) community health and safety, (iii) spontaneous settlements.

- Interactions with other projects at the same location (one stop border post, new road and bridge, new railway.

Key environmental issues for the operation phase have been identified as:

- The bypassing of the Rusumo Falls and the 500 metre section of river downstream from the Falls impact hydrology and consequently flora and fauna, this will be a continuation of the impact initiated during construction;
- The physical presence of the dam and the maintaining of the water level at 1,320 metres asl creates an area of permanently flooded marshland upstream of the dam and modifies the seasonal variations of water level of the marshland. This impact also affects flora and fauna, but in both positive and negative ways;
- Physical presence of the dam may trap sediment, which may accumulate upstream of the dam reducing electricity production capacity and reducing sediment loads downstream which may influence downstream river morphology;
- Socioeconomic issues related to impacts on arable marshland on the edge of the papyrus marshland and which is farmed by local people.

### 6.2.2. Impact Characteristics (Magnitude)

The magnitude of impacts is expressed in terms of relative severity (negligible, minor, moderate, major). The criteria for magnitude are presented in the table on the following page.

The impact characterisation and determination of the magnitude also needs to take into account the following parameters:

- Nature (positive, negative, direct, indirect, cumulative);
- Extent/location (area/volume covered, distribution);
- Timing (during construction, operation, decommissioning, immediate, delayed, rate of change);
- Duration (short term, long term, intermittent, continuous);
- Reversibility/irreversibility, and
- Likelihood (probability, uncertainty or confidence in the prediction).

In the sections 6.3 to 6.8, the impacts are characterised and an impact magnitude attributed. Section 6.9 includes a table summarising the analysis of impacts and characterising the impacts according to the above parameters.

## Table 6-1 Impact Magnitude Definitions

| Impact Magnitude Definition | |
|---|---|
| Air Quality | **Major:** Off-site receptor is in the vicinity of the activity. Estimated emissions, with respect to the background air quality concentration and likely dispersion and meteorological conditions, may result in elevated long-term concentrations at receptors. |
| | **Moderate:** Off-site receptor is in the vicinity of the activity. Estimated emissions, with respect to the background air quality concentration and likely dispersion and meteorological conditions, may result in elevated short-term pollution concentrations at receptors. |
| | **Minor:** Off-site receptor is in the vicinity of the activity (i.e. within 5 km). Emissions are anticipated to be transient, short-term and infrequent in nature. Estimated emissions, with respect to the background air quality concentration and likely dispersion and meteorological conditions, are low in magnitude. |
| Noise | **Major:** Increase short-term ambient noise at receptor sites by more than 20 dB(A). |
| | **Moderate:** Increase short-term ambient noise at receptor sites by 10 to 20 dB(A). |
| | **Minor:** Increase short-term ambient noise at receptor site by 10 dB(A). |
| Water Quality | **Major:** Breaching of effluent discharge standards. |
| | **Moderate:** Effluent quality within discharge limits; poor dilution capacity in receiving water. |
| | **Minor:** Effluent quality within discharge limits; rapid dilution achieved to levels where no discernible impacts to aquatic ecology are likely. |
| Biologiocal Environment | **Major:** Affect an entire population or species in sufficient magnitude to cause a decline in abundance and /or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations of the species being affected. In the case of fish, an impact over one season/generation would be significant. |
| | **Moderate:** affect a portion of a population and may bring about a change in abundance and / or distribution over one or more generation of the species affected, but does not threaten the integrity of that population or any population dependent on it. Moderate Impacts to the same resource multiplied over a wide area would be regarded as a Major Impact. |
| | **Minor:** affect a specific group of localised individuals within a population over a short time period (one generation of the species affected or less), but does not affect other trophic levels or the population itself. |
| Hydrology of rivers and marshland | **Major**: Fundamental change to hydrological/hydrogeological conditions resulting in temporary or permanent consequential changes. |
| | **Moderate**: Detectable change to hydrological/hydrogeological conditions resulting in non- fundamental temporary or permanent consequential changes. |
| | **Minor**: Detectable but minor change to hydrological/hydrogeological conditions. |
| Lanscape and Visual Aminity | **Major**: Landscape A notable change in landscape characteristics over an extensive area. Visual A large number of viewers affected by major changes in view. |
| | **Moderate**: Landscape Moderate changes in landscape components. Visual A moderate number of viewers affected by moderate changes in views. |
| | **Minor**: Landscape: A small change in components of the landscape. Visual Few viewers affected by minor changes in views. |
| Socioeconomic environment | **Major**: Impacts are considered as major, when (i) the reduction of the overall agricultural production/livestock production or of any other benefit from affected land jeopardizes the livelihoods of affected households and results in a change of the overall livelihood pattern of these households, from which the household cannot recover without substantial external assistance or, (ii) land take results in loss of home and physical displacement of affected households. |
| | **Moderate**: Impacts are considered as moderate, when (i) reduction of the overall agricultural production/livestock production or of any other benefit from affected land does not jeopardize livelihoods of affected households and results in noticeable changes in the overall livelihood pattern of these households, and (ii) land take does not result in physical displacement of affected households. |
| | **Minor**: Impacts resulting from the Project's land take are considered as minor, when (i) reduction of the overall agricultural production/livestock production or of any other benefit from affected land does not jeopardize livelihoods of affected households and does not result in any significant change in the overall livelihood pattern of these households, and (ii) land take does not result in physical displacement of affected households. |

### 6.2.3. Value of Resources (Importance)

The value and resources (environmental sensitivity of receptors) are ranked as low, moderate or high based in expert judgement. In the assessment the ranking of the reception is explained on a case-by-case basis. However, because it it one of the main issues, the criteria for the evaluation of the value and sensitivity of habitats and species are as described as follows:

- The presence of any habitat, plant or animal species that is internationally, nationally, regionally or locally rare;
- The presence of any habitat, plant or animal communities, which are internationally, nationally, regionally or locally uncommon or suffering serious reduction nationally or locally;
- The 'naturalness' of the habitat. Naturalness and diversity can be strongly correlated and recreated habitats tend to be more species poor than their natural or semi-natural equivalents.
- The fragility and sensitivity of the habitat and its ability to recover (either naturally or with assistance) from disturbance. This criterion is linked also to size, naturalness and rarity but generally fragile sites are usually highly fragmented, decreasing rapidly in extent and number and are difficult to recreate;
- The recorded history of the site. The loss of an irreplaceable biological record would be particularly significant. Such records may also be of cultural and historical value;
- Whether a species has a seasonally variable vulnerability due, for example, to breeding, critical feeding times or migratory passage, and
- Whether any species has cultural significance (for example, as a resource utilised by local settlements).

### 6.2.4. Control and Mitigation Measures

Control and mitigation measures are planned where a potential impact is considered as significant (see below). The control and mitigation measures are intended to reduce the significance of the impact to an acceptable level. Control and mitigation measures are not planned for potential impacts which are not considered as significant. However, monitoring measures can be planned.

Control and mitigation measures can include the following:

- Design options that avoid or reduce the impact, for example the adoption of the Run-of-River is a design option that reduces the impacts compared to the Full Development Scheme;
- Design features to avoid or reduce the impact, for example the environmental flow;

- Control systems to control discharges, example wastewater treatment systems;
- Management plans to reduce, minimize and control the extent of impacts.

### 6.2.5. Residual Impact

The residual impact is the magnitude of the impact taking into account control and mitigation measures. The measures can reduce the magnitude extent, likelihood, frequency or duration of the impact.

### 6.2.6. Risk and Uncertainty

Some control and mitigation measures may be proven and expected to be straightforward to put in place, in which case there is a high likelihood that the impact reduction will be effective. However, some control and mitigation measures may be difficult to implement, in which case there is a risk that the impact reduction, or avoidance may not be effective. In the assessment of each impact, where this aspect is pertinent commentary has been added.

### 6.2.7. Significance

Once impacts have been characterised and the value (importance) of receptors established, the significance of the impact is determined and is ranked as low, high. The criteria used for determining significance are as follows:

- Not significant is where a resource or receptor will not be affected in any way by a particular activity or the predicted effect is deemed to be ‘negligible’ or ‘imperceptible’ or is indistinguishable from natural background variations.
- An impact of low significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
- An impact of high significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.

A notion of scale has been used to describe if the impact is of significance on a local or regional scale.

# 6.3. IMPACTS ON PHYSICAL ENVIRONMENT

## 6.3.1. Impacts on Hydrology

*Impacts during Construction*

To allow for the construction of the dam, the Kagera River will be temporarily diverted into a channel on the left bank effectively bypassing the Rusumo Falls and re-joining the Kagera River further downstream. The intake to the channel will be located 150 metres upstream from the Falls and the length of the channel will be about 265 metres.

a) *Impact on hydrology upstream of the dam*

The creation of the temporary deviation channel will not affect water levels or flow regimes of the river or marshland upstream of the dam, no direct or indirect impacts are anticipated.

b) *Impact on the hydrology at the Site of Rusumo Falls and the stretch of river extending 100 metres downstream*

There will be potential major impact on the hydrology of the Falls and the stretch of river immediately downstream which is bypassed by the deviation channel. An environmental flow (of 10% of the rivers average flow rate) is recommended as a mitigation measure for flora and fauna, but even with the environmental flow there will still be a major impact for the duration of the construction which is anticipated to take 4 to 5 years. The location and extent of this impact is illustrated in Figure 6-1 overleaf.

The magnitude of the residual impact is considered to be major but local. However, because the impact on hydrology has important consequences on flora, fauna and fishing the impact is considered to be of high significance. The acceptability of the impact is discussed in the sections discussing the impact on flora and fauna (§6.4.1 and 6.4.2).

c) *Impacts on the hydrology of downstream sections of the river*

The river downstream from the discharge of the temporary deviation channel is not anticipated to be affected. The chosen method of construction and sequencing of activities will ensure that there will be no periods, even short when there will be an interruption or reduction in the normal flow of river water.

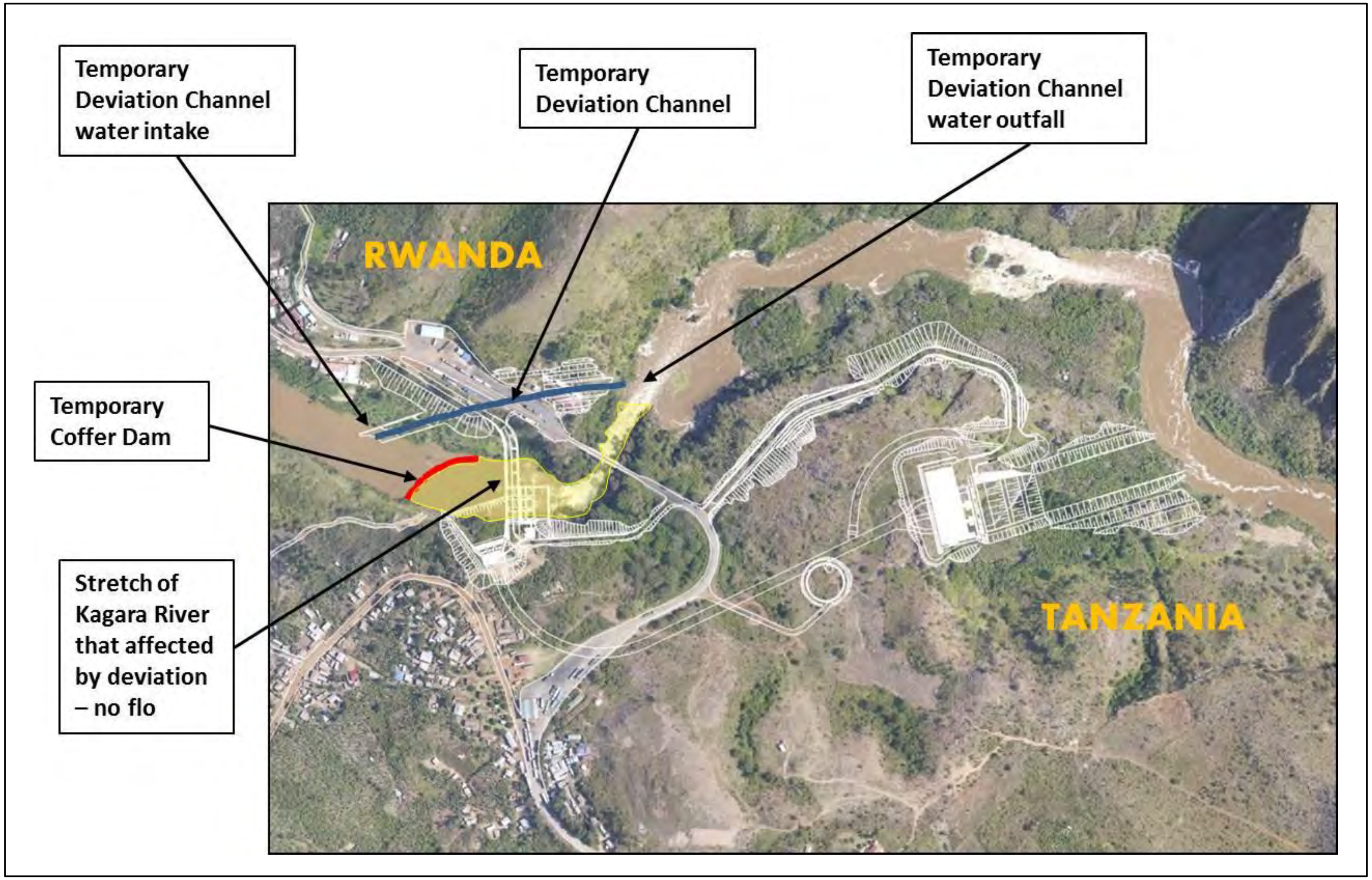



**Figure 6-1 Section of Kagera River Affected by Temporary Deviation Channel**

***Impacts during Operation***

When the construction works have been terminated, the temporary deviation channel will be closed, and the river deviated through the head race and tail race tunnels on the right bank, to the turbines and discharged back into the Kagera River some 500 metres downstream from the dam. The scheme can then be considered to be in operating mode. The coffer dam and temporary deviation channel will then be deconstructed and rehabilitated.

The Run-of-River operating mode for the dam and powerplant will be such that the level of the river and body of water upstream of the dam will be maintained at a constant 1,320 metres asl. The changes in hydrology upstream of the dam as a result of the dam and constant water level at the dam of 1,320 metres asl has been determined using hydraulic modelling. The model used was the HEC-RAS (Hydrologic Engineering Centres River Analysis System) developed by the US Army Corps of Engineers (USACE). The modelling report is provided in the Appendix E and the findings are presented in the following pages.

*a) Changes to flooding regime of upstream marshlands*

The impacts of the changes in the flooding regime of the upstream marshes can be described under five headings:

- Creation of a permanently flooded area of shallow depth extending 15 kilometres upstream from the dam and encompassing a total surface area of 977 ha;
- Creation of temporary additional flooded areas in May of 75 ha;
- Creation of permanently flooded additional areas near the dam site of 6 ha;
- Reduced rate of seasonal lowering of water level which reduces availability of arable marshland along the edge of the papyrus marshland extending 15 kilometres upstream from the dam along the Kagera valley, and
- Increased water depth in the main river bed.

These impacts are discussed in detail in the following paragraphs.

<u>Creation of a permanently flooded area of shallow depth</u>

The most noticeable change in the flooding regime of the marshlands upstream of the dam will be the creation of a permanently flooded area, i.e. creation of an area that does not completely dry out during the dry season.

For natural conditions, at the end of the wet season (May) the marshland is completely flooded and the water is at its highest level. Then during the period May – October, the water slowly recedes and reaches its lowest level in October (end of dry season). For an average year the water recedes to the main river bed and the marshes (with the exception of depressions and pools) become dry. Though it should be noted that in wet years (in general, one year out of two) the water does not completely recede and the marshland can remain partially flooded.

With the dam and the maintaining of the water level at 1,320 metres asl at the dam site, during the period May to October, the water in the 15 kilometres upstream from the dam will not recede, and the marshland will remain flooded. The area that remains flooded at the end of October is referred to as permanently flooded marshland.

The extent of the permanently flooded marshland (i.e. extent of flooded marshland in October) is illustrated in Figure 6-2 and Figure 6-3, and it can be seen that it extends from the upstream from the dam along the Kagera valley affecting both Rwanda and Tanzania for a distance of about 15 kilometres. The map shows that the permanently flooded area does not encroach on Burundi, nor does it extend along the Ruvubu valley in Tanzania.

It is emphasised that the permanently flooded area is of shallow depth. The depth of water at the end of October is similar to that of the natural situation in May (end of wet season) the water depth ranges from 40 - 50 cm near the dam to 2 – 5 cm 15 kilometres upstream.

The area of water extending from dam to a distance of about 5 kilometres upstream is a continuous body of flat water in October. However, from 5 kilometres to 15 kilometres, the flooded marshland is a patchwork of flooded marsh with numerous non flooded hillocks and embankments protruding from the water. This can be clearly soon in Figure 6-2 and Figure 6-3.

The total surface area of the permanently flooded area is 977 ha.

<u>Creation of temporary additional flooded areas in May</u>

The presence of the dam will create some temporary additional flooded areas during the month of May (end of wet season). These areas are of two types: (i) additional flooding of hillocks and embankments within the marshland areas, and (ii) flooded of land that extends beyond the limit of the marshland. The extent of the additional flooded area is illustrated in Figures 6-4, Figure 6-5 and Figure 6-6 (and shaded in yellow).

The hydraulic modelling of the water level in May for an average year indicates that there the additional flooded area will cover a total of 75 ha of which about 37 ha is in Rwanda and 38 ha is in Tanzania. However, it is important to note that the additional flooded area created by the dam for an average year is within the area flooded by a 2-year flood event for the natural situation. This is illustrated in Figure 6-7.

Creation of permanent additional flooded areas

During the period May to October, the water recedes from most of the temporary additional flooded areas. However, near the dam the creation of the permanent flooded area encompasses a small area of permanently additional flooded land. The total surface area of this is 6 ha. The extent of the area is illustrated in Figure 6-8. Again, it is important to note that the permanent additional flooded areas are within the area flooded by a 2-year flood event in May.

Reduced rate of seasonal lowering of water and reduced availability of arable marshland

For the natural situation for the period May to October, the water level in the marshland recedes. As the water recedes, the local people clear the papyrus vegetation from a narrow band on the edge of the marsh and which they know from experience will be dry long enough for crops to be grown. This band of cleared marshland is referred to as arable marshland as the people use it for crops and as pasture land for animal grazing. With the presence of the dam the water will recede more slowly and not recede as far. Consequently the availability of arable marshland will be reduced and in some areas, where the water will not recede arable marshland will be lost. The loss of arable marshland extends from the dam up the Kagera valley affecting both sides for a distance of 15 kilometres. The extent of the reduced marshland is illustrated in Figures 6-8 and Figure 6-9.

Increased water depth

During both the wet and dry seasons, the physical presence of the dam creates an increase in water level that extends up the Kagera and Ruvubu River. This is illustrated in the Figures 6-10 to 6-14.

- Kagera River May

Compared to an average wet season without the dam, there is a noticeable increase in water level that extends 10 kilometres upstream. The increases in water level at different distances are as follows:

| Distance upstream from the dam | Increase in water level compared to natural situation |
|---|---|
| 0.3 km | 43 cm |
| 2 km | 30 cm |
| 5 km | 20 cm |
| 10 km | 6 cm |
| 15 km | 3 cm |

The increase in water level is not expected to be noticeable at a distance of more than 10 kilometres upstream from the dam.

The increase in water level translates as the creation of temporary additional flooded areas discussed above and illustrated in Figure 6-4.

The depth of water in the marshland is in the range of 40 to 50 cm as shown in Figure 6-14 and Figure 6-15.

- Ruvubu River May

Compared to an average wet season without the dam, there is an increase in water level that extends 40 kilometres upstream. The increases in water level at different distances are as follows:

| Distance upstream from the dam | Increase in water level compared to natural situation |
|---|---|
| 2 km | 28 cm |
| 6 km | 22 cm |
| 10 km | 18 cm |
| 20 km | 12 cm |
| 30 km | 9 cm |
| 40 km | 6 cm |

Unlike the Kagera River, the increase in water level in the Ruvubu River does not translate as the creation of temporary additional flooded land. The reason for this is that the sides of the valley are steep and the increased water depth does not increase the surface area flooded. At distances greater than 10 kilometres upstream from the dam, most of the banks are at an elevation greater than the water level and that the increased water level is contained within the main river bed.

- Kagera River – October

Compared to an average dry season without the dam, there is an increase in water level that extends nearly 80 kilometres upstream. The increases in water level at different distances are as follows:

| Distance upstream from the dam | Increase in water level compared to natural situation |
|---|---|
| 0.3 km | 1.4 m |
| 2 km | 1.3 m |
| 5 km | 1.15 m |
| 10 km | 1 m |
| 15 km | 80 cm |

The increase in water level translates as the creation of a permanently flooded area extending from the dam 15 km upstream (see above). The permanently flooded area does not extend further because the water level beyond the 15 km point is lower that the elevation of the river banks as illustrated in Figure 6-12 and Figure 6-15.

The depth of water in the marshland near the dam is in the range of 40 to 50 cm (see Figure 6-14) and in the range of 2 to5 cm further upstream (see Figure 6-15).

- Ruvubu River – October

Compared to an average dry season without the dam, there is an increase in water level that extends nearly 80 kilometres upstream. The increases in water level at different distances are as follows:

| Distance upstream from the dam | Increase in water level compared to natural situation |
|---|---|
| 2 km | 1.25 m |
| 6 km | 1.12 m |
| 10 km | 1 m |
| 20 km | 70 cm |
| 30 km | 55 cm |
| 40 km | 40 cm |

Unlike the Kagera River, the increase in water level in the Ruvubu River does not translate as the creation of permanently flooded land. The reason for this is that most of the banks are at an elevation greater than the water level and that the increased water level is contained within the main river bed. See Figure 6-13.

Impact Analysis

The impacts from the changes in hydrology on marshland flood regime are ranked as local and minor to moderate. However, it is more pertinent to analyse the impacts in terms of the consequential impacts on fauna, flora and socioeconomics which are analysed in §6.4 and 6.7.

*b) Site of Rusumo Falls and stretch of river extending 500 metres downstream*

The impact will be a continuation of the impact incurred during the construction phase discussed earlier in this subsection. However the impact area is greater, affecting 500 metres stretch of river, whereas the construction affects a 100 stretch of river.

*c) Downstream sections of the river*

There is often concern with dam projects that downstream sections of the dam river may undergo important changes in hydrology associated with filling of the reservoir, storing water and dam powerplant operating modes. The Run-of-River alternative has been adopted which does not require the filling of a reservoir, there is no storage of water or changes in downstream hydrology. Consequently there will be no impact on the downstream section of the river.

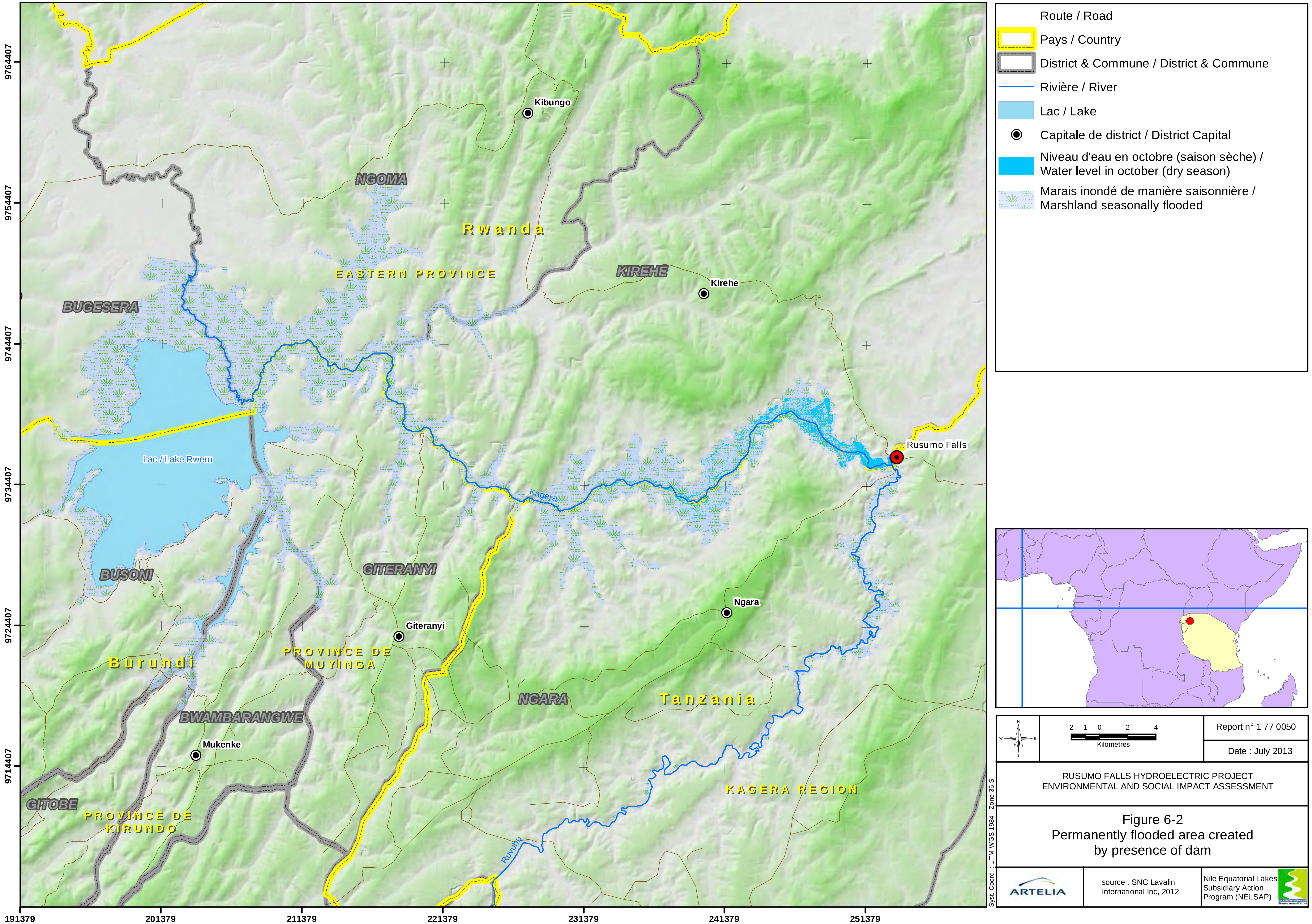
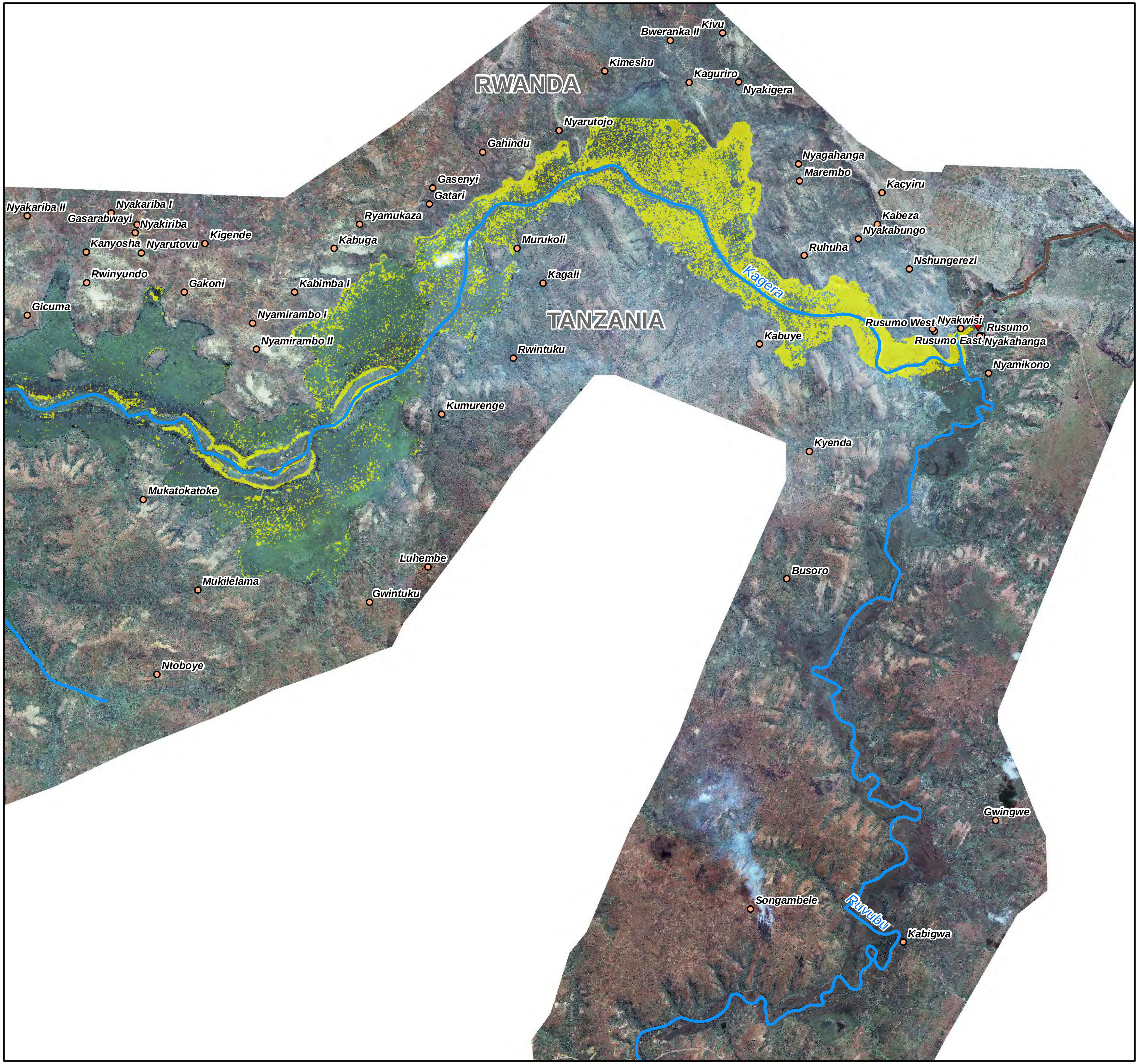



Figure 6-2
Permanently flooded area created by presence of dam



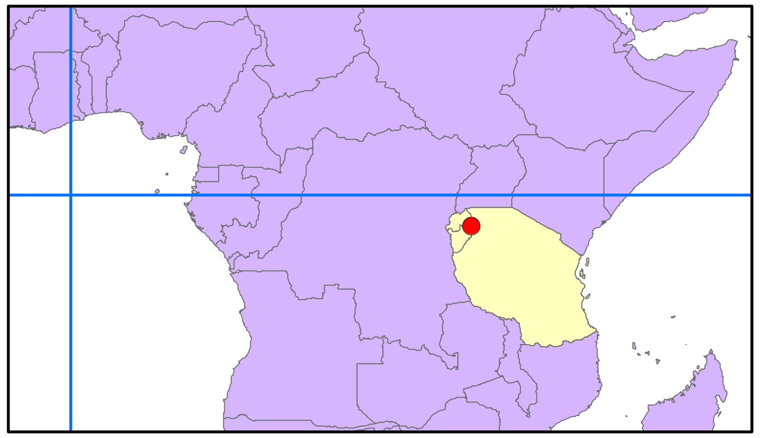

Key

- Village
- Rusumo falls and futur dam site
- River
- Extent of permanently flooded marshland
- Extent of flooded marshland (natural conditions for October)

The map shows the extent of the permanently flooded marshland created by the dam in October (end of dry season) when the water level is at its lowest.

For the natural situation in October, for an average year the water level recedes to the main river bed and much of the flood plain is no longer flooded. However in wet years the marshland often remains flooded.

Viewing in colour is essential for interpreting this map

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RUSUMO FALLS HYDROELECTRIC PROJECT
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Figure 6-3
Extent of permanently flooded marshland created by presence of dam

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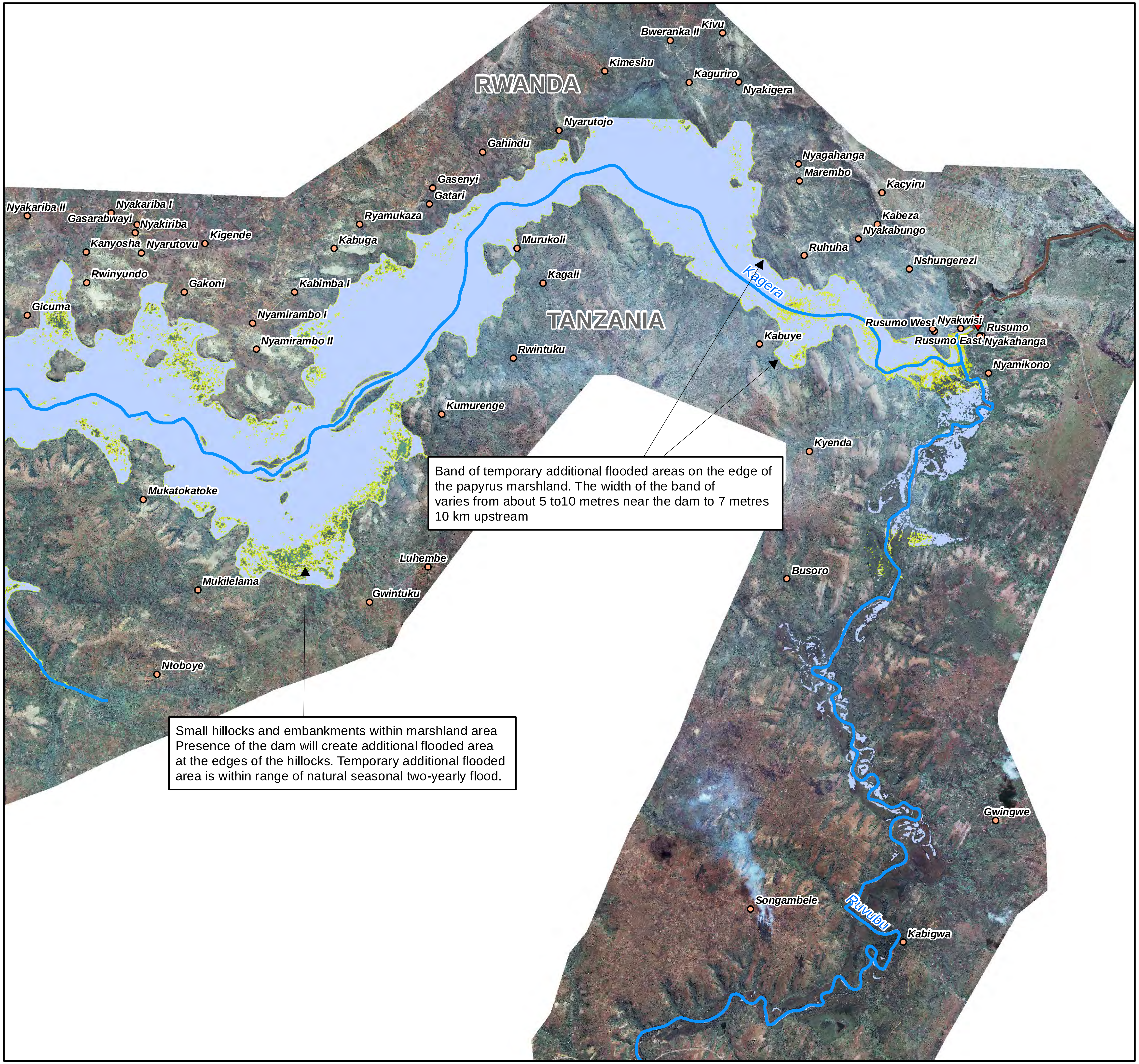
Nile Equatorial Lakes Subsidiary Action Program (NELSAP)




**Key**

- Village
- Rusumo falls and futur dam site
- River
- Extent of temporary additional flooded area caused by the dam
- Extent of seasonally flooded marshland (natural conditions)

Viewing in colour is essential for interpreting this map

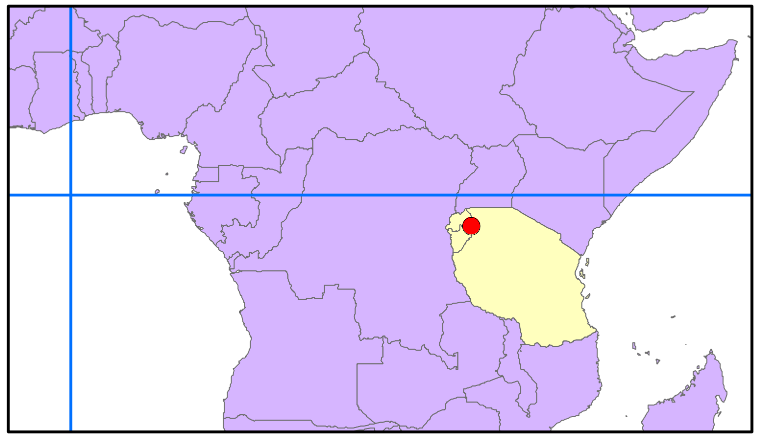


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Figure 6-4
Seasonally flooded area in May (end of wet season)
Natural situation and with dam

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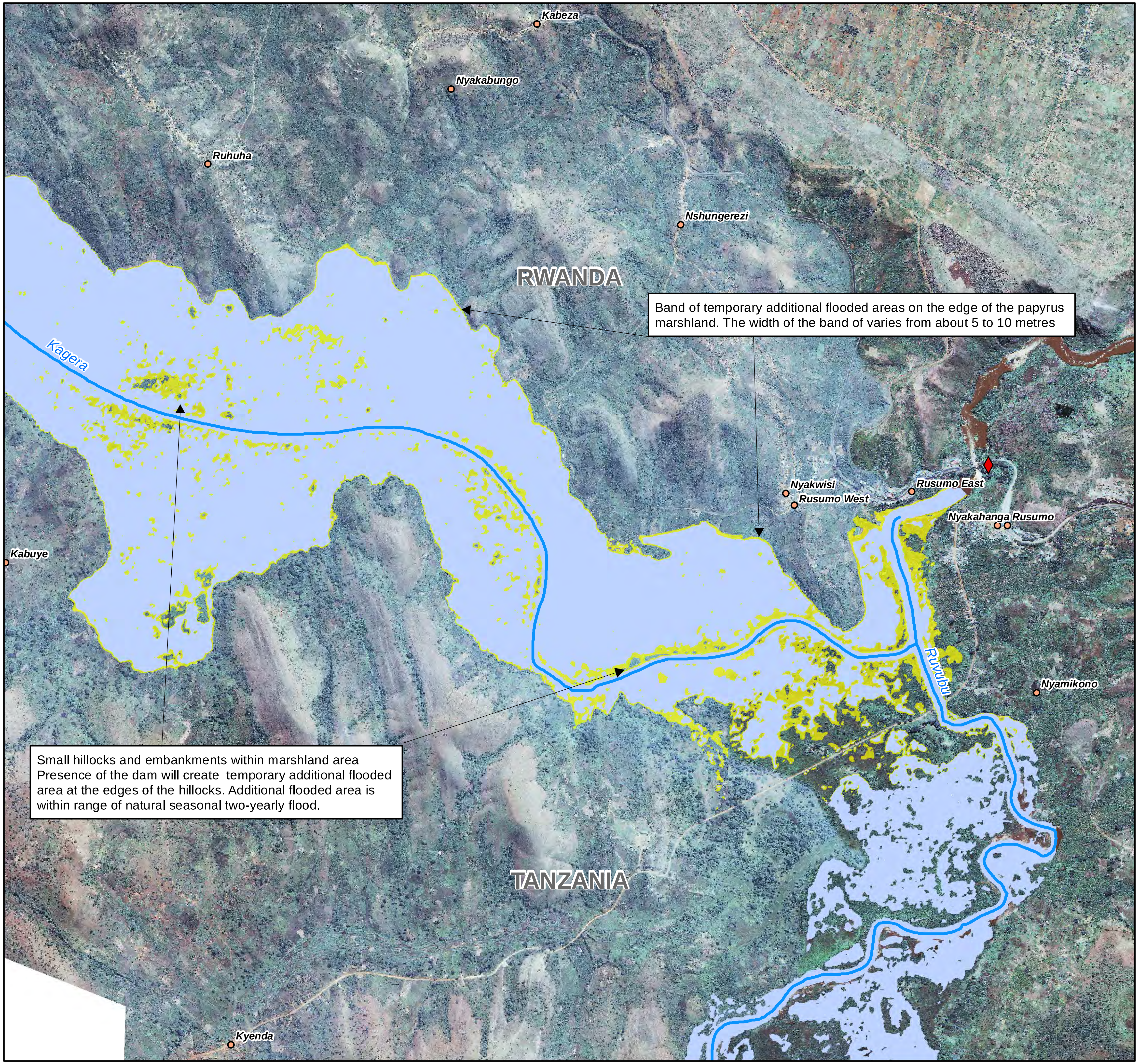
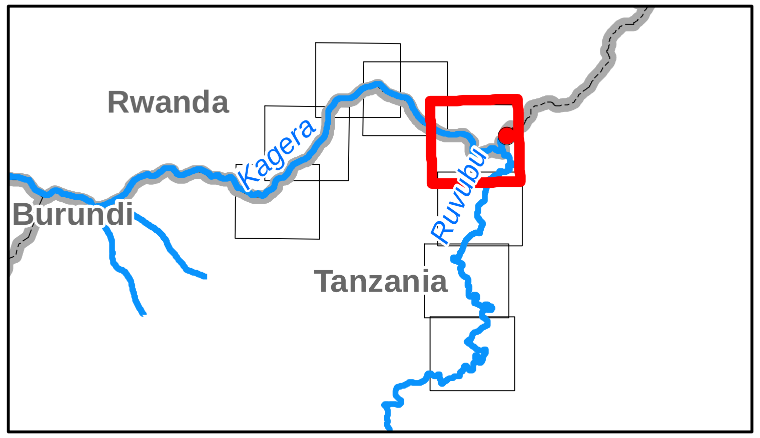
Nile Equatorial Lakes Subsidiary Action Program (NELSAP)




**Key**

- Village
- Rusumo falls and futur dam site
- Country
- River
- Extent of temporary additional flooded area caused by dam
- Extent of seasonally flooded marshland (natural situation)

Viewing in colour is essential for interpreting this map

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RUSUMO FALLS HYDROELECTRIC PROJECT
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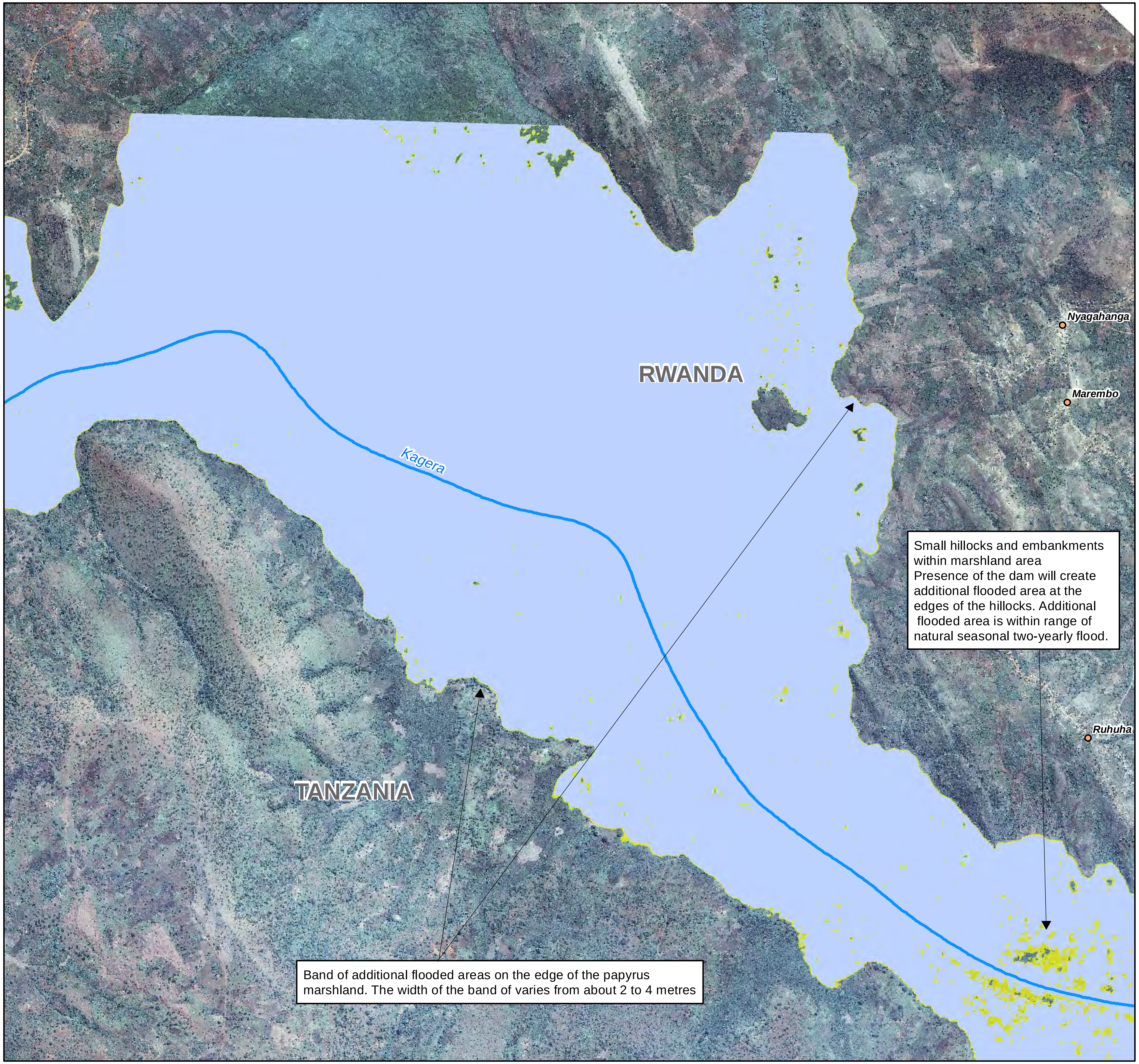
Figure 6-5
Seasonally flooded area in May (end of wet season)
Near dam (natural situation and with dam)

ARTELIA

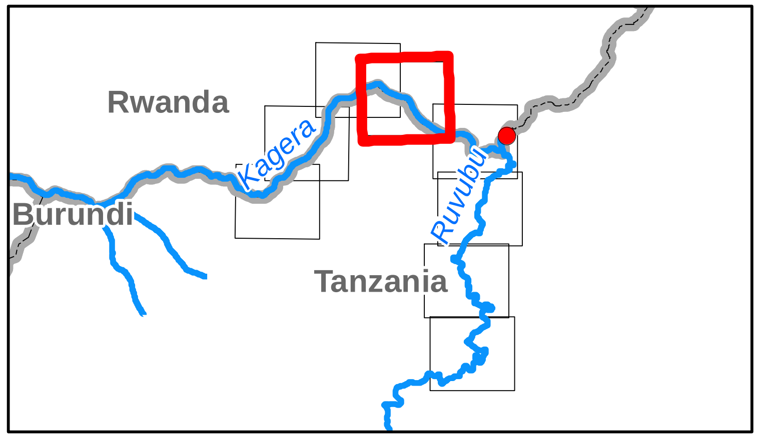
Nile Equatorial Lakes Subsidiary Action Program (NELSAP)




**Key**

- Village
- Rusumo falls and futur dam site
- Country
- River
- Extent of temporary additional flooded area caused by dam
- Extent of seasonally flooded marshland (natural situation)

Viewing in colour is essential for interpreting this map

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RUSUMO FALLS HYDROELECTRIC PROJECT
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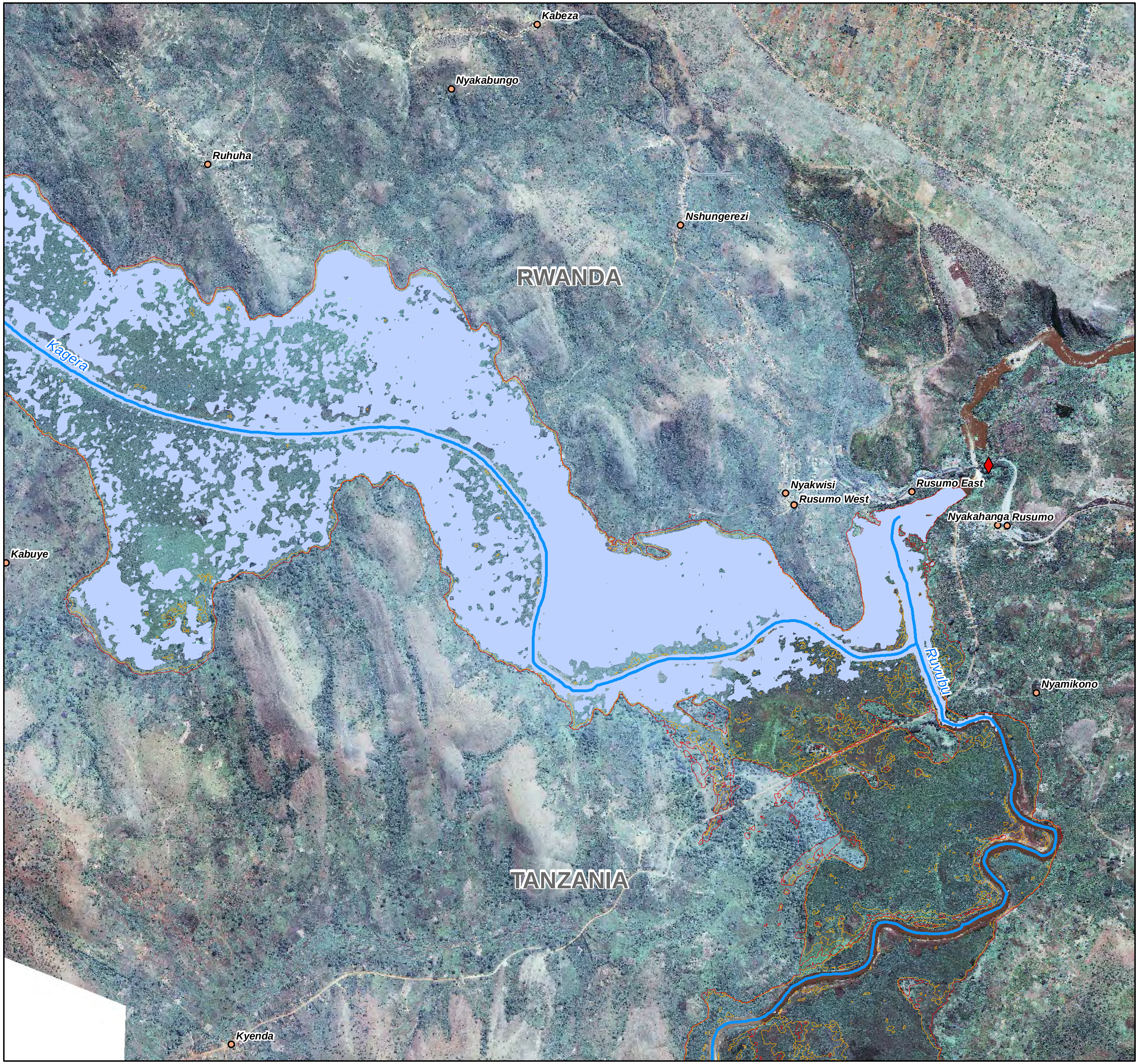
Figure 6-6
Seasonally flooded area in May (end of wet season)
8-10 km upstream from the dam
(natural situation and with dam)

ARTELIA

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)



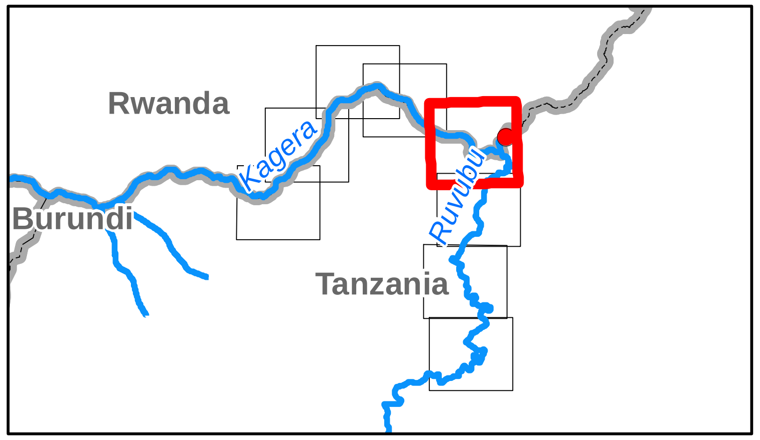

**Key**

- Village
- Rusumo falls and futur dam site
- Country
- River
- Limit of flooded area with dam in October
- Limit of flooded area (natural 5-year flood event)
- Limit of flooded area (natural 2-year flood event)

The map shows the extent of the permanently flooded marshland created by the dam in October (end of dry season) when the water level is at its lowest.
The map also shows the flooded area for the natural situation in May (when the water is at its highest) for two-year and five-year flood events.

It can be seen that the permanently flooded area does not extend beyond the limits of the natural two-year flood water level.

Viewing in colour is essential for interpreting this map

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RUSUMO FALLS HYDROELECTRIC PROJECT
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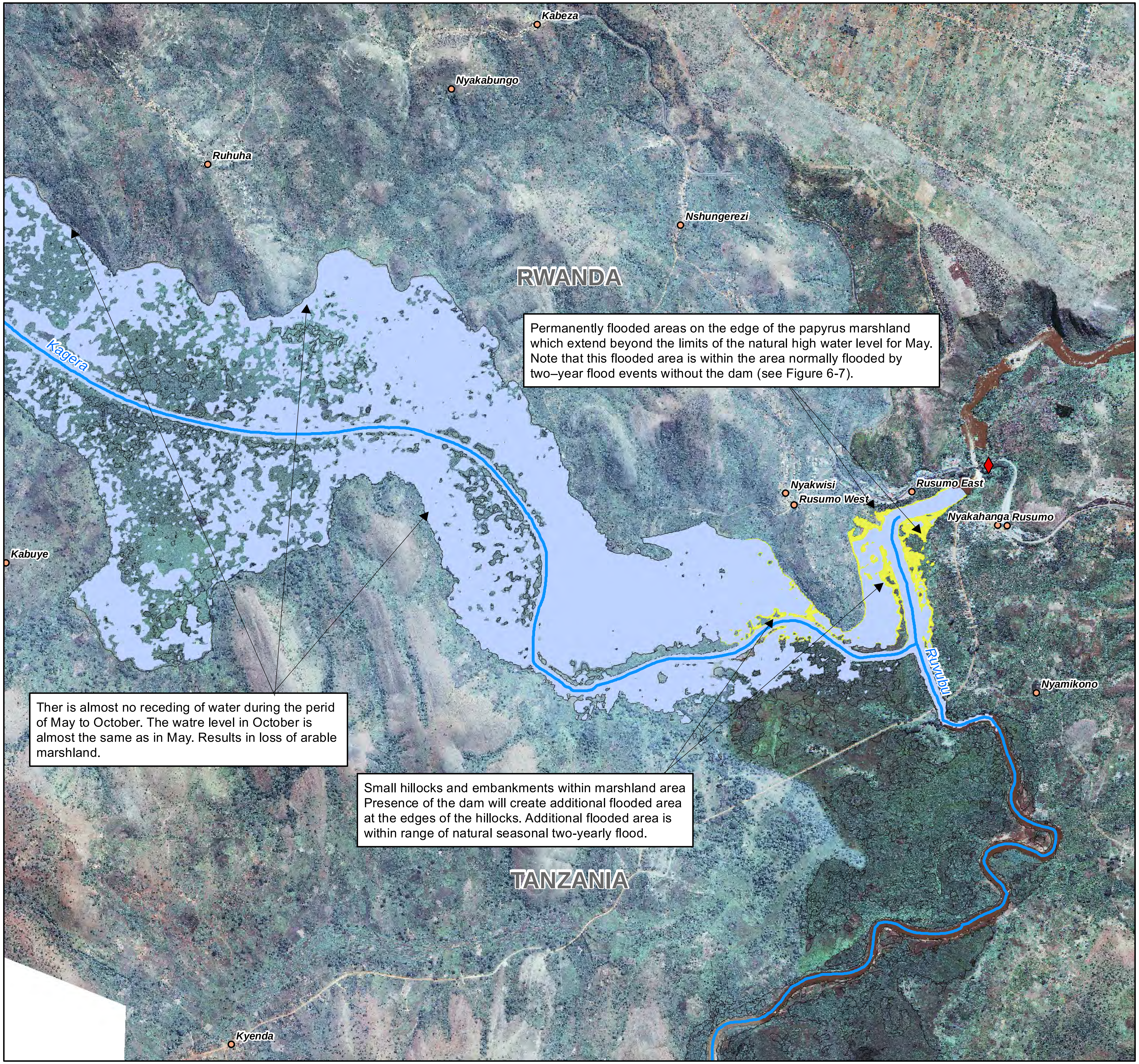
Figure 6-7
Seasonally flooded area in October (end of dry season)
(Natural 2 and 5 year flood events and with dam)

ARTELIA

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

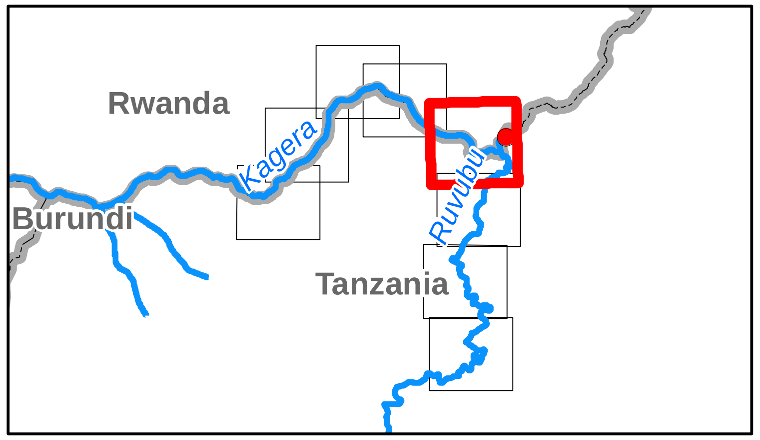



**Key**

- Village
- Rusumo falls and futur dam site
- Country
- River
- Extent of permanently additional flooded area in October caused by dam
- Extent of flooded area in October created by dam
- Flooded marshland (natural conditions) for May

The map shows that near the dam the area flooded in October (end of dry season) is much the same as the flooded area in May (end of wet season). With the dam, the water will not recede during the period May – October and therefore no cultivation of arable marshland will be possible along the edges of the Kagera papyrus marshland extending from the dam upstream for a distance of about 8 kilometres (see also Figure 6-9).

Viewing in colour is essential for interpreting this map

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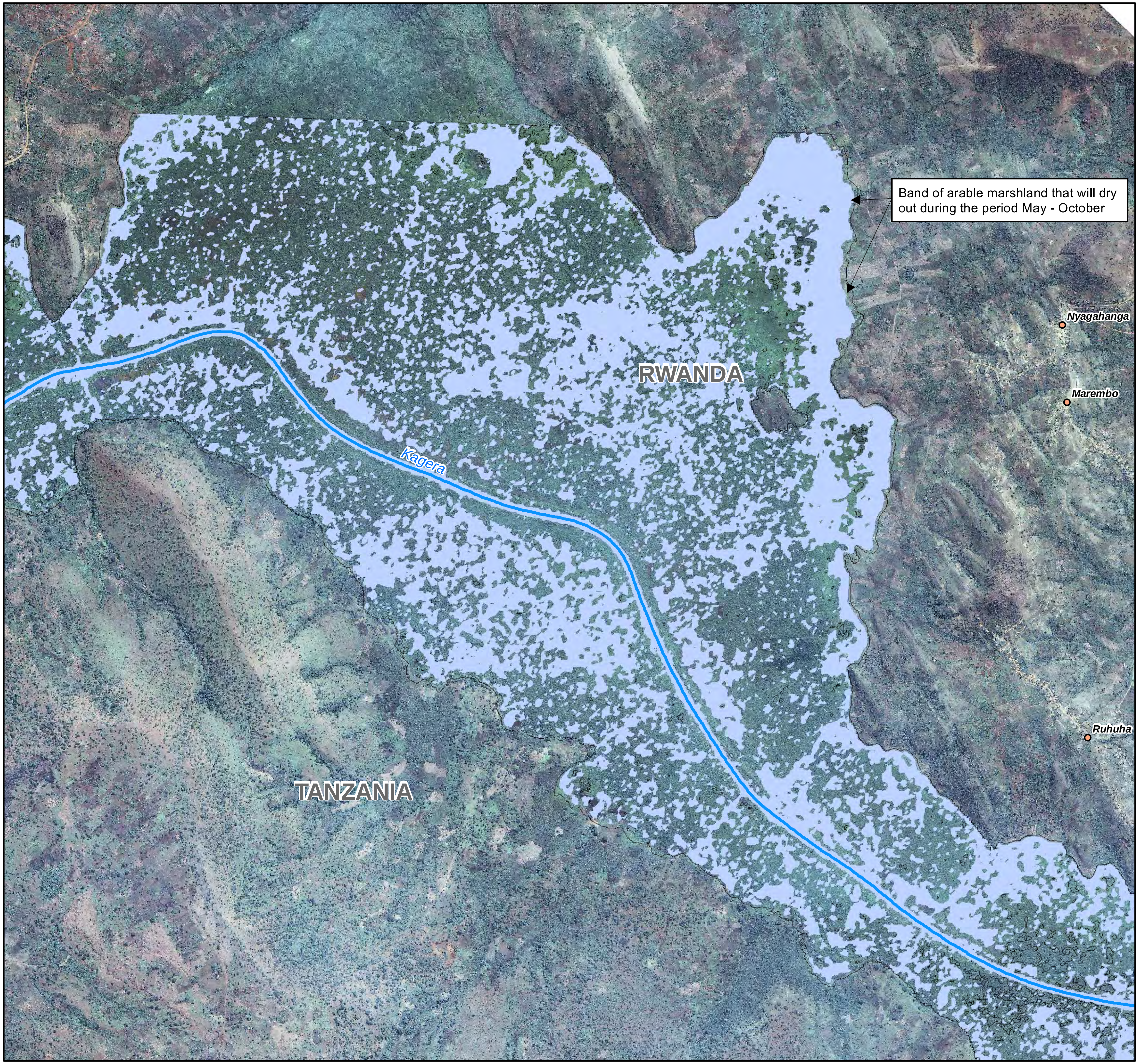
RUSUMO FALLS HYDROELECTRIC PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Figure 6-8
Extent of permanently flooded area near dam

ARTELIA

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

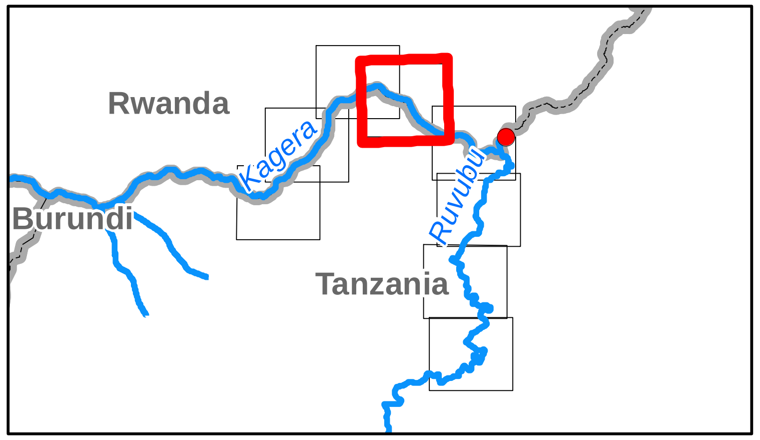



**Key**

- Village
- Rusumo falls and futur dam site
- Country
- River
- Extent of additional flooded area in October caused by dam
- Extent of flooded area in October created by dam
- Flooded marshland (natural conditions) for May

The map shows in the Kagera valley 8 kilometres upstream from the dam the area flooded in October (end of dry season) is smaller than the flooded area in May (end of wet season). This demonstrates that water will recede during the period May – October and allow cultivation of the band of arable marshland. The width of the band of arable marshland that can be cultivated will be smaller than an average year without the dam, but probably much the same as for a wet year without the dam.

Viewing in colour is essential for interpreting this map

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RUSUMO FALLS HYDROELECTRIC PROJECT
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Figure 6-9
Extent of permanently flooded area
8-10 km upstream from the dam

ARTELIA

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

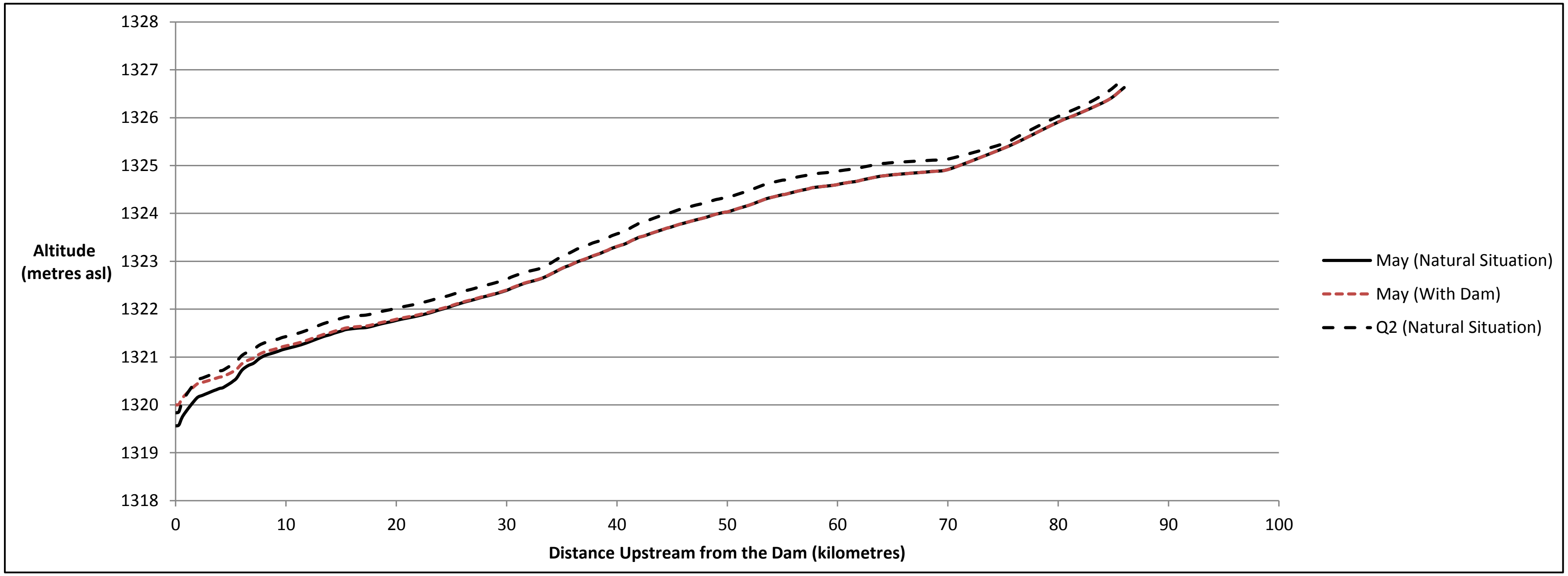



**Figure 6-10 Increase in Water Level in May for the Kagera River**

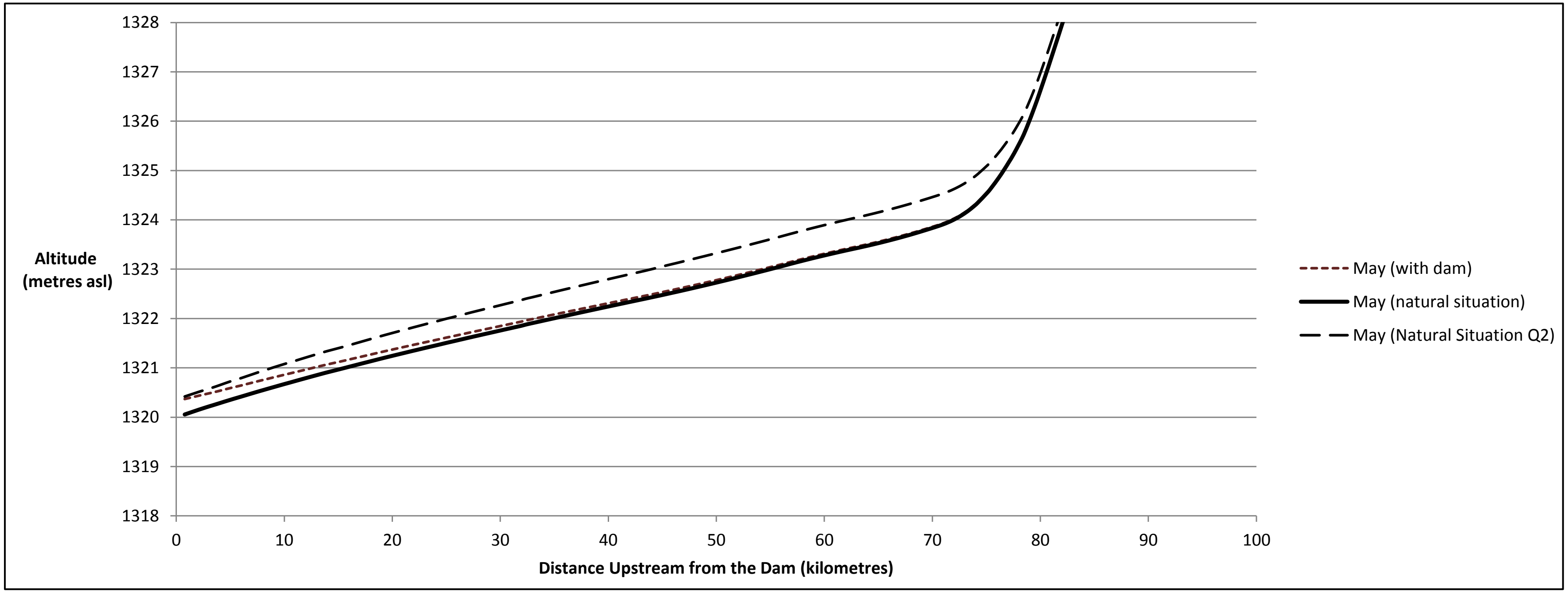



**Figure 6-11 Increase in Water Level in May for the Ruvubu River**

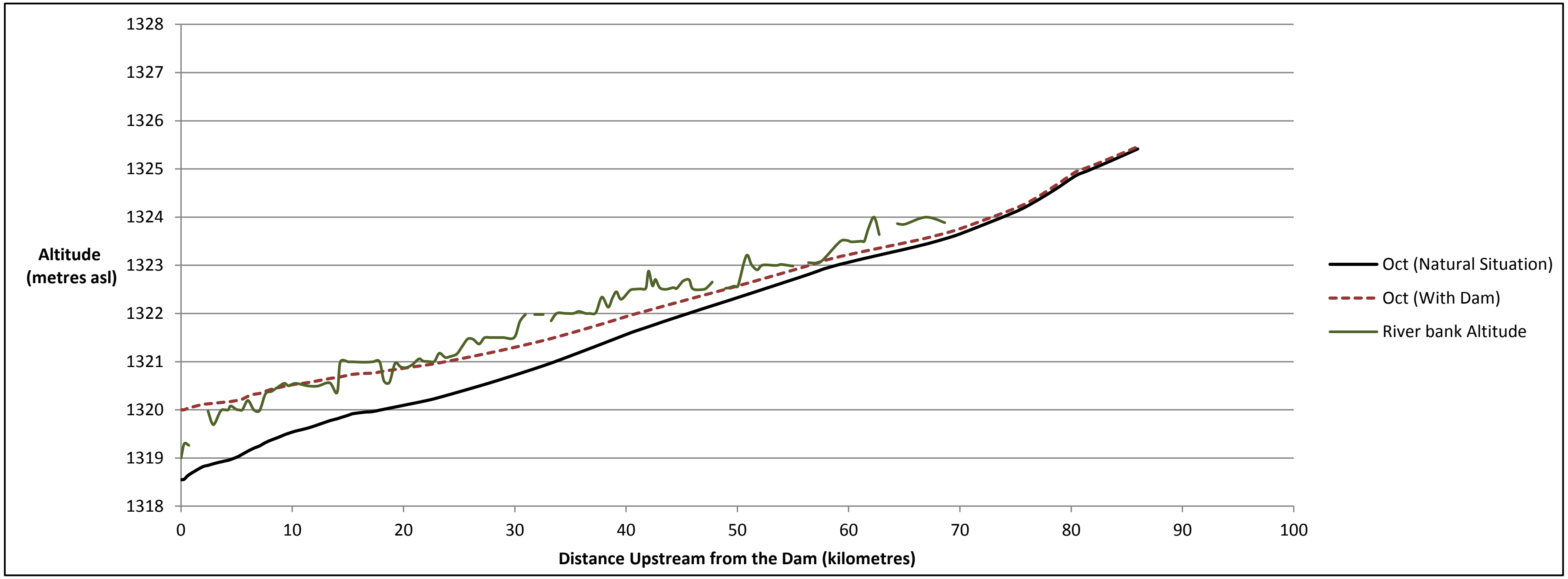



**Figure 6-12 Increase in Water Level in October for the Kagera River**

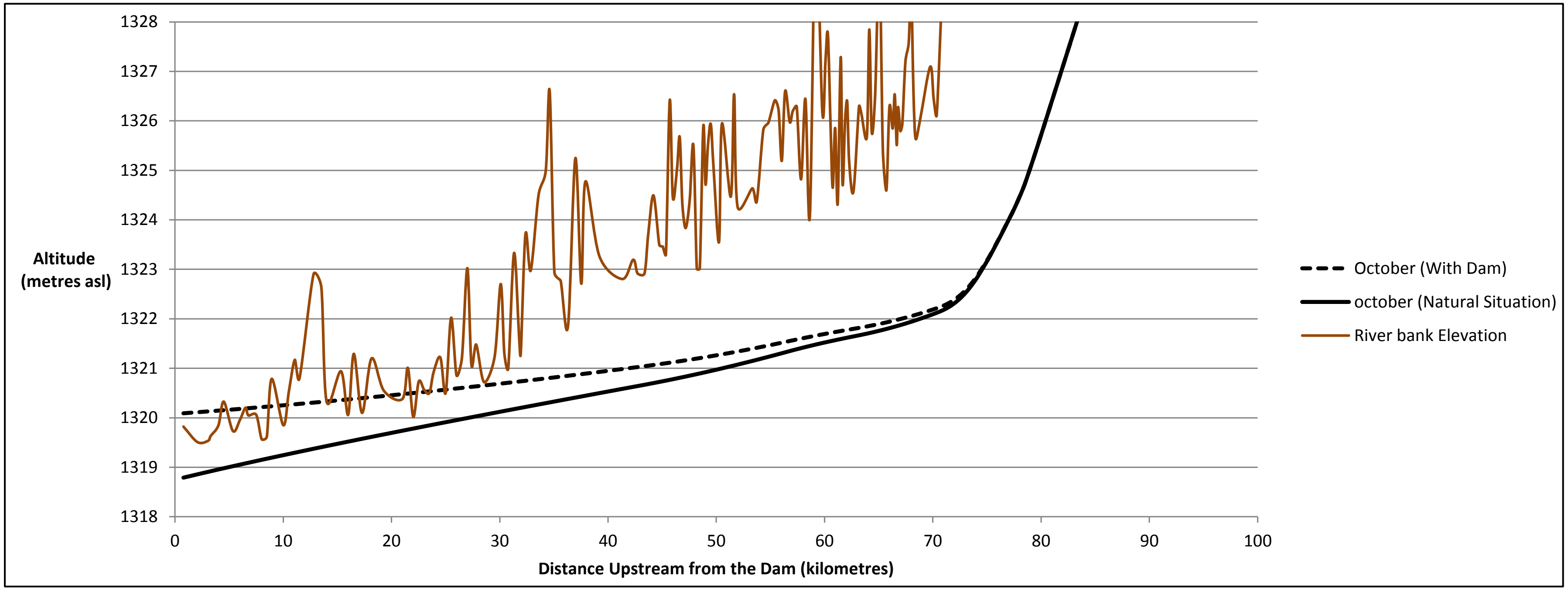



**Figure 6-13 Increase in Water Level in October for the Ruvubu River**

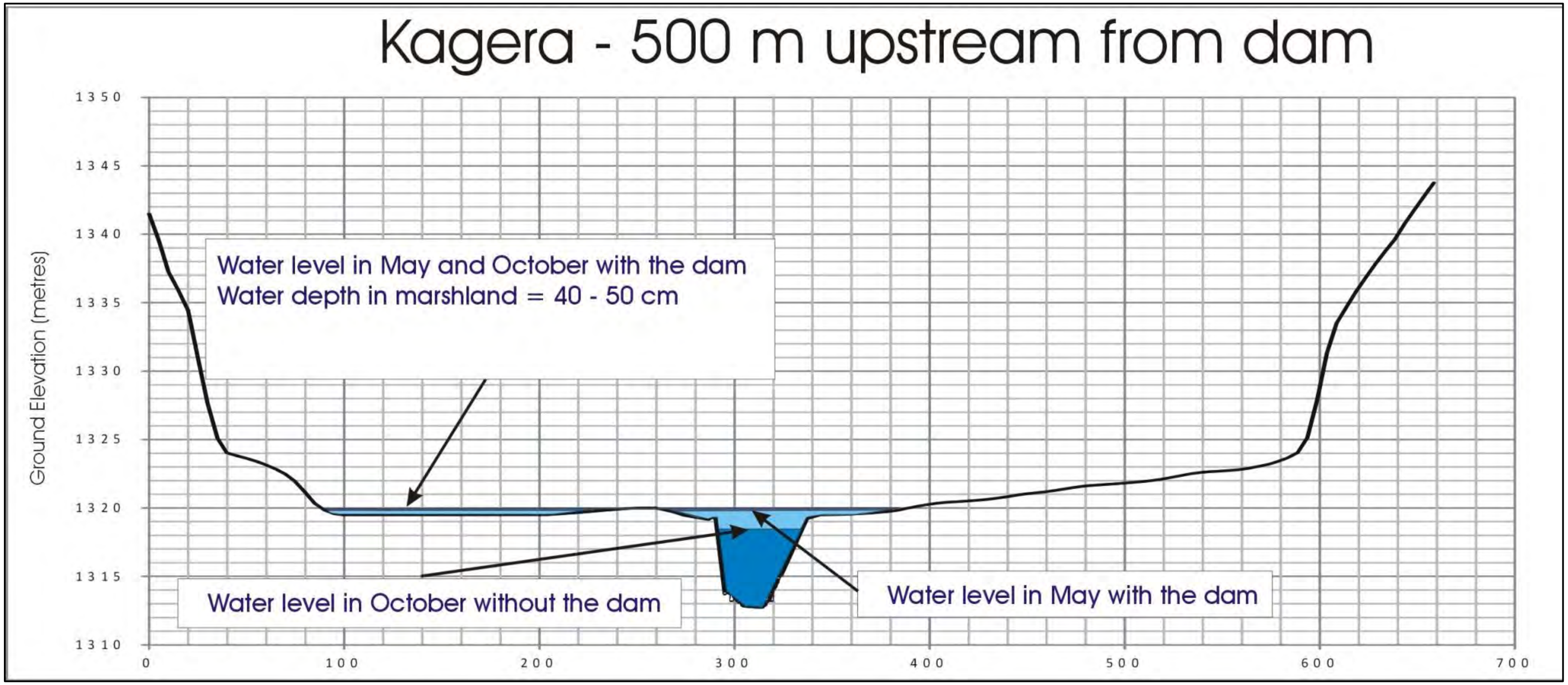



**Figure 6-14 Cross Section of Kagera River (0.5 km) Showing Water levels - With and Without Dam**

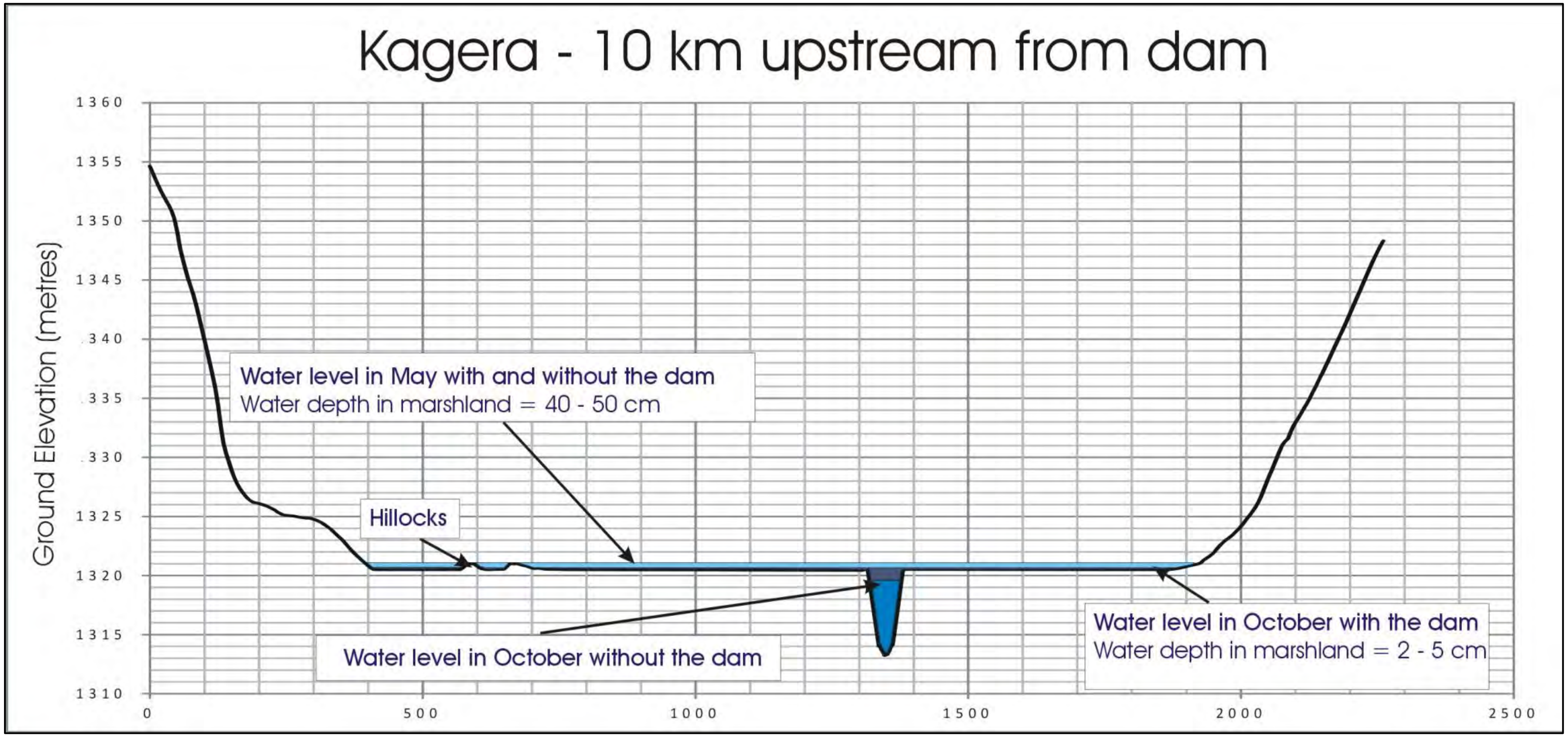



**Figure 6-15 Cross Section of the Kagera River (10 km) Showing Water Levels - With and Without Dam**

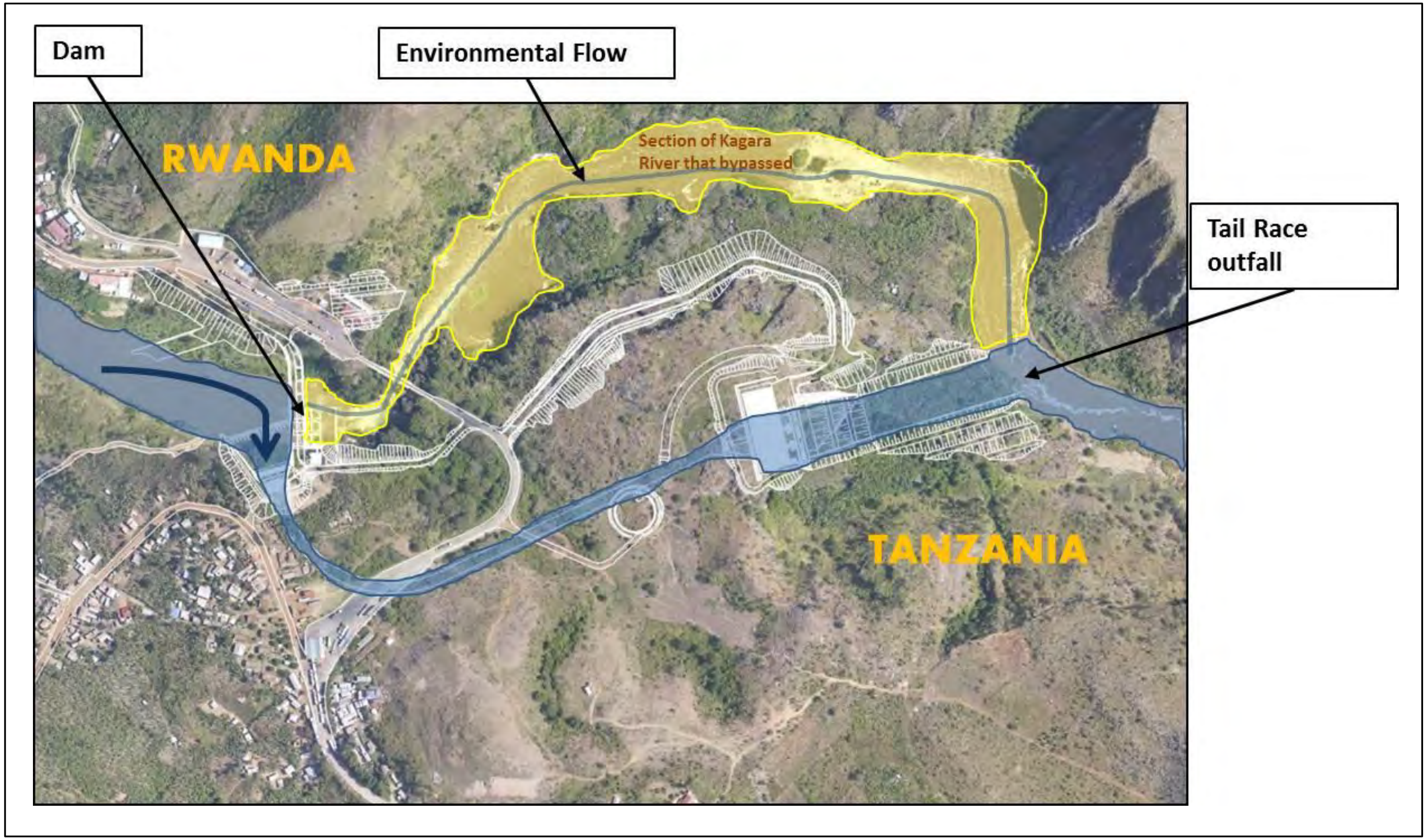



**Figure 6-16 Section of Kagera River Affected by Power Production**

### 6.3.2. Impacts on Land Use

***Impacts during Construction***

The construction of the dam associated project structures impacts terrestrial and riverine land use. The magnitude and importance of the potential impact on the land use depends on the overall surface area of the zones which will be disturbed by activities. The land use in the general areas of Rusumo East and Rusumo West (Rwanda) and Rusumo (Tanzania) comprises residential areas. In terms of control and mitigation measures, the principal factor that reduces the impact on land use is the minimisation of the overall footprint of the disturbed areas, which are optimised for economic reasons.

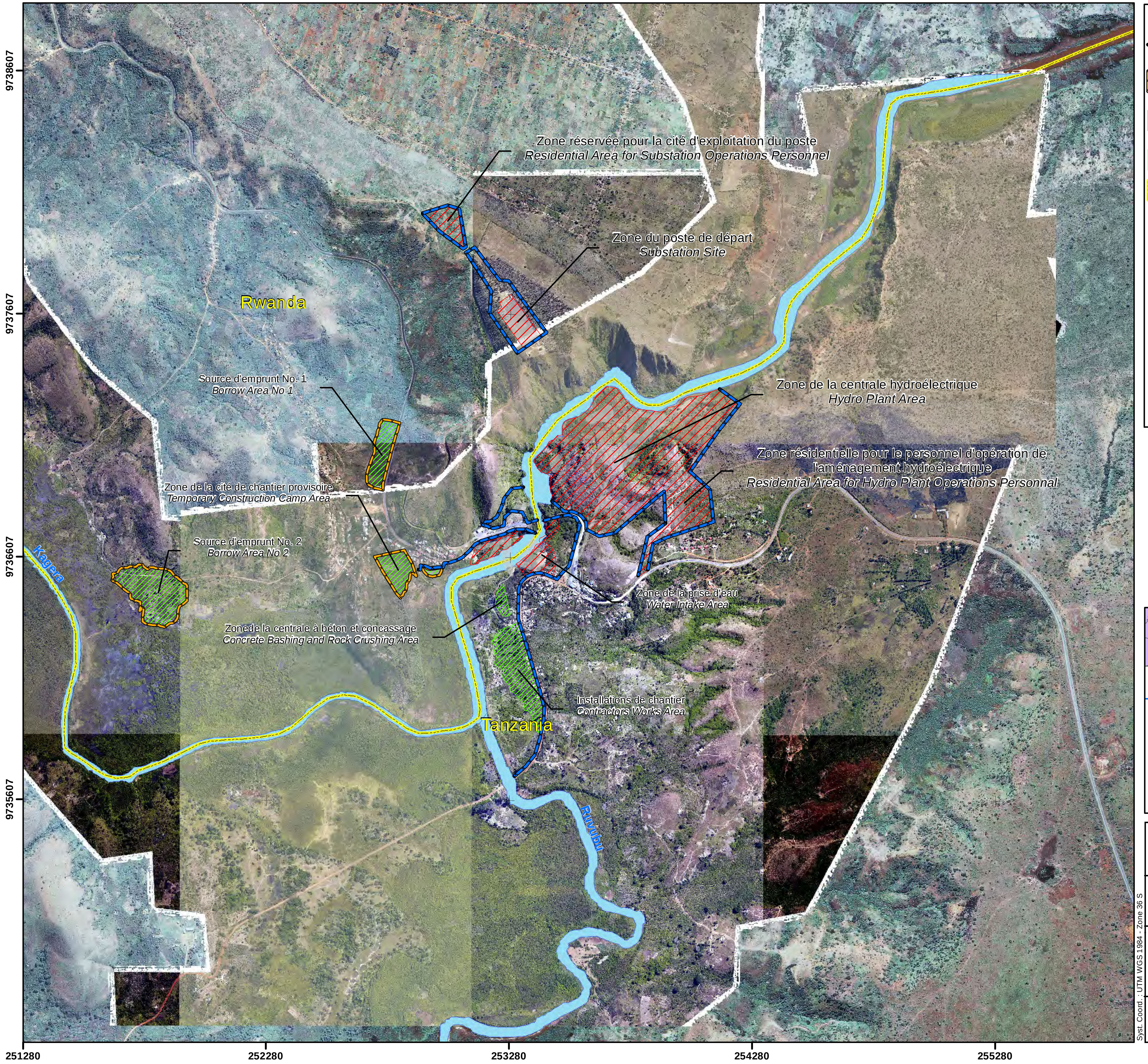
- The layout of the project structures has been designed to minimize environmental and social footprint;
- The temporary structures will be rehabilitated at the end of the construction phase (See Chapter 7).

The layout of the different project components is shown in Figure 6-17, and this illustrates the extent of impacts. Table 6-2 presents the surface areas of different types of land use that are changed.

**Table 6-2 Changes in Land Use from Dam Construction Activities**

| Description | Natural vegetation | Agricultural land | Residential areas | Total |
|---|---|---|---|---|
| Borrow Area No 1 | | 2.06 | | 2.06 |
| Borrow Area No 2 | | 4.89 | | 4.89 |
| Operation Base Camp sub-station | | 1.26 | | 1.26 |
| Sub-station Area | | 1.79 | | 1.79 |
| Construction Base camp (Rwanda) | | 1.02 | | 1.02 |
| Construction Area | 1.84 | 0.62 | 1.03 | 3.50 |
| Spoil Deposit Area | | 2.70 | | 2.70 |
| **TOTAL RWANDA** | **1.84** | **14.34** | **1.03** | **17.21** |
| Power plant Building | 21.51 | 6.69 | | 28.19 |
| Operation Base Camp (power and dam) | 2.73 | 1.71 | | 4.44 |
| Construction Workers Permanent Camp | | 1.84 | 0.05 | 1.89 |
| Construction Workers Temporary Camp | 0.22 | 3.72 | 0.42 | 4.36 |
| Water Intake | 2.51 | 1.79 | 0.41 | 4.70 |
| **TOTAL TANZANIA** | **26.97** | **15.75** | **0.88** | **43.58** |
| **TOTAL for the Project (ha)** | **28.81** | **30.09** | **1.91** | **60.80** |

The residual impact on land use is considered to be negative, minor to moderate and localised. The change in land use *per se* is not of significance, however the consequence of change in land use on flora, fauna and socioeconomics are of significance and these are discussed under separate headings (§6.4.1, §6.4.2 and §6.6).



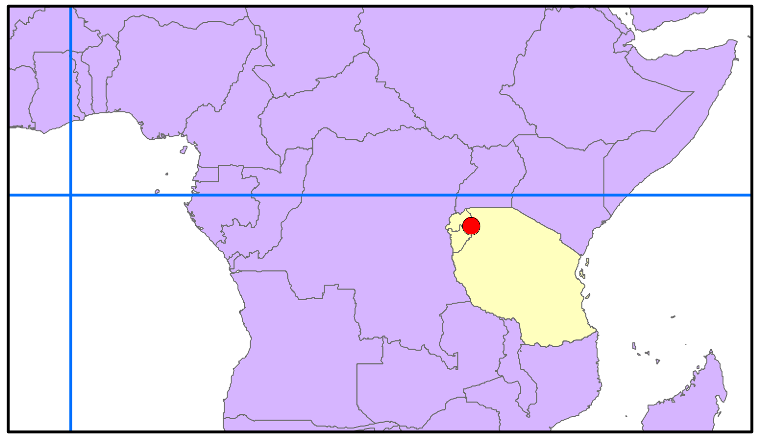

Clôture permanente / Permanent Fence

Clôture temporaire pour zone de construction / Temporary Construction Site Fence

Emprise permanente proposée pour les installations / Permanent Land Take Boundary

Emprise des activités de construction / Boundary of Land Take for Temporary Works

Pays / Country



150 75 0 150 300
Metres

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RUSUMO FALLS HYDROELECTRIC PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Figure 6-17
Construction zones

ARTELIA

source : SNC Lavalin International Inc, 2012

Nile Equatorial Lakes Subsidiary Action Program (NELSAP)

***Impacts from Operation***

The operation of the dam will create a change in water level and a change in the season variations in water level, this is discussed in detail in §6.3.1. The changes in water level and seasonal variations will result in some changes in land use.

a) *Area immediately upstream of the dam (Kagera and Ruvubu):*

The increased flooded area at the end of May and the reduced receding of the water will result in the following changes in land use:

- Areas of seasonally flooded papyrus marshland will become permanently flooded (discussed in §6.4.1);
- Areas of seasonally flooded arable marshland on the edge of the papyrus marshland will become permanently flooded marshland (discussed in §6.6.2);
- Areas of private intermediate land (used for perennial crops) will become seasonally flooded and some areas permanently flooded, (discussed in 6.6.2), and

In the area extending further upstream, only marshland will be affected by the changes in hydrology:

- The seasonally flooded marshland will remain as seasonally flooded, however the duration that the land is flooded will increase, and
- Isolated areas of seasonally flooded marshland will become permanently flooded and progressively become papyrus marshland.

The change in land use from operation *per se* is not of significance, however the consequence of change in land use on flora, fauna and socioeconomics are of significance and these are discussed under separate headings (§6.4.1, §6.4.2 and §6.6).

b) *Site of Rusumo Falls and stretch of river extending 500 metres downstream*

Because of the reduced water flow this zone will undergo change and the river land use will become that of a partially dry riverbed. The change in land use from operation *per se* is not of significance, however the consequence of change in land use on flora, fauna are of significance and these are discussed under separate headings (§6.4.1 and §6.4.2).

c) *Downstream sections of the river*

No change in land use downstream of the powerplant discharge is anticipated.

### 6.3.3. Impacts from Sediment

***Impacts during Construction***

Release of high sediment load in water may occur mainly during works on the diversion channel construction, excavation works at dam site, construction of protection dikes and coffer-dams, quarrying works, sand borrowing in river bed, creation of spoil areas too close to the river bank or with unstable slopes, etc. All these activities may create an increase in the sediment load discharged into the river. High sediment loads may reach the river during periods of rain, when the first heavy storms wash out unstable slopes of spoils or bare soils in the construction sites or camps, or along the access roads.

The means of minimising and controlling sediment during the construction are described in the ESMP (PAC-05: Erosion and sediment control).

It can be anticipated that even with the means of minimising and controlling sediment run-off there will be some increase in sediment load in the river downstream from the construction site. However, the sediment load of the river is naturally high and the increase will probably be negligible to minor.

***Impacts from Operation***

The waters of the Kagera River are naturally high in sediment load and this could increase with time due to the effects of deforestation and erosion in the catchment basins. The physical presence of the dam could be a physical barrier for sediment transported by the river water, and there is a risk that sediment will accumulate at the base of the dam and this in turn will reduced sediment load in the river waters downstream of the dam. The consequences of this could be modifications to downstream river morphology as a result of erosion and deposition.

The risk of sedimentation was not considered to be significant during the earlier project studies carried out by Norconsult (1975, 1976), Tractebel (1987, 1992) and Acres (2003). It was thought that water storage volume would not be affected over the lifetime of the Project. However, the Norwegian Water and Energy Directorate (NWED, 2006) pointed to the fact that much deforestation had occurred recently in the Kagera River Basin and that data from the 1970's may not be representative of the current situation.

In light of the NWED report, as part of the FDS/IDS feasibility study, sediment transport studies were carried out by SLII using the HEC-RAS sedimentation module. The simulation was for the FDS reservoir area with a water level set at 1,325 metres asl. The rate of sedimentation was studied by simulating a period of 100 years of daily operation and the conditions noted at the end of every 10-year interval. The results of the simulation revealed the following:

- Most of the Kagera River sediment load (nearly 99%) is deposited in and around Lake Rweru upstream;
- While a significant portion of the Ruvubu River load also settles upstream and all along the river channel, the greater part of the suspended solid (about 61%) is carried towards the dam site.

Due to the large proportion of the storage being in the dead storage zone, the live storage in the reservoir, even after 100 years, would be only partly affected by sediments. The HEC-RAS model predicted that the loss of live storage volume would be in the order of 17% and that sedimentation would not significantly affect the power generation capabilities over the life of the project.

It is planned to conduct further sediment transport studies to confirm that the findings of the FDS/IDS sediment study are still applicable for the RoR alternative. Modelling is to take into consideration recent sediment transport data which has become available. The detailed design of the water intake structures to optimise the transport of the sediment. (See Chapter 7: PAP-06: Sediment transport study and necessary design adaptations).

### 6.3.4. Impact on Water Quality

#### *Impacts during Construction*

The extent of the impact on water quality during the construction phase covers the river at the dam site and the river downstream from the dam.

The sources of potential impact on water quality are associated with inadequate worksite management and accidental pollution from the following:

*Pollution from HAZMAT*: During construction, large volumes of gasoline, lubricant products as well as significant quantities of explosives and chemicals (concrete additives, acids, paints, thinners, solvents) will be stored and handled on the construction sites, with related risk of leakage or accidental spill in the environment. This risk can be efficiently reduced by the implementation of preventive management procedures by the contractor: appropriate location of storage areas with a design complying with international good practices (bunded storage), collection and recycling of used oils, monitoring of all hazardous products with specific handling procedures and contingency plans. Another source of pollution is represented by the batching plants, and particularly by the effluent from concrete truck cleaning which consist of wastewater with high pH and contaminants from the concrete additives. In case of direct release into the river, there may be severe effects on the downstream population which relies on the river for domestic and cattle water supply, washing and irrigation.

*Pollution from Domestic Waste*: The Operator's Village and other temporary worker camps will probably accommodate a few thousands of workers. Without appropriate sanitation system and wastewater treatment, the release of pathogens and coliforms in the river may the population downstream. Domestic waste will be produced by the worker camps and, based on the observation of previous construction sites in similar conditions, the anticipated production can be estimated on 0.5 kg/capita/day, or about 1 ton/day for 2000 workers

*Pollution from Solid Waste*: Large quantities of solid waste, either from domestic or construction origin, will be generated during the construction stage. Most of these waste, if not appropriately managed, may result in soil and water pollution, with possible detrimental impacts on the environment and on public health. Construction waste including mainly scrap metal, wood, plastic, cement bags, used tires and batteries will also be produced and will require management. Decommissioning of construction sites at the end of the Project construction will also generate significant quantities of solid waste.

In terms of potential impacts, the impact on water quality is potentially major and of high significance.

The control and mitigation measures are described in different Construction Action Plans (see Chapter and 6.9). Key points are described as follows:

*Prevention of Pollution from Chemicals*: Dedicated bunded storages with a retention capacity of at least 110% of the largest container stored will be required from the Contractors for all chemicals and chemical waste including fuel, engine oil and hydraulic fluids. Monitoring and recording of the quantities of used oils and used hydraulic fluids will also be required. These wastes will constitute most of the hazardous waste produced on site. Recycling option identification and study will be required from the Contractors. Options may include for example the use as substitution fuel or the production of low grade diesel. Contractors will also be required to prepare and implement a Spill Response Plan including management of storage sites and equipment related to spill control. Storage of HazMat will be located at more than 100 m from the river.

*Prevention of Pollution from Worker Camps*: Worker camps will be equipped with a sanitation system in order to collect and treat all grey and black waters produced by the camps before discharge into the environment. Construction sites will be equipped with a sufficient number of toilets in order to control pollution discharge into the river streams. More information regarding the requirements is developed into the ESMP. Regular controls of faecal Coliforms will be carried out during construction in order to ensure treatment efficiency of the wastewater before discharge.

*Prevention of Pollution from Solid Waste*: A Solid Waste Management Plan will be required from the main contracting companies to present their action plan regarding solid waste management. This plan should cover 1) the management of domestic waste from the camps, 2) the management of non-dangerous construction waste and 3) the management of hazardous solid waste. Details about obligations of Contractors regarding solid waste are provided in the ESMP.

In terms of residual impacts, with the effective implementation of the control and mitigation measures, the impact on water quality should be negligible to minor. However, the impact is considered as significant but acceptable if the discharges are in compliance with country and World Bank discharge standards.

***Impacts from Operation***

Because the Project does not create a reservoir, the usual water quality issues associated with hydropower projects do not apply the Rusumo Falls RoR Scheme. The issue of reduced sediment load is discussed in §6.3.4.

### 6.3.5. Impact from Noise and Vibration

***Impacts during Construction***

The construction activities will generate noise and will involve the use of rock blasting explosives. Noise coming from the site during the construction will be perceptible by the residents of Rusumo and Rusumo East villages.

The frequency of heavy truck movements will increase in villages located along the roads leading to Rusumo. The ambient noise levels will be increased for a short period of time (a few seconds during each passage of a vehicle) and at a relatively low frequency.

Given that many heavy trucks already use the road and cross the Rwanda-Tanzania border on the Rusumo Bridge, traffic will not significantly increase the level of noise on the roads and the effect on villages located along the road will be small.

Even if the expected impact should be very low, the social and environmental management plan proposes various plans to limit as much as possible the possible impacts on noise and vibration.

The first is a general management plan that addresses the Grievance Management. This plan will propose how any unexpected complaints regarding noise or vibration will be managed during the construction period.

The second comprises different Construction Action Plans - (see Chapter and §6.9).

In terms of residual impacts, with the effective implementation of the control and mitigation measures, the impact of noise and vibration are expected to be minor to moderate but localised and short term. However, the impacts are considered as significant but acceptable if minimised if minimised as far as practicable.

***Impacts from Operation***

During the operation phase the following are expected to be sources of noise:

- Turbines and powerplant;
- Maintenance activities;
- Warning sirens and klaxons;
- Operation of cranes and diverse motors, and
- Manoeuvring of gates for the control of water flow.

The tender documents for the construction will require that the facilities be designed to comply with noise emission requirements and noise limit values of Rwanda, Tanzania and the World Bank.

In terms of residual impacts, there will probably a discernible increase in background noise levels compared to the baseline situation by the residents of Rusumo and Rusumo East villages. This impact will be negligible and not significant – no control measures are proposed.

### 6.3.6. Impacts on Air Quality

***Impacts during Construction***

Most air pollution will be created during the construction phase and will originate from the fugitive dust resulting from traffic on the road and the earthworks and from the release of exhaust fumes from trucks and heavy equipment engines. Most of these dust emission are easily controllable and the impacts will be temporary. However, there are community health issues related to these emissions, because of the proximity of local residential areas. Fugitive emissions will also originate from the cement manufacture batch plant. Emission sources are expected to include the following:

- Aggregate and sand transfer;
- Cement unloading to elevated storage silo (pneumatic);
- Cement supplement unloading to elevated storage silo (pneumatic);
- Weigh hopper loading;
- Mixer loading (central mix).

Mitigation measures and monitoring for air quality issues are detailed in the different Construction Action Plans (see Chapter and 6.9). Key points are described below.

The air emission controls listed below will be implemented at the batch plant to minimize emissions of fugitive dust and reduce ambient PM10 levels.

- Sand and aggregates to be stored in hoppers or bunkers which shield the materials from wind and rain;
- Enclosed aggregate/sand conveyors at the batch plant;
- Use of curtains for the transfer point between loader and conveyor;
- Use of cement bulkers with tight blower systems to transfer the cementitious materials from the truck to the elevated silos;
- Central dust collector.

In terms of residual impacts, there will probably a discernible localised change in background air quality levels compared to the baseline situation in the vicinity of Rusumo and Rusumo East villages. This impact will be negative, direct, and of minor to moderate magnitude. The impact is considered to significant but acceptable if air and dust emissions are minimised as far as practicable.

***Impacts from Operation***

Dust and air emissions are expected to be negligible during dam operation. Impacts are not expected significant and no control and mitigation measures are recommended.

### 6.3.7. Impacts on Climate

***Impacts during Construction***

One of the issues often associated with hydropower projects are the Greenhouse Gas (GHG) emissions. The GHG emissions contribute to global warming and are generated by the flooding of the reservoir inundated area and the consequent anaerobic decomposition of the flooded vegetation. GHG emissions also result from combustion of hydrocarbon fuel by diverse vehicles and equipment. Because the RoR scheme does not create a reservoir and increased seasonal flooding of land is minimal, quantifiable reservoir GHG emissions are not expected. In terms of residual impacts, the impacts on climate are expected to be negligible. However, the Project will contribute to national GHG emissions, and although the impact is not significant, the control and mitigations are recommended as a best practice measure.

***Impacts from Operation***

In an indirect manner, the project should contribute to overall reduction of GHG emissions on a regional scale. The project should contribute to rural electrification which will reduce the need for households to burn hydrocarbons (diesel, wood and charcoal) thus reducing GHG emissions. In terms of microclimate, because the Project does not create a new body of water, no noticeable effect on local microclimate is expected. The residual impact will therefore be positive and minor to moderate. The impact is significant.

### 6.3.8. Visual Impact

The main impact on the landscape will be related to the hydropower plant infrastructures (dam, power house, power line, power station) and the reduction of the river flow in the Rusumo waterfalls. The impact will be negative, permanent and major on a local scale.

### 6.3.9. Impact from and on Seismic Activity

There is often concern that dam projects may increase the risk of seismic activity. The creation of a large water storage reservoir can increase the risk of induced seismic activity caused by increased tectonic stresses. The adoption of the Run-of-River alternative minimises this risk because there is not the creation of a large water storage reservoir. For the Rusumo Falls Project the creation of a relatively small permanently flooded area of marshland is not anticipated to create a noticeable effect on seismic activity. This impact is not considered significant.

### 6.3.10. Impacts from Extraction of Local Materials and Spoil Areas

The dam construction will require the use of local materials which will be taken from two borrow areas and a quarry (see § 3.5). The technical studies (at the stage they have reached at the time of preparation of the present ESIA) show that there could be a surplus of materials resulting from removal of surface soils and excavation, which will have to be stored in a manner that is most respectful of the environment and the least penalising in terms of land use (see §3.6 and Figure 3-9).

The impacts arising from the extraction works are managed through the Plan for Management of Borrow Areas and Spoils (see §7.5.2 PAC-02). The programme for the management of borrow areas and spoils will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (see §7.5.1 PAP-03). The contractor responsible for the civil works will therefore be asked to produce a plan for managing these materials which respects the objectives set out in the Tender Documents. In particular the spoils deposit locations proposed by the Contractor will be reviewed jointly by the Owner's Engineer and the PIU prior to non-objection.

Once the position of borrow and spoil areas have been finalised there will be a need to identify and compensate the land owner in accordance with the compensation rates defined in the RAP. It is also to be noted that the borrow area N°1 proposed in the feasibility study overlaps with the Rusumo One Stop Border Post and an alternative borrow area will need to be located.

# 6.4. IMPACT ON BIOLOGICAL ENVIRONMENT

## 6.4.1. Impacts on Natural Habitats and Flora

*Impacts from Terrestrial Pre-Construction and Construction works*

The terrestrial pre-construction and construction works that could affect terrestrial flora are presented in impact on land used (§6.3.2).

The natural terrestrial vegetation (excluding riverine habitat) around the villages of Rusumo East and Rusumo West (Rwanda) and Rusumo (Tanzania) comprises essentially tree and shrub savannah. The habitat has not been identified as being of particular environmentally importance. There is a potential negative impact on the terrestrial vegetation, though the magnitude depends on the overall surface area of the zones which will be disturbed by activities.

The principal factor that reduces the impact is the minimisation of the overall footprint of the disturbed areas, which has been optimised for economic reasons. The layout has been designed taking into geotechnical constraints and has minimised encroaching on residential areas. The control and mitigation measures are described in different Construction Action Plans (see Chapter and 6.9).

The total surface area of construction areas and will be 61 ha, comprising 17 ha in Rwanda and 43 ha in Tanzania. The magnitude of the impact is expect to be minor to moderate depending on the extent of vegetation clearing required.

However, the significance is considered to be low and on a local scale because of the low environmental sensitivity of the natural terrestrial habitat.

The areas of natural vegetation that are within the construction work areas presented in the following Table.

**Table 6-3 Natural Habitat with the Zones of Terrestrial Construction Works**

| Description | Tree savannah | Shrub savannah | Marshland | Total |
|---|---|---|---|---|
| Construction Area | 1.68 | | 0.16 | **1.84** |
| **TOTAL RWANDA** | **1.68** | | **0.16** | **1.84** |
| Power plant Building | | 21.51 | | 21.51 |
| Operation Base Camp (power and dam) | | 2.73 | | 2.73 |
| Construction Workers Temporary Camp | | | 0.22 | 0.22 |
| Water Intake | 0.77 | 0.52 | 1.22 | 2.51 |
| **TOTAL TANZANIA** | **0.77** | **24.76** | **1.44** | **26.97** |
| **TOTAL for the Project (ha)** | **2.45** | **24.76** | **1.60** | **28.81** |

***Impacts from Riverine Pre-Construction and Construction***

a) *Impact on riverine and aquatic habitat at the dam construction work sites*

The riverine and aquatic vegetation which populate areas where project structures will be constructed comprises mainly papyrus reeds and the area of open water is populated by invasive species, in particular, water lilies and water hyacinths. The habitat has not been identified of being of particular environmental interest and there are no flora species of conservation concern.

The construction activities that will affect the riverine and aquatic habitat comprise construction of: (i) the coffer dam; (ii) the inlet to the temporary deviation channel; (iii) the inlet to the headrace, (iv) the main dam structure, and (v) the tail race outlet. The civil works will require the clearing of the vegetation in the immediate zone of the works.

It is estimated that the area affected will be about 4 to 5 ha. of which about 90% is papyrus marshland.

The magnitude of the impact is considered to be negative and minor because of the very small area impacted compared to the surrounding areas of similar vegetation. The impact is not considered significant because of the low environmental sensitivity of the habitat. No particular mitigation or monitoring measures are recommended.

b) *Impact on habitat at the Rusumo Falls spray zone*

The vegetation present in the spray zone close to the Falls is characteristic of seasonally inundated forest habitat. The tree community includes: *Markhamia lutea, Ficus lutea, F.valis choudae, Allophylus africanus, Salacia erecta, Pancovia golungensis, Dracaena fragrans* and *Phoenix reclinata*. The herbaceous vegetation along the river banks is dominated by the Tristicha trifaria (*Podostemonacea*). Other vegetation forms include lichens (*Philonotis sp.*) as well as several species of algae. Two CITES protected species, the *Impatiens irvingii* and *Eulophia guineensis (an orchid)* have been observed.

During the construction works, the river will be deviated and by-pass the Rusumo Falls. The habitat and vegetation of the spray zone will therefore be deprived of the humidity and mist created by the Falls for the duration of the construction works (4 to 5 years). The habitat will probably gradually degrade and other species more adapted to the reduced humidity and probably similar to those prevalent in the vicinity will develop and gradually replace those plants which are characteristic of the spray zone habitat.

The potential impact is considered as negative and major and will affect an area of about 1 ha. However, field survey has established that there are no flora species of conservation concern, other than the orchids, which are not in the immediate spray zone, are quite common in Eastern Rwanda, and are not spray zone dependent. Nevertheless the potential impact is considered to be significant.

In terms of control and mitigation measures there will be an environmental flow of 10% of average river flow rate and this flow over the Falls creating a somewhat reduced spray effect (see Appendix F for the rationale in selecting this flow rate) It is also recommended to carryout further studies to establish if a lower environmental flow rate can be adopted.

The residual impact on the flora of the spray zone is considered as moderate but of low local significance.

c) *Impact on riverine and aquatic habitat along the stretch of river extending 100 m downstream from the falls*

The riverine vegetation along the banks of the 100 metres stretch of bypassed river will also be affected by the deviation of the River. The riverine vegetation along the banks of the River will probably degrade and be replaced by other plant species more adapted to the dryer environment and which are already predominant in the vicinity. The aquatic habitat along this 100 metre stretch of river will be affected. Vegetation will be reduced and replaced by terrestrial vegetation. The main aquatic vegetation comprises reed beds of *Echinochloa pyramidalis* and the aquatic plants *Leersia hexandra* and *Panicum coloratum*. The river is between 20 and 50 metres wide and the affected stretch about 100 metres long. The impacted area will therefore be in the order of 0.5 ha.

In terms of control and mitigation measures, the creation of an environmental flow (10% of the average river flow – see Appendix F) will reduce to some extent the impact on the flora, this reduction will be minor but will prevent the loss of all of the riverine and aquatic habitat. The residual impact will therefore be of moderate to major magnitude, affecting an area of about 0.5 ha and affecting flora which is not identified of being of particular environmental importance. The significance of the impact is therefore considered as low.

d) *Impact on riverine and aquatic habitat along the Kagera River further downstream from the falls*

No impact on the natural habitat downstream from the Dam (excluding the immediate downstream stretch discussed above) is expected to be affected by the construction. The risk of changes in water quality due to accidental pollution is expected to be minimised by implementation of environmental management procedures. Domestic wastewater should be treated prior to discharge and the risk of increased sediment load from rain run-off is thought to be negligible compared to the natural sediment load of the river.

### *Impacts on Natural Habitats from Operation*

e) *Impact on habitat upstream from the dam*

This area discussed in this paragraph extends from the future dam up the Kagera valley for a distance of about 15 kilometres. This area is populated by papyrus (*Cyperus papyrus*). Under natural conditions the marshland becomes flooded during the period October to May and during the period May to October, the water level recedes to the main riverbed. The presence of the dam will create an area of permanently flooded marshland of shallow depth, ranging from 40 – 50 cm near the dam, to 2 – 5 cm 15 kilometres upstream. See §6.2.1.

*Cyperus papyrus,* even if accustomed to an aquatic environment and variation in water level, specific conditions allow it to evolve well. Optimum conditions for the papyrus growth are a substratum which is easily penetrable, continuous flooding of the root system, an intense light and a humid soil with plentiful and rich nutrients (Serag, 2003). The plant's roots can reach about 1 m deep; it is particularly resilient to water level variation (Boar, 2006).

The new hydrological conditions with a reduced water level variation will probably have a positive minor impact on the papyrus.

f) *Impact on habitat of the Rusumo Falls spray zone*

The impact on the spray zone during the operation phase will be a continuation of the impact resulting from the construction – discussed above.

g) *Impact on the riverine and aquatic habitat of the stretch of river extending 600 km downstream from the falls*

The deviation of the river to the powerplant will result in the stretch of river extending from the falls to the outlet of the tail race receiving a significantly reduced flow. The impact will be a continuation of the impact resulting during the construction phase (see above) however the area impacted will be extended to encompass a 500 metre stretch of river. The type of impact however, will be as for construction discussed above. The impacted area will therefore be in the order of 3 ha.

h) *Impact on the habitat of the Kagera River further downstream from the falls*

No impact on the natural habitat downstream from the dam (excluding the immediate downstream stretch discussed above) is expected to be affected during operation of the facility. There will be less risk of changes in water quality due to accidental pollution and the quantities of discharged treated domestic wastewater will be significantly less than that during construction.

There is a risk however that there will be a change in sediment load, the physical presence" of the dam could trap sediment upstream of the dam and consequently reduced sediment load of the waters downstream. The consequences of the change in sediment load could result in changes in river morphology due to erosion and deposition, and consequently affect riparian and aquatic vegetation. During the detailed design of the facilities a specific study to address sediment transport will be carried out to determine the changes that could occur and to define control measures that can be integrated into the dam design to minimise the risk.

### 6.4.2. Impacts on Fauna

***Impacts from Terrestrial Pre-Construction and Construction Works***

The impact on fauna is linked to the impact on habitat described in §6.4.1. The terrestrial habitat in the area where the terrestrial construction activities will be carried out covers an overall area of 29 ha. The area has a strong anthropogenic presence and the impact on fauna in this area not considered to be an issue, the vegetation is not habitat for species of conservation concern.

The construction contractor will be required to implement a site flora and fauna protection plan (See ESMP, Chapter 7, PAC-06).

In terms of residual impact, the presence of construction workforce and equipment combined with noise and vibration will cause the birds and small mammals to flee the immediate area. There are large areas of similar habitats in the vicinity and impact on birds and mammals is not expected to be discernible. The residual impact on fauna is considered to be minor and of local significance.

***Impacts from Riverine Pre-Construction and Construction Works***

a) *Impacts on fauna at the construction work sites upstream of the Falls*

The upstream areas close to the villages of Rusumo (Tanzania) and Rusumo West (Rwanda) where the project structures are to be constructed is habitat for zooplankton, benthic communities, fish, reptiles and mammals.

The construction contractor will be required to implement a site flora and fauna protection plan (See ESMP, Chapter 7, PAC-06).

In terms of residual impacts, benthic communities at the work sites will be smothered by the earth works and rock dumping, and from the increased sediment in the waters; zooplankton in the immediate vicinity could be affected by the changes in water quality, possible changes in pH, increase in sediment load, and changes in water quality associated with discharge of treated domestic wastewater and any accidental spills or leaks of hazardous materials. Fish and reptiles and aquatic mammals that are present in vicinity of the construction works will probably flee the immediate area. There are large areas of similar undisturbed habitat further upstream. The impact is thought to be of minor magnitude.

b) *Impacts on fauna at the Rusumo Falls and stretch of river immediately downstream*

The fauna at the site of the Falls and stretch of river downstream are affected by the deviation of the river which affects hydrology and habitat and consequently fauna. And at the site of the tailrace outfall the civil works represent a physical disturbance.

The species of terrestrial and avian fauna that have been observed at the Rusumo Falls spray zone include the African fish eagle, the long crested eagle, the common black kite, the pin-tailed whydah, the grey heron, the speckled mouse-bird, as well as mammal species such as the Blue and grivet monkeys. However; none of these species are specific to this zone. The degrading of the habitat could result in reduced population numbers of these species at the site. The species will move away from the site to seek alternative neighbouring habitats.

In terms of aquatic fauna, the bypassing of the Rusumo Falls and stretch of river downstream will affect ichthyofauna that are present in this area, the turbulent waters are a suitable habitat for spawning and juvenile fish.

The flow reduction will reduce the fish habitat in this section of river. However, the tailrace channel will create a new fish habitat, which although less interesting than the bypassed rapids will support a substantial fish population. Furthermore, most of the fish species identified in the area will be able to benefit from the new habitat to compensate for the reduction of the habitats downstream of the water fall. The environmental flow will be maintained at 10% the average flow and the feasibility of constructing a weir at a suitable location in the bypassed section of river will be studies during the detailed design so that the water level in the river bed can be maintained and at the same time create a small but additional zone of turbulent water.

Among the amphibians and reptile species known to be in this area, the Nile Crocodile, and the African Rock Python (two valued species), use the riparian vegetation as their favourite habitat to build nest and hatch eggs in the sandy bank of the river. The reduced flow in the river along this stretch could affect these populations, because if reduced food supply. The population could move further downstream to the outlet of the tail race. The baseline surveys and interviews with local people have established that a priori there are no hippopotamus in the immediate downstream stretch of river from the falls.

The residual impact is expected to be major, but of local significance.

c) *Kagera River further downstream from the falls*

No impact on the natural habitat downstream from the dam (excluding the immediate downstream stretch discussed above) is expected during construction and consequently no discernible impact on terrestrial or avian flora is expected.

***Impacts from Operation***

*Impact on fauna in the marshland upstream from the dam*

Aquatic fauna in this area comprises: zooplankton, benthic communities, fish, reptiles, mammals, and birds.

*Zooplankton and benthic communities:* No physical and chemical changes in water quality are expected due to the project and consequently no effect on zooplankton and benthic communities are expected.

*Fish*: Because no physical and chemical changes in water quality are expected, no negative effects on fish are anticipated. Though the risk of sedimentation increase near the dam may affect lotic species and create conditions more favourable for lentic species. Most fish species present in the upstream waters need the river for reproduction, the riparian marsh for shelter, nutrition and juvenile growth and the river water for food and maturation. Thus, the reduced season variations of water level and increased area of permanently flooded marshland should increase the availability of nutritional matters and have an overall positive impact on the fish biomass.

*Herpetofauna*: No discernible impact is anticipated with respect to reptiles and amphibians. The change in seasonal variations in water level will probably result in amphibians and reptile species adapt their nesting sites to the new hydraulic conditions. The increase in fish biomass should have a positive impact on the availability of food for the species that feed mainly on fish.

*Birdlife*: The rare and endangered bird communities that are present in the marshland are Carruthers's Cisticola (*Cisticola carruthersi*), White-winged Swamp Warbler (*Bradypterus carpalis*), the near threatened Papyrus Gonolek (*Laniarius mufumbiri*) and the vulnerable Papyrus Yellow Warbler (*Chloropeta gracilirostris*). Shoebill (*Balaeniceps rex*) is also of concern as it is dependent on the ecology of the marshes and it is sensitive to marshes degradation and loss. However, the creation of a permanently flooded marshland area is not expected to create any loss of the papyrus habitat because the increase in water depth will be slight. The increase in area of lotic conditions could be beneficial to some aquatic bird species from Gruiformes, Ciconiiformes, Anseriformes as new feeding grounds. The near threatened African Skimmer (*Rynchopsflavirostris*) can in this sense benefit from the new conditions. Also, given the limited extent of the change in marshland habitat any impact on birds could be limited by the fact that these species will be able to move to other surrounding high quality habitats.

*Hippopotamus*: The project should not affect the hippo families mainly because the change in hydrology will not noticeably reduce or alter their habitat, but could have a positive impact because of increased area of the creation of an area of permanently flooded marshland which is a suitable habitat for hippo, though this may not be discernible.

*Other mammals*: The impacts will be mainly limited to species related to aquatic ecosystem and marsh habitat such as: African Clawless Otter (*Aonyx capensis*), Marsh Mongoose (*Atilax paludinosus*) and the Egyptian Mongoose (*Herpestes ichneuman*). The reduced seasonal variation in water depth and creation of a permanently flooded area may create an impact on these animals. But due to their mobility, they will adapt to the new environment.

*Kagera River further downstream from the falls*

No impact on the natural habitat downstream from the dam (excluding the immediate downstream stretch discussed above) is expected during operation and consequently no discernible impact on terrestrial or avian flora is expected.

## 6.5. IMPACT FROM WASTE

The construction works and the presence of workers during the construction and operation periods will generate wastewaters and residual materials including some hazardous wastes (e.g. used oil, solvents, waste batteries, etc.). These residual materials and hazardous wastes pose risks to human and animal health (wildlife, domestic and farm animals) through the contamination of the soils and surface waters and groundwater. A visual pollution may also be indicated by the presence of waste in the environment.

A management plan for hazardous waste and wastewaters should be developed and implemented as soon the construction works start. This plan will be maintained when the project moves into its operation period and should include a series of measures to protect the populations and the environment such as beams, controlled and isolated areas avoiding mismanagement of residual materials, hazardous waste and wastewaters. This component has a low value and disturbance level. Considering its site specific extent and long-term duration, this environmental impact is considered low.

## 6.6. POSITIVE SOCIOECONOMIC IMPACTS

### 6.6.1. Direct Employment Opportunities

It is estimated that the Project will create up to about 1,000 temporary jobs during the construction period for the civil works, which will be divided according to the following professions: managers and executives, engineers, technicians and support and administrative staff, administrative, carpenters, structural steel fitters, cement workers, labourers, crane workers, welders, electricians, mechanics and others. Among these positions, 10% will be occupied by foreigners and 90% by nationals. According to the timetable planned, the construction should take 4 to 5 years but most of the workload will take place during the second and the third year. For the mechanical and electrical work, the ratio is up to 25-30% foreign labour (supervisors or highly skilled labour) and 70-75% national labour (foremen, electricians, mechanicals, welders, helpers, etc.).

In terms of potential impact, the direct employment opportunities will have a major local impact. However, to ensure that the benefit to local people and business is optimised, the following enhancement measures will be taken:

- The Project owner will prepare a recruitment policy and procedure which is aimed at maximizing the recruitment of local people and at the same time managing the recruitment process so as to minimize potential negative impacts such as influx of people and spontaneous settlements (see §6.7.4);
- The recruitment policy and procedures will be included in the tender documents for the Construction Contractor(s) (Contractor's Environmental and Social Specification), which translates the policy and procedure into contractual requirements. The Construction Contractor will prepare a recruitment plan which will be validated by the Project Owner prior to the start of the works;
- The Project Owner's Engineer, contracted for the supervision of the construction works will be charged with monitoring the recruitment to make sure of compliance with the plan.

The residual impact will be major positive local impact and the effects will also be noticeable on the Province scale. The impact is of high local significance.

### 6.6.2. Induced and Indirect Employment

The presence of a workforce of 1,000 people at the Rusumo site will create induced and indirect employment. There will be a need for multiple diverse services to support the workforce. Services can be expected to include the catering, cleaning, guards, transport, repair work, provision of goods, and the like.

The provision of services will be provided by existing local companies, or by new local companies, or by companies from outside the area who send representatives and workers to Rusumo site to take advantage of the situation. It is estimated by expert judgment that induced employment will create in the order of 100 to 200 temporary jobs.

The indirect employment is related to work which will be given to people to provide diverse services or goods to services companies and people benefiting from induced employment. It is estimated by expert judgment that indirect employment will create temporary and occasional work for in the order of 600 people.

The impact on employment on a local scale will be major. However, as for direct employment, there is a need to ensure that benefit to local people and businesses are optimised, the following enhancement measures will be taken:

- The tender documents for the Construction Contractor(s) (Contractor's Environmental and Social Specification), will include requirements for the contracting of local services and assistance for development of local companies. The Construction Contractor will prepare a plan for the contracting of service companies which will be validated by the Project Owner prior to the start of the works;
- The Project Owner's Engineer, contracted for the supervision of the construction works will be charged with monitoring the contracting companies to make sure of compliance with the plan, and
- The Local Area Development Plan (LADP); which is part of the Resettlement Action Plan (RAP) includes the measures to enhance the development of local resources.

The residual impact will be major positive local impact and the effects will also be noticeable on the Province scale. The impact is of high local significance.

### 6.6.3. Socioeconomic Benefits Associated with the Economic Development at the Project Site

The implementation of the Project will create increased economic development in the villages and districts near the Rusumo site.

- The employment opportunities (direct, induced and indirect) will increase the income and spending capacity of the local population. The increased income should enable people to improve their standing of living for example by improving their housing conditions and purchasing commodities; which in turn will increase general economic development;
- The project and developments will attract external investors, which will contribute further to economic development;
- Taxes paid to local government will increase the treasury and capacity to improve local services and infrastructures.

The impact is potentially positive and major on a local scale. However, to ensure that the maximum socioeconomic benefits, the enhancement measures for direct and indirect employment above will be implemented.

### 6.6.4. Indirect Socioeconomic Benefits Associated with Rural Electrification

The overall objective of the Rusumo Falls Hydropower Project is to develop hydropower and a regional transmission network to Burundi, Rwanda and Tanzania.

The realisation of the Project will enable rural electrification projects to be implemented and which will benefit people on a local and regional scale.

The positive impacts of rural electrification will include the following:

- Increased standard of living of people, for example the availability of electricity in villages will enable people to better conserve food, to have access to media communication, to have lighting, power for cooking and heating without the use of firewood.
- Electricity will improve schools and health centres by providing lighting and power and consequently contributing to improvements in health and education, and
- Existing and new business will be able to develop because of the availability of power.

The impact is potentially positive and moderate on a regional scale. However, the positive effects are dependent on the realisation of the rural electrification, which is not a component of the overall Project.

### 6.6.5. Improved Fisheries Capacity

The operation of the dam with a water level at 1,320 metres asl creates a permanently flooded area, whereas for the natural situation the water recedes during the dry season.

The creation of the permanently flooded area should be beneficial for the development of fish and fishermen should benefit from increased catch. However, it should be noted that the creation of the permanently flooded marshland is not expected to create a habitat for new species of fish, and the permanently flooded marshland will be of very shallow depth.

The residual impact is expected to be positive and minor on a local scale. However, because many of the people are living in poverty even a minor improvement in fishing potential is of high local significance.

### 6.6.6. Assistance to Farmers

The operation of the dam with a water level at 1,320 metres asl creates a change in the seasonal flood regime of the marshland and there will be a loss of arable marshland on the edge of the Kagera marshland near the dam and reduced arable marshland extending upstream to a distance of 15 kilometres. The local farmers who will be affected by the loss or reduced marshland will be compensated through the Resettlement Action Plan (RAP) which includes a Local Area Development Plan (LADP) which is designed to assist affected people in improving their livelihood to compensate the loss of arable marshland. In the frame of the LADP, local farmers will receive assistance to improve their farming techniques with the aim of improving crop production yields.

The residual impact is expected to be positive and minor on a local scale. However, because many of the people are living in poverty even a minor improvement is of high local significance.

## 6.7. NEGATIVE SOCIOECONOMIC IMPACTS

### 6.7.1. Identification, Consultation with, and Compensation of Project Affected People

*The identification of, consultation with PAPs, and the resettlement and compensation process are described in full in the Resettlement Action Plan (RAP), which is issued as a separate document. Pertinent information from the RAP is provided in the following paragraphs.*

Villages affected by the Run-of-River scheme were identified taking into account the impacts on land use of the construction activities (see §6.3.2) and the impacts during operation of the change in the seasonal flooding of the upstream marshlands (see §6.3.1).

The Project Affected People (PAP) were identified and consulted with during field work carried out during the period November 2012 to January 2013. It should be noted that extensive consultations with potentially project affected people started in 2008 in the context of the ESIA and RAP for the FDS and IDS. The consultations for the RoR Scheme carried out in 2012 and 2013 were therefore a continuation of previous work.

***Affected Communities***

*Dam Construction Activities*

The communities affected by the dam construction activities comprise residents and businesses in the villages of Rusumo East and Nyakwisi (Rwanda) and Rusumo West (Tanzania) representing a total of 223 people, of which 133 households are in Tanzania and 90 households are in Rwanda. The PAP affected by construction will need to relocate because the land where they are currently living is required for the construction of the dam. The people have been consulted with and have all opted to for cash compensation rather than resettlement. This is further described below under the heading compensation below.

*Dam Operation Activities*

Communities affected by the operation of the dam are affected because of the change in seasonal flooding of the marshland upstream of the dam. The affected villages are located along the Kagera River extending from the dam site to a distance 15 kilometres upstream on both sides of the Kagera River.

The Tables below provide a list of affected villages. All affected villages in Rwanda are located in the Kirehe district and all affected villages in Tanzania are located in Ngara district.

**Table 6-4 Affected Villages in Rwanda**

| Village | Cell | Sector | Total population (Census 2012) |
|---|---|---|---|
| Rusumo East | Kiyanzi | Nyamungari | 204 |
| Rusumo West | Nyankurazo | Kigarama | 163 |
| Nyakwisi | Nyankurazo | Kigarama | 89 |
| Nshungerezi | | | 118 |
| Nyakabungo | | | 124 |
| Ruhuha | | | 148 |

**Table 6-5 Affected Villages in Tanzania**

| Village | Sub-Village | Division | Ward | Total population |
|---|---|---|---|---|
| **Nyakiziba** | Kabuye | | | 2,309 |

The PAP will not need to relocate, because the villages will not by physically affected by change in seasonal flooding of the marshland. However, the PAP will be affected economically by the changes in the flooding of marshland, which is one of their sources of livelihood.

***Consultation Process***

*The consultation process is described in full in the RAP and is closely linked with the Project's Stakeholder Public Consultation and Disclosure Plan (PCDP), which is a stand-alone document and attached as an annex to the RAP.*

The overall goal of consultation and stakeholder engagement process was to establish an on-going, accessible and constructive dialogue with potentially affected parties and other interested organizations and individuals, so that their views and concerns are taken into account with respect to decisions regarding the Project.

*Consultations for the Full Development Scheme Alternative*

Between 2007 and 2008 and in the context of the ESIA and RAP for the FDS, a total of 270 individual and group interviews with stakeholders were conducted in eleven survey areas. Similar individual and group interviews were subsequently conducted with 75 selected stakeholders in Tanzania (Nyamiaga, Kasharazi, Rusumo and Nyakiziba in the Ngara District). These interviews were conducted with the following stakeholder groups:

- Administrators and local elected representatives;
- Representatives of agricultural extension services or of social education and health care services;
- Representatives of trade associations (farmers, fishermen, small traders etc);
- Representatives of local civil society associations (women, youth, etc.).

These interviews aimed to identify: (i) the status and recent developments in local economic conditions (agriculture, fishing, trade, crafts, industry, tourism, etc.); (ii) status and recent developments in infrastructures and services; (iii) project`s key stakeholders and representatives and on-going programs and local priorities.

*Consultations for the Intermediate Development Scheme Alternative*

In 2011 in the context of the ESIA and RAP for the IDS, a comprehensive government stakeholder consultation process was developed in order to obtain authorizations for Consultants to conduct field work, as well as to engage as soon as possible with government authorities in obtaining their views, advice and participation in defining the socio-economic and environmental impacts of the project and the most adequate mitigation measures to apply. This was also a particularly important step in terms of gaining a better understanding of resettlement impacts and planning possible synergies with rural development projects to find available land and propose restoration strategies.

*Consultations for the Run-of River Development Scheme (Adopted Alternative)*

During November and December 2012 and in January 2013, consultations with communities in Rwanda and Tanzania along the Kagera River, amongst them the affected communities, were performed. Consultations were conducted after preparatory meetings with authorities of Kigarama sector in Rwanda and the district of Ngara in Tanzania. Sector authorities in Rwanda and Ngara district authorities in Tanzania facilitated the performance of the field program.

Affected local communities were consulted in order to validate the affected assets (= marshland plots) in a participatory manner. Village leaders, resettlement committees and affected households participated in the self-validation process. Self- validation was aiming to obtain information on marshland use on the individual/household level. In the context of these consultations, communities were provided with updated information about the Project through the organisation of community meetings.

A summary of the consultations is provided below.

- Consultations with respect to the approach for resettlement and compensation:
  - Self -validation of affected land by local communities
  - Consultation with resettlement committees on compensation approach
- Consultations with local communities/focus groups with respect to marshland use and marshland users and with respect to the best approach to compensate for loss of marshland;
- Consultations with local communities with respect to needs and aspirations with regard to the design of livelihood restoration measures;
- Consultations in the context of RAP disclosure;
- Routine consultations with local resettlement committees in the context of the monitoring program for resettlement and compensation;
- Continuous provision of information to the affected population and other project stakeholders regarding Project progress.

The RAP report, appendices and annexes provide a full description of the consultation process:

- Chapter 9 of the RAP provides a full description of the consultation process;
- Appendices 1 provides support material used in the consultations;
- Appendices 2 provides the findings of the consultations;
- Appendix 7 provides minutes of meetings;
- Annexe 1 provided the Public Consultation and Disclosure Plan;
- Annexe 3 provides the endorsement documentation, and
- Annexe 4 provides the signatures of the project affected people regarding their acknowledgement of being informed of the cut-off date for compensation.

***Resettlement and Compensation Process***

*The resettlement and compensation is described in full in the RAP, which is provided as a separate document. Pertinent information from the RAP is provided in the following paragraphs.*

The overall objective of the resettlement and compensation is to ensure that all affected parties are compensated and assisted in restoring their livelihoods. The resettlement and compensation will be carried out in compliance with the World

Bank's OP 4.12. Compensation will be paid to the affected households before the impacts occur. For construction impacts, compensation will be made prior to the start of construction activities. For impacts from operation, compensation will be made prior to the start of operation. Specific objectives of the resettlement and compensation are as follows:

- Avoid or at least minimize involuntary resettlement;
- Mitigate adverse social and economic impacts from land acquisition by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- Improve or at least restore the livelihoods and standards of living of affected people;
- Provide additional targeted assistance (e.g., credit facilities, training, or job opportunities) and opportunities to improve or at least restore their income-earning capacity, production levels, and standards of living to economically displaced persons whose livelihoods or income levels are adversely affected;
- Provide transitional support to affected people, as necessary, based on a reasonable estimate of the time required to restore their income earning capacity, production levels, and standards of living.

The RAP provides the full description of the resettlement and compensation process, including the budget. The pertinent appendices and annexes in relation to resettlement and compensation are as follows:

- Appendix 3 provides the list of marshland users affected by operation;
- Appendix 4 provides the compensation rates for annual and perennial crops;
- Appendix 5 provides the approach for calculating compensation rates for residential structures, and
- Appendix 6 provides budget tables.

The compensation approach adopted for the different types of impact are provided in the following subsections addressing impacts on land use and impacts on communities.

***Livelihood Restoration Program***

Affected households are entitled to participate in and to benefit from the targeted set of livelihood restoration programs, which were developed and described in full in the RAP. The key elements of the livelihood restoration program are as follows:

- Financial training for the sustainable use of cash compensation (including training on the maintenance of a bank account, on small household investments, saving strategy and financial planning on the household level);

- Agricultural extension training for intensification of production;
- Livestock keeping extension training, and
- Business skills training: facilitation of access to alternative income generating activities.

Affected households will be provided with priority consideration for construction employment and affected households will be entitled to priority assistance through the LADP.

### 6.7.2. Land Impacts from Construction

The impact on land during construction is limited to the dam site. Affected land will be residential land, land used for business and small areas of agricultural land. Land take will result in the permanent change of land use and the termination of the present use of the land. Some the areas required for construction activities are indicated as "*temporary land acquisition* (see Figure 6-18). However, for the RAP all land acquisition for construction is considered as permanent, as at the time of the preparation of the RAP, no information was available with regard to the plans for future use of the areas labelled as *temporary*.

**Table 6-6 Changes in Land Use from Dam Construction**

| Description | Natural vegetation | Agricultural land | Residential areas | Total |
|---|---|---|---|---|
| Borrow Area No 1 | | 2.06 | | 2.06 |
| Borrow Area No 2 | | 4.89 | | 4.89 |
| Operation Base Camp sub-station | | 1.26 | | 1.26 |
| Sub-station Area | | 1.79 | | 1.79 |
| Construction Base camp (Rwanda) | | 1.02 | | 1.02 |
| Construction Area | 1.84 | 0.62 | 1.03 | 3.50 |
| Spoil Deposit Area | | 2.70 | | 2.70 |
| **TOTAL RWANDA** | **1.84** | **14.34** | **1.03** | **17.21** |
| Power plant Building | 21.51 | 6.69 | | 28.19 |
| Operation Base Camp (power and dam) | 2.73 | 1.71 | | 4.44 |
| Construction Workers Permanent Camp | | 1.84 | 0.05 | 1.89 |
| Construction Workers Temporary Camp | 0.22 | 3.72 | 0.42 | 4.36 |
| Water Intake | 2.51 | 1.79 | 0.41 | 4.70 |
| **TOTAL TANZANIA** | **26.97** | **15.75** | **0.88** | **43.58** |
| **TOTAL for the Project (ha)** | **28.81** | **30.09** | **1.91** | **60.80** |

The map on the page below presents the spatial setting of areas required for construction with the indication of losses.

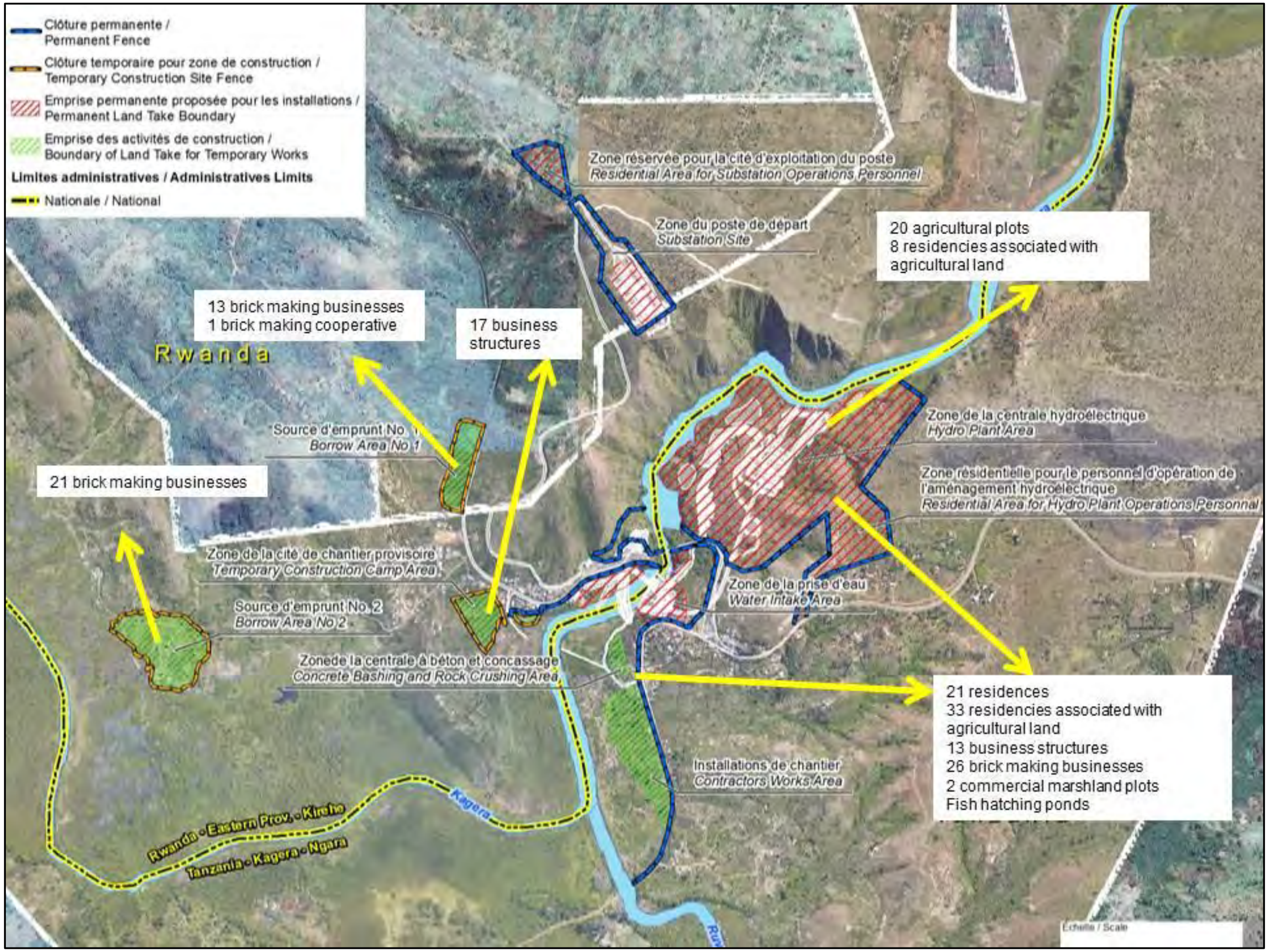


**Figure 6-18 Components of Project during Construction and Losses Resulting from Impacts on Land**

### 6.7.3. Impact on Communities from Construction

Project affected households were identified during field surveys between November 2012 and January 2013. In total, 90 households will be affected in Rwanda and 133 households will be affected in Tanzania.

The following tables provide an overview on the types of project impacts and the corresponding numbers of affected households.

**Table 6-7 Overview of Project Impacts due to Construction**

| **Description of Project Impacts**<br>**Construction; Impacts on Land (Dam Site)** | **Number of affected Households** | | |
|---|---|---|---|
| Land loss due to construction of dam | ***Rwanda*** | ***Tanzania*** | ***Total*** |
| Residential structures, associated with agricultural land plots | | 8 | 8 |
| Agricultural land | | 10 | 10 |
| | **Subtotal** | | **18** |
| Land loss due to establishment of concrete bashing and rock crushing and contractors work area, future residential area for operation staff | | | |
| Residential structures, associated with agricultural land plots | | 33 | 33 |
| Residential structures | | 21 | 21 |
| | **Subtotal** | | **54** |
| Land loss due to establishment of concrete bashing and rock crushing area | | | |
| Business structures | | 13 | 13 |
| Brick making businesses | | 26 | 26 |
| Arable marshland | | 2 | 2 |
| fish hatching ponds (1 cooperative) | | 6 | 6 |
| | **Subtotal** | | **47** |
| Land loss due to establishment of construction contractor's area | | | |
| Business structures: owners | 17 | | 17 |
| Business structures (business tenants in affected structures as per row above) | 36 | | 36 |
| residential structures (as annex of affected business structure as per row above) | 3 | | 3 |
| | **Subtotal** | | **56** |
| Land loss due to establishment of borrow areas (borrow area 2) | | | |
| Sand digging and brick making businesses | 34 | | 34 |
| | **Subtotal** | | **34** |
| ***Temporary loss of access to resources due to construction activities*** | | | |
| Loss of access to the river due to construction of dam structure: **fishing business downstream of dam site** | | 14 | 14 |
| | | | **14** |
| **Total** | | | **223** |

### Table 6-8 Project Construction - Overview of Affected Households

| Construction Period - Overview on affected households | Rwanda | Tanzania |
|---|---|---|
| Households affected by loss of agricultural land **and** loss of residency | | 41 |
| Households affected by loss of residency: owners | | 21 |
| Households affected by loss of agricultural land | | 10 |
| Households affected by loss of arable marshland | | 2 |
| Households affected by loss of business: commercial structures | 17 | 13 |
| Households affected by loss of residential structures (as annexes to affected business structures) | 3 | |
| Households affected by loss of business premises as part of affected business structures (tenants) | 36 | |
| Households affected by loss of business: brick making/sand digging structures | 34 | 26 |
| Households affected by loss of business: fish hatching pond | | 6 |
| Households affected by temporary loss of access to resources: fishers | | 14 |
| **Total** | **90** | **133** |

***Loss of Residence***

In Tanzanian 21 households will be affected by a loss of their residence and 3 households will be affected by loss of a residential premise they are renting. The types of affected residences were determined during the field surveys and are documented in the RAP.

During the consultation process the PAP were presented with the general approach for compensation and resettlement with respect to loss of residential structures and residential land.

Two options were proposed (as listed below) and all PAP without exception indicated their preference for cash compensation over the land for land or the house for house approach.

| Option 1 (preferred option) | Option 2 |
|---|---|
| ▪ Cash compensation at replacement value for loss of residential house;<br>▪ Cash compensation for loss of residential land at replacement value;<br>▪ Cash compensation at replacement value for loss of other structures;<br>▪ Cash compensation at replacement value for permanent crops in home garden;<br>▪ Plus: all necessary transaction costs, and<br>▪ Money management training. | ▪ Allocation of residential plot an agreed resettlement site, with secure tenure;<br>▪ Reconstruction of a resettlement house of at least the same quality as the affected house;<br>▪ cash compensation at replacement value of any specific features that would not be included in the resettlement house, and<br>▪ Resettlement assistance. |

The unit values of residential structures for compensation purposes are provided in Appendix 5 of the RAP.

***Loss of Agricultural Land***

In Tanzania, 10 households will be affected by the loss of agricultural land. This land is intermediate (private) land. Areas of affected agricultural land and the overall cultivation pattern were determined during the field surveys and are documented in the RAP.

During the consultation process the PAP were presented with the general approach for compensation with respect to loss of agricultural land. PAP stated their preference for cash compensation. The approach for compensation is as follows:

- Compensation at full replacement value or allocation of a land plot in an acceptable distance to residence of at least equivalent productivity;
- Compensation for loss of perennial crops and trees and full replacement value;
- Compensation for loss of seasonal crops at market value;
- Compensation for developments on land at full replacement value;
- Plus: all necessary transaction costs;
- Participation in the livelihood restoration program;
- Participation in money management training.

The value of agricultural land for compensation purposes was determined through consultation with local agronomists and district authorities and is provided in Chapter 7 of the RAP. The compensation rates for loss of crop production are provided in Appendix 4 of the RAP.

***Loss of Residence and Loss of Agricultural Land***

In Tanzania, 41 households will be affected by both the loss of residential structures and the loss of the associated agricultural land (private land). The full details of affected residences and areas of affected land are documented in the RAP.

***Loss of Arable Marshland***

In Tanzanian 2 households in Tanzania will be affected by loss of arable marshland plots. The affected plots and cultivation patterns were determined during the field surveys during the period November 2012 to January 2013 and are documented in the RAP.

During the consultation process the PAP were presented with the general approach for compensation with respect to loss of arable marshland. PAP stated their preference for cash compensation. The approach for compensation is as follows:

- Compensation for loss of income from marshland production at market value of crop (most important crop on affected marshland plot for the 3 years prior to cut-off date);
- Compensation for labor costs to develop the marshland;
- Compensation for developments on land at full replacement value;
- Participation in livelihood restoration program, and
- Participation in money management training

Note: Marshland is under government ownership. Hence, the loss of marshland will not be compensated for the land as such, but under consideration of the loss of production/income from marshland.

Note: In order to provide for livelihood restoration, compensation will be paid for a period equivalent to 3 years of income from marshland production. For affected households who entirely depend on marshland, compensation will be paid for a period equivalent to 5 years of income from marshland production.

Final calculation of compensation: The rationale for final calculation of compensation rates is based on factual information that marshland cultivation is only possible every second year, due to flooding of marshland every other year. Hence, income from marshland only occurs every second year. Consequently, a three-year period of income from marshland is compensated by cash compensation at market value for lost crop with the factor 1.5. A five-year period of income from marshland is compensated by cash compensation at market value for lost crop with the factor 2.5. Reference information on marshland cultivation was obtained from local resettlement committees, from district agronomists and from affected people; the information was confirmed during the consultative workshop in Kigali on 4 February 2013.

***Loss of Business***

Commercial structures that are affected comprise 17 structures in Rwanda and 13 structures in Tanzania.

In Rwanda, there will be 36 businesses that will lose their rented business premises in affected commercial.

Brick making businesses will also be affected; 34 businesses in Rwanda and 26 in Tanzania will lose their fabrication sites in the marshland.

A fishing cooperative with 6 members in Tanzania will lose the area of their fish hatching ponds.

Affected businesses are of different types:

- Permanent built business structures;
- Kiosks of small traders;
- Rented premises in business structures;
- Brick making businesses in marshland, and
- Fish hatching businesses in marshland.

Affected businesses were determined during the field surveys during the period November 2012 to January 2013 and are documented in the RAP, including the names of owners and cooperative members and names of tenants of business premises.

During the consultation process the PAP were presented with the general approach for compensation with respect to loss of businesses. The approach for compensation is as follows:

<u>Fixed Business Structure</u>

- Compensation at full replacement value for immovable assets (including commercial land associated to the structure);
- Plus: all necessary transaction costs;
- Compensation for loss of income for the period of time required to re-establish the business and restore associated income - typically three month income, with a maximum of one year income;
- Money management training;
- If business cannot be re-established affected person will be eligible to benefit from the livelihood restoration program.

<u>Movable business structure (e.g.kiosk)</u>

- Moving allowance (covering moving costs/transaction costs);
- Transition allowance to cover the period until the business is fully operational again after moving (typically 3 month income, with a maximum of 1 year income);
- Money management training, and
- If business cannot be re-established the affect person will be eligible to benefit from the livelihood restoration program.

<u>Loss of Income due to Loss of Employment</u>

- Compensation for lost income for employees of displaced business is the responsibility of the business owner (salaries of employees are part of the compensation amount for lost income); PIU will facilitate respective arrangements between owners and employees, based on the results of field work carried out during the period December 2012 – January 2013 and on the results of the exit survey;

- In the case that a displaced business does not reopen elsewhere, former employees will be eligible to benefit from the livelihood restoration program.

Loss of Brick Making and Sand Digging Businesses in Marshland

- Assistance in finding a new business site;
- Restoration allowance (costs for moving and re-establishment of business site plus all transaction costs);
- Compensation for loss of income for the period of time required to re-establish the business and restore associated income - typically three month income, with a maximum of one year income;
- Money management training, and
- In case the business cannot be restored, the affect person will be eligible to benefit from the livelihood restoration program.

Loss of Fish Hatching Ponds in Marshland

- Assistance in finding a new business site;
- Restoration allowance (costs for moving and re-establishment of business site plus all transaction costs);
- Compensation for loss of income for the period of time required to re-establish the business and restore associated income - typically three month income, with a maximum of one year income;
- Money management training, and
- In case the business cannot be restored, the affect person will be eligible to benefit from the livelihood restoration program.

***Loss of Access to Resources***

The construction will cause a loss of access to the Kagera River for fishing and 14 fishermen, who practice fishing as a seasonal economic activity, will temporary lose the access to their present fishing sites/mooring locations of their boats. The names of affected fishermen were collected during the field surveys carried out during the period November 2012 to January 2013 and are documented in the RAP.

During the consultation process the PAP were presented with the general approach for compensation. The approach for compensation is as follows:

- Assistance in finding alternative fishing sites upstream during construction period;
- Re-establishment of access to original fishing sites immediately after construction (2 month period after completion of construction), and
- Severance allowance equivalent to a 2-month income from fishing).

### 6.7.4. Impacts on Communities from Operation

The project will function as a Run-of-River scheme and there will be change in the seasonal flooding of marshland (see § 6.3.1). The Figures 6-3 and 6-4 present an overview on the area which will be flooded permanently due to dam operation (= area in light blue).

***Arable Marshland Affected by Operations***

Impacts will be limited to marshland and no private agricultural land will be affected. The chnage in flooding conditions of the marshlands will effect both sides of the Kagera river, though only affecting a narrow strip of arable marshland on the edge of the papyrus marshlands. The extent of the strip of affected arable marshland was determined using satellite imagery and hydrological modelling. The impact extend up to 5 km upstream of the dam site. Arable marshland will be flooded up to the areas of Ruhuha village in Rwanda and Kabuye sub-village in Tanzania. A total of 107.6 ha of arable marshland will be actually affected in Rwanda, see Table below.

**Table 6-9 Rwanda, Affected Marshlands as per Village Self-Validation**

| Village | Total area cultivated by marshland users (ha) | Marshland cultivated (ha) |
|---|---|---|
| Rusumo East | 8.56 | 5.06 |
| Nyakwisi | 99.29 | 37.33 |
| West Rusumo | 42.68 | 16.24 |
| Nshungeruzi | 65.77 | 26.52 |
| Nyakabungo | 22.71 | 4.33 |
| Ruhuha | 100.54 | 18.1 |
| **Total** | **339.55** | **107.58** |

Source: Village self-validation, Novembre 2012

The affected marshland encompasses about 31% of the total land available to marshland users in the affected communities. A total of 79.6 ha of arable marshland will be actually affected in Tanzania, see Table below.

**Table 6-10 Tanzania, Affected Marshlands as per Village Self-Validation**

| Village | Sub-Village | Total area cultivated by marshland users (ha) | Marshland Cultivated (ha) |
|---|---|---|---|
| Nyakiziba | Kabuye | 37.75 | 18.25 |
| Nyakiziba | Kyenda | 258.46 | 61.37 |
| Total | | **296.21** | **79.62** |

Source: Village self-validation, Novembre 2012

The affected marshland encompasses about 26% of the total land cultivated by marshland users in the affected communities.

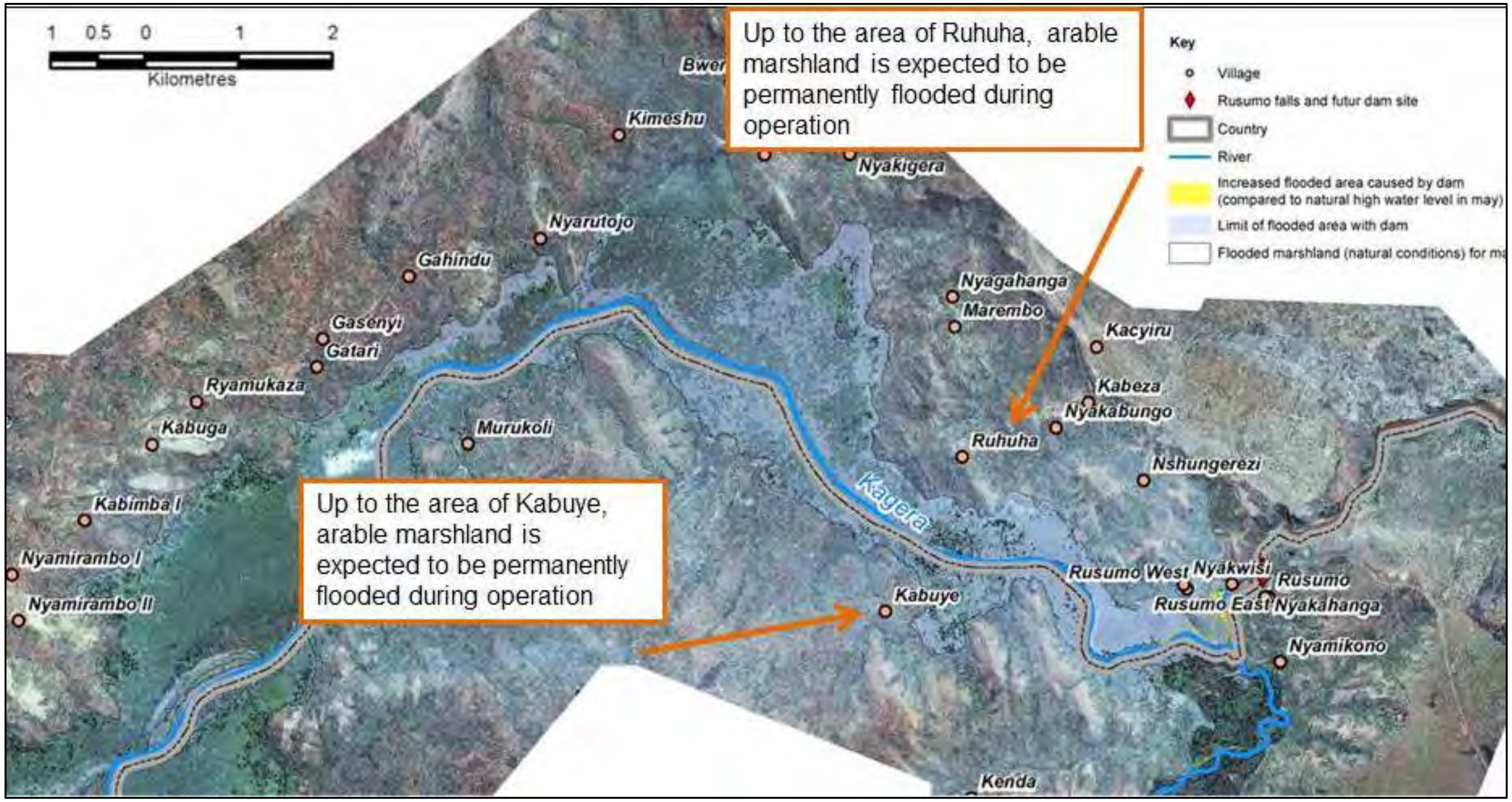


**Figure 6-19 Overview with Areas with Ruhuha and Kabuye Villages**

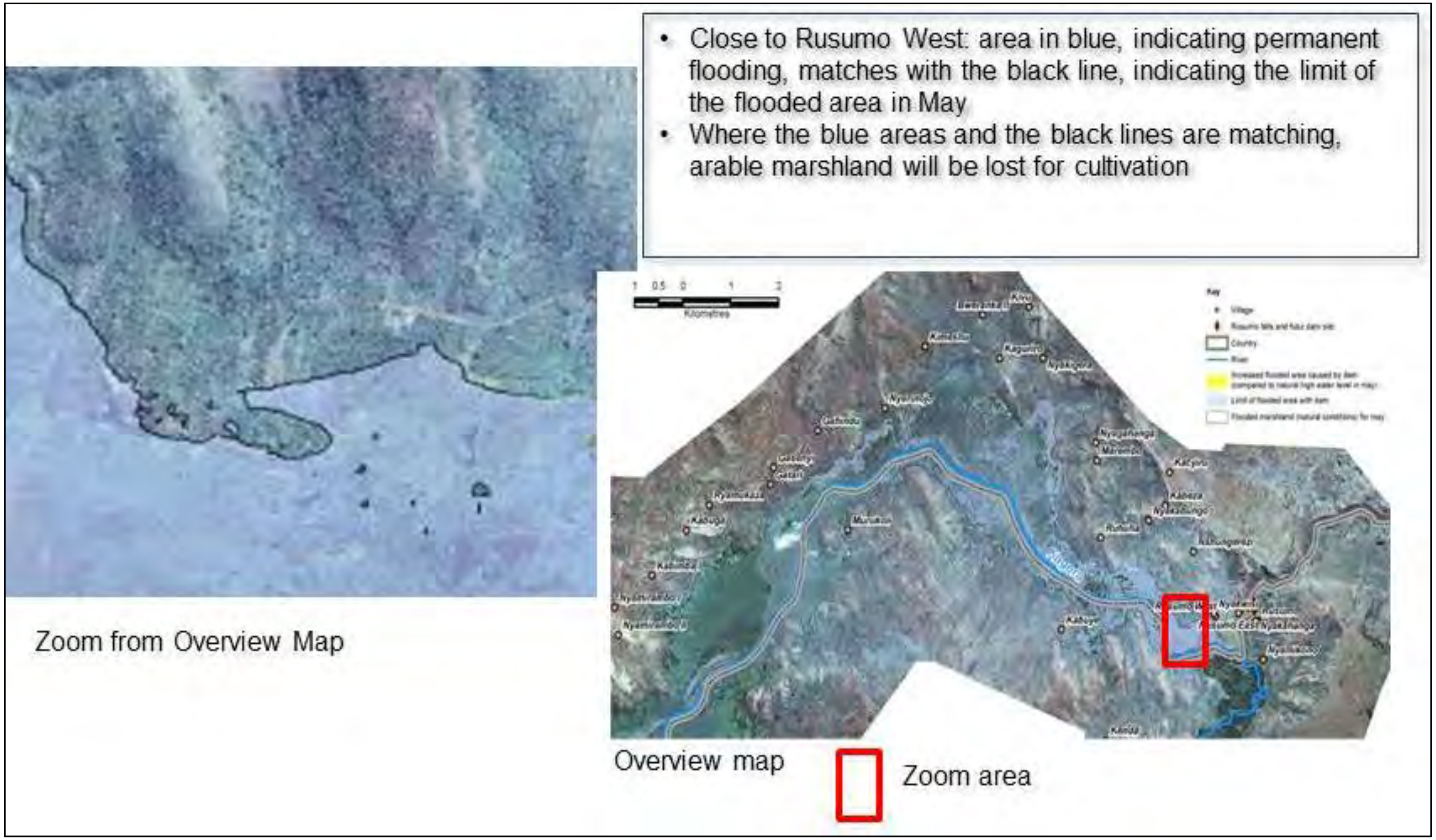


**Figure 6-20 Cut Out with Example for Marshland Affected by Operation**

***Project Affected People – Project Operation***

*Households cultivating arable marshland*

Households affected by the permanent flooding of arable marshland plots will permanently lose the agricultural production from their marshland plots.

In Rwanda, households cultivating arable marshland in the following villages are considered as actually affected

- Rusumo East
- Nyakwisi
- West Rusumo
- Nshungeruzi
- Nyakabungo
- Ruhuha

In Tanzania, households cultivating arable marshland in the following villages are considered as actually affected

- Rusumo
- Nyakiziba Village, sub villages Kyenda and Kabuye

Validation of arable marshland in the actually affected villages was undertaken in November 2012, through a self-validation by marshland users, with confirmation from village heads and resettlement committees.

Information from self-validation comprises

- Names and contact details of affected households
- Size of marshland plots/household
- Size of total land cultivated/household
- Most important crop cultivated on marshland plot over past 3 years prior to cut-off date (see chapter on baseline conditions/marshland cultivation above)

Each affected household signed the cut–off date (date of self-validation in village). For documentation of self-validation, see RAP.

Amongst the affected households, a total number of 4 households are entirely depending on marshland cultivation, with no land uphill (private land). They make up about 4.35% of the marshland users.

**Table 6-11 Affected Marshland Users, Rwanda**

| Village | Total No. of HH* | HH using marshland | | HH entirely depending on marshland | | | HH using marshland for agriculture – average sizes of land of different types/HH | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *No.* | *% of total HH* | *No.* | *% of marshland users* | *% of total HH* | *Average size of total land (marshland plus private, ha)* | *Average size of private land (ha)* | *Average size of marshland (ha)* | *Average size for users entirely depending on marshland (ha)* |
| Rusumo East | 204 | 12 | 5.9 | 5 | 41.7 | 2.5 | 0.71 | 0.5 | 0.42 | 0.37 |
| Nyakwisi | 89 | 84 | 94.4 | 14 | 16.7 | 15.7 | 1.18 | 0.89 | 0.44 | 0.28 |
| West Rusumo | 163 | 48 | 29.4 | 11 | 22.9 | 6.7 | 0.89 | 0.49 | 0.71 | 0.33 |
| Nshungeruzi | 118 | 57 | 48.3 | 5 | 8.8 | 4.2 | 1.13 | 0.75 | 0.47 | 0.25 |
| Nyakabungo | 124 | 28 | 22.6 | 3 | 10.7 | 2.4 | 0.39 | 0.73 | 0.15 | 0.08 |
| Ruhuha | 148 | 122 | 82.4 | 5 | 4.1 | 3.4 | 0.82 | 0.7 | 0.15 | 0.28 |
| **Total** | **846** | **351** | **41.5** | **43** | **12.3** | **5.1** | **0.9** | **0.7** | **0.4** | **0.3** |

In the six affected villages, a total number of 351 households will be affected. Amongst the affected households, a total number of 43 households are entirely depending on marshland cultivation, with no land uphill (private land). They make up 12.3% of the marshland users. Marshland users make up between 5.9% (Rusumo East) and 82.4% (Ruhuha) of the total population of affected villages.

**Table 6-12 Affected Marshland Users, Tanzania**

| Village | Sub-Village | Total No. of HH* | HH using marshland | HH entirely depending on marshland | | | | HH using marshland for agriculture – average sizes of land of different types/HH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *No.* | *% of total HH* | *No.* | *% of marshland users* | *% of total HH* | *Average size of total land (marshland plus private) (ha)* | *Average size of private land (ha)* | *Average size of marshland (ha)* | *Average size for users entirely depending on marshland (ha)* |
| Nyakiziba | Kabuye | n.a. | 24 | | 1 | 4.2 | | 1.57 | 0.84 | 0.76 | 0.5 |
| Nyakiziba | Kyenda | n.a. | 66 | | 3 | 4.5 | | 3.91 | 3.12 | 0.92 | 1.66 |
| **Total** | | | **90** | | **4** | **4.35** | | **2.74** | **1.98** | **0.84** | **1.08** |

In the two affected sub-villages, a total number of 90 households will be affected. Amongst the affected households, a total number of 4 households are entirely depending on marshland cultivation, with no land uphill (private land). They make up about 4.35% of the marshland users.

*Summary of Affected from Project Operation*

The table below summarizes project impacts from operation and project affected households.

**Table 6-13 Summary of Project Impacts and Project Affected Households**

| Project Impact from Operation | No of Affected Households | |
|---|---|---|
| | *Rwanda* | *Tanzania* |
| Permanent flooding: L**oss** of arable marshland | 351 | 90 |
| **Total** | **441** | |

*Compensation for Loss of Marsland*

During the consultation process the PAP were presented with the general approach for compensation with respect to loss of arable marshland. PAP stated their preference for cash compensation. The approach for compensation is as follows:

- Compensation for loss of income from marshland production at market value of crop (most important crop on affected marshland plot for the 3 years prior to cut-off date);
- Compensation for labor costs to develop the marshland;
- Compensation for developments on land at full replacement value;
- Participation in livelihood restoration program, and
- Participation in money management training

Note: Marshland is under government ownership. Hence, the loss of marshland will not be compensated for the land as such, but under consideration of the loss of production/income from marshland.

Note: In order to provide for livelihood restoration, compensation will be paid for a period equivalent to 3 years of income from marshland production. For affected households who entirely depend on marshland, compensation will be paid for a period equivalent to 5 years of income from marshland production.

Final calculation of compensation: The rationale for final calculation of compensation rates is based on factual information that marshland cultivation is only possible every second year, due to flooding of marshland every other year. Hence, income from marshland only occurs every second year. Consequently, a three-year period of income from marshland is compensated by cash compensation at market value for lost crop with the factor 1.5. A five-year period of income from marshland is compensated by cash compensation at market value for lost crop with the factor 2.5. Reference information on marshland cultivation was obtained from local resettlement committees, from district agronomists and from affected people; the information was confirmed during the consultative workshop in Kigali on 4 Feb 2013.

### 6.7.5. Summary of Project Impacts and Affected People

**Table 6-14 Overview of Project Impacts and Project Affected Households for Construction and Operation**

| Description | Area (hectares) | | | No. of Households | | |
|---|---|---|---|---|---|---|
| | Rwanda | Tanzania | Total | Rwanda | Tanzania | Total |
| 1. Land Acquisition in Dam Site | | | | | | |
| • Agricultural Land | 14.34 | 15.75 | | | 45 | 45 |
| • Natural Vegetation | 1.84 | 26.97 | | | | |
| • Residential Structures | 1.03 | 0.88 | | 3 | 29 | 32 |
| • Business Units | | | | 87 | 59 | 146 |
| Sub-Total | 17.21 | 43.58 | 60.79 | 90 | 133 | 223 |
| 2. Affected Marshland (flooded) | | | | | | |
| • Arable Marshland | 107.6 | 79.6 | 187.2 | 351 | 90 | 441 |
| Sub-Total | 107.6 | 79.6 | 187.2 | 351 | 90 | 441 |
| **TOTAL** | **124.81** | **123.18** | **247.99** | **441** | **223** | **664** |

### 6.7.6. Spontaneous Settlements

The need for a large construction workforce, opportunities for induced and indirect employment and the general economic development that is expected around the Project, which are all positive impacts, also have a possible negative aspect.

The number of workers at the site will increase with the waves of hiring that take place following the start-up of the construction phase and the commissioning of the hydropower plant. The prospect of finding employment with Project or its suppliers, or in the businesses and services that grow out of the resulting economic development, will attract many migrants to settle in the area with their families. This migration may well give rise to a range of problems, however: competition for access to land, increased pressure on natural resources, cultivable land and public services (management of waste and wastewater, supply of drinking water and household water, etc.), health problems, increased conflicts, and transformation of traditional social and cultural structures. At the same time, if the development resulting from the influx of migrants is managed properly, it could lead to sustainable economic growth in the region.

The potential impact is therefore of major importance and of high significance on a local scale.

The proposed control measures are as follows:

- During the preparation stage, before construction activities start a plan for the management of spontaneous settlements will be prepared. The overall management of spontaneous settlements will be the responsibility of local authorities. However, to ensure that local authorities are informed of the potential problem the Project Owner will inform and liaise with local authorities to ensure that a suitable plan is prepared in a timely manner;
- The Project owner will prepare a recruitment policy and procedure which is aimed at maximising the recruitment of local people and to minimise the uncontrolled influx of people. The recruitment will be carried out at a designated recruitment office, which will be at a suitable location to be determined with local authorities. The procedure will also define priorities for local people. The tender documents for the Construction Contractor(s) (Contractor's Environmental and Social Specification), which translates the policy and procedure into contractual requirements. The Construction Contractor will prepare a recruitment plan which will be validated by the Project Owner prior to the start of the works;
- The Project Owner's Engineer, contracted for the supervision of the construction works will be charged with monitoring the recruitment to make sure of compliance with the plan.
- During the construction, the local authorities will implement the plan for the management of spontaneous settlements, and this will include when necessary the removing of any unwanted spontaneous settlements that are created.

The residual impact is expected to be minor or moderate, depending on the effectiveness of the management of spontaneous settlements. There is a high risk that correct management may be difficult to implement. The impact will probably be of high local significance.

### 6.7.7. Infectious Diseases

During the construction phase, the presence of workers and truck drivers spending several months away from their families is recognized as one of the factors that can lead to an increase of spread of infectious and sexually transmitted diseases (STDs), HIV/AIDS, tuberculosis, etc.

The prevalence of HIV/AIDS in the Rusumo East (Rwanda) and Rusumo (Tanzania) is already high, and the local population has expressed concerns regarding the influence of the project on the baseline situation, due to the arrival of a large construction workforce.

The potential impact is of high magnitude and significance and the control and prevention measures that will be put in place are as follows:

- The tender documents for the Construction Contractor(s) (Contractor's Environmental and Social Specification), will require that the construction contractor prepare (i) a public health management plan, (ii) a workforce health and safety plan and (iii) a management of permanent and temporary camps plan. Each of these documents will address the issue of prevention and control of STDs, and
- The Project Owner's Engineer, contracted for the supervision of the construction works will be charged with monitoring the construction work to make sure of compliance with the plan.
- An action plan to protect and fight against HIV/AIDS and other STDs at a district and ward scale will be prepared with local authorities. The project will provide assistance and a budget has been allocated for local authorities.

The residual impact will be negative and minor with the effective implementation of control and prevention measures. However the issue of HIV/AIDS and STDs is not specific to the project, and economic development, which is a positive impact of the project, will result in increased population numbers in the neighbouring villages. These people will be outside the responsibility of the Construction Contractor and Project Owner. It will be difficult to attribute any increase in prevalence of STDs to poor management on the part of the Construction Contractor or other factors. The fight against HIV/AIDS is a global issue and particularly important in Africa, the Project can contribute by optimising the control and prevention with respect to its construction works.

### 6.7.8. Waterborne Diseases

One of the issues associated with the creation of the permanently flooded area, is the possibility that it will create a habitat which is favourable for the development of vectors of waterborne diseases. The baseline situation with respect to waterborne diseases is summarised as follows:

*Malaria:* Malaria has been endemic in the Rusumo region for a long time due to the presence of marshlands. The modification to the seasonal flooding of the marshland could cause an increase of the disease by creating a wider habitat favourable for mosquito breeding. Communities near the marshland are already subject to endemic malaria.

*Onchocerciasis:* The Project site is known for the prevalence of onchocerciasis (commonly known as river blindness) because of the presence of waterfalls and rapids downstream on the Kagera River which provide a habitat very favourable for the development of black flies, vectors of this disease. The diversion of water to the hydroelectric dam will reduce the water flow in the falls and rapids which could reduce the habitat of black flies and potentially reduce the prevalence of onchocerciasis.

*Bilharzias or Schistosomiasis:* This is a parasitic disease caused by trematode flatworms of the genus Schistosoma. Larval forms of the parasites, which are released by freshwater snails, penetrate the skin of people in the water. Snails serve as the intermediary agent between mammalian hosts. Schistosomiasis is the second most socioeconomically devastating parasitic disease after malaria.

*Sleeping sickness:* This is present at the project site, but its effects are felt much less than the effects of onchocerciasis and malaria. Preventive measures to fight against the vector, glossina (or tsetse fly) a biting insect are disinfecting the environment and bush-clearing in the vicinity of rivers and lakes, depending on the types of vectors (hygrophiles or xerophiles). The project is not expected to significantly change (negatively or positively) the occurrence of the disease in the study area since the conditions after the works are completed are not so different from what they bare the current situation in terms of availability of sites favourable for the development of glossinas.

The potential and residual impact is expected to be negligible. The modification to the seasonal flooding of the marshland will not increase the habitat for the vectors of Bilharzias, which live in the vegetation of the edge of watercourses. There is a risk of an increase in prevalence of malaria, but there are many factors involved and it is most probable that there will be no discernible increase because the area of the permanently flooded marshland is negligible compared to the surface areas of water bodies in the surrounding areas. The impact is expected to be of negligible significance. However, there will be monitoring of the water related disease vectors.

### 6.7.9. Health and Safety Related to Construction Works

Health and safety is a major issue on a hydropower project construction site. Potentially impacts can be of major importance, for example in the case of high accident rates and fatal accidents, which can occur if there are no health and safety procedures or of there is a malfunction in the health and safety management system. There is a potential for social unrest among workers in this case.

Examples of health and safety related issues include the following:

- Works required to build the power plant will increase the level of dust at the construction site which will affect people with respiratory problems especially.
- The project will also require new and modern facilities for safe drinking water, latrines and hygienic awareness programs will be put in place for adequate practices during construction.
- The presence and movement of machinery, the transportation and temporary storage of hydrocarbons, blasting (projections of debris) and the construction of infrastructure are sources of impact that could affect safety of host communities. Accidents may occur as a result of increased traffic.
- Movements and building site roads must be planned in order to avoid nuisance to the resident populations and areas presenting risks of accidents (such as intersections, crossing places and roads where schoolchildren circulate, etc.). Vehicle speed limits will be set at 40 km/h or even lower in these sectors.

The potential impact is of high magnitude and significance and the control and prevention measures that will be put in place are as follows:

- The tender documents for the Construction Contractor(s) (Contractor's Environmental and Social Specification), will require that the construction contractor prepare (i) a workforce health and safety plan and (ii) a hazardous substance management plan, (iii) a management of air quality, dust, noise and vibration plan, (iv) a management of road traffic and access plan, and (v) a plan for management of permanent and temporary camps. Each of these documents will address the issue of workforce health and safety, and
- The Project Owner's Engineer, contracted for the supervision of the construction works will be charged with monitoring the construction work to make sure of compliance with the plans.

The residual impact, with the effective implementation of control measures will be of minor magnitude and low significance on a local scale.

### 6.7.10. Impact on the Tourist Industry

The Rusumo Falls is a recognised but little visited tourist destination. Tourists who are visiting the Akagera National Park may make a detour to see the Falls, but few if any make the trip specifically to see the Falls.

The construction of the dam will create a significant change to the area, but its impact will not necessarily be negative. The residual flow in the falls will still conserve an attractive interest for tourism. The infrastructure of the Rusumo dam and hydroelectric facilities could also represent a tourist attraction for people in the region.

The potential and residual impact is expected to be negligible magnitude and not significant. No control and prevention measures or enhancement measures are recommended.

### 6.7.11. Impacts on Physical Cultural Heritage

No physical cultural heritage sites have been identified in the project affected area, however a chance find procedure to manage any chance finds during the construction activities will be put in place.

### 6.7.12. Impact on International Border between Rwanda and Tanzania

The construction of the dam and the creation of the permanently flooded marshland extending upstream from the dam for a distance of approximately 5 kilometres could affect the international border between Rwanda and Tanzania. The Kagera River represents the border between the two counteries and the creation of the permanently flooded area will cause the marshland on both sides of the river to be permanently flooded, and could physically hide the position of the border. However, this is thought to be unlikely. The water depth in the permanently marshland will be much the same as the natural situation during the rainy season (May) and the papyrus reeds of the marshland will remain clearly visible, as will the position of the river. The creation of the permanently flooded area is not expected to have a negative effect on the papyrus reeds and no changes to the morphology of the main river channel are expected. Neverthess before construction of the dam starts it is it is recommended that electronic coordinates of the order by taken jointly by both countries to ensure that there is no future dispute regarding the exact position of the boundary.

## 6.8. CUMULATIVE IMPACTS

### 6.8.1. Introduction

Cumulative impacts are the environmental and social effects of a project in combination with the effects of other existing projects and/or projects that are being carried out, or are reasonably foreseeable, in respect of specific components of the environment and social conditions. The assessment is carried out to ensure that the cumulative impacts are identified and evaluated in an integrated manner at the catchment basin level.

The assessment considers the effects of projects that may interact cumulatively with those of the Project based on available existing information, especially as can be provided by the Governments of Burundi, Rwanda and Tanzania as well as NELSAP, the World Bank Group, the African Development Bank, bilateral development organizations, and other regional or national organizations. Projects to be particularly encompassed by the assessment include hydroelectric power generation, electricity transmission and distribution infrastructure, irrigated agriculture, development of parks and protected areas, and other uses of basin water that involve significant hydrological or water quality effects.

### 6.8.2. Interacting Project

***Nyabarongo I Hydroelectric Project***

Nyabarongo I is a run of the river power plant with a design capacity of 27.5 MW (two 14 MW Francis turbine) and an estimated cost of US$97.7 million. The project is financed by a line of credit with Exim Bank of India and the balance is financed by the Government of Rwanda (Allafrica, 2010). The project is located on Bijyojyo Hill, in Ngororero District, Western Province (see Figure 6-24). The construction of the power plant began in May 2009 and it should be commissioned by early 2013. It will then become the largest domestic hydropower project of Rwanda. The project is built under a turnkey contract by a consortium of India's Bharat Heavy Electricals Ltd. (BHEL) and Angelique International Ltd. Since the project is a run of the river type of hydroelectric project, it will not modify the hydrology of the river. However, the sedimentation in the reservoir may reduce the suspended solid in the water discharged from the reservoir.

***Nyabarongo II Hydroelectric Project***

Nyabarongo II is a multipurpose project. In addition to the production of hydroelectricity, the project will supply water and power to Kigali and for irrigated perimeter. It is located in the Bwenda Sector, Gakenke District of the Northen Province (see Figure 6-24). The Strategic/Sectoral Social and Environmental Assessment of Power Development Options (SLII, 2006), which included a comparative analysis of power development options screened out the Nyabarongo II project as a viable alternative to the Rusumo Falls project (See § 5.4.2). The project involves diversion from the river from the dam/intake to the powerhouse over some 8 kilometres and the projected energy cost from the project is high, with the firm energy cost estimated as 15 cents/kWh.

The Nyabarongo II project was originally intended to develop 8,152 ha of land in the region of Bugesera. But in 2009 in an evaluation report by the AfDB (Integrated Rural Development Project of the Natural Region of Bugesera (Rwanda-Burundi), advocated instead a project of 1,500 ha. At the time, domestic and industrial water needs were estimated at 15 cubic metres per second, or a total corresponding to 6% of the flow of the Kagera. By reducing the amount of water in the Nyabarongo River, a tributary of Kagera River, this project may have an impact on the production of energy at the Rusumo Falls power plant. However, predictions of climate change for the East Africa indicate a trend of increased precipitation and flow which may counterbalance the effect.

***Kakono Hydroelectric Project***

Downstream of the Rusumo Falls, and downstream of the Akagera park, the proposed Kakono hydro dam project is located in Tanzania. This project should place in 2015. The Strategic/Sectoral Social and Environmental Assessment of Power Development Options (SLII, 2006), which included a comparative analysis of power development options identified the Kakono project as of interest but it is not a viable alternative to the Rusumo Project.

The 53 MW project would be located in Tanzania, on the Kagera River near the Uganda border, approximately 90 km to the west of the city of Bukoba and Lake Victoria (See Figure 6-24). Part of the benefit of this option would be the provision of irrigation water.

The river is already naturally regulated by the Nyabarongo marshland and the Akagera lakes system, and the adoption of a run-of-river scheme for the Rusumo Falls project will mean that there will be no perceivable impact on the Kakono Project.

***Powerline Component of the Rusumo Falls Hydrolectric Project***

Three power lines will link the Rusumo Hydroelectric power plant to Gitega in Burundi, Kigali in Rwanda and Nyakanazi in Tanzania. These power lines will have some negative impacts on the land use and the land tenure but may also provide an opportunity to develop rural electrification of small villages along each of the power lines.

***Isaka-Kigali / Keza-Gitega-Musongati Railway Project***

In 2009, the African Development Bank (AfDB) Group approved combined loans and grants to finance a multinational Railway Project Study in Tanzania, Rwanda and Burundi. The project is part of the East African Community priority investment program. The Phase I of the project (co-financed by the AfDB)has been completed and  analysed various rail alignments. Phase II will focus more on deepening the institutional framework and structuring the project in the form of a Public Private Partnership (PPP).

The length of the line between Isaka and Kigali is 494 kilometres overall and each of the three alternative corridor routes passes the border between Rwanda and Tanzania at the site of the Rusumo Falls. Also the tentative planning for the railway project was for the construction to start in 2014, thus overlapping with the construction period for the Rusumo Falls dam and power plant. There is consequently concern regarding potential interaction and cumulative impacts between and resulting from the railway project and the dam and powerplant construction and operation.

The feasibility study proposed that the railway line crosses the Kagera River downstream of the existing Rusumo road bridge. However the feasibility study did not determine with precision the exact location or elevation of the crossing point, in order that the railway line project can be harmonised with the dam project design (which was not completed at that time). However, the ESIA Consultant was able to interview representatives from the Rwanda Transport Development Agency, who informed the Consultant that the railway line will cross the Kagera River downstream of the future dam, and some 50 metres downstream from the future new bridge that will be constructed in the context of the *Rwanda International Bridge and One Stop Border Post*, which is currently in the construction phase (see below). The alignment of the railway on each side of the bridge has also not been determined at the feasibility stage.

With respect to the schedule for project implementation, the Rwanda Transport Development Agency informed the ESIA Consultant that the project is still in the feasibility stage and there is much uncertainty regarding the overall project schedule. However, the construction works will not be starting in 2014 as initially planned.

Despite the early stage in the development of the railway project it can be anticipated that the railway will pass over the headrace tunnel of the hydroelectric power plant.

***Rwanda International Bridge and One Stop Border Post***

The project aims at replacing the old Rusumo bridge with a new international bridge on the Akagera River between Rwanda and Tanzania border, constructing a road serving the border facilities and introducing OSBP facilities. The Rusumo International Bridge will be constructed downstream, at 15m from the existing bridge. The impossibility of introducing bridge piers in the river means that the bridge must be a single span bridge with a length of 80 m. The One Stop Border Post (OSBP) on the Rwanda side will be constructed 750m from the current border post while on the Tanzania side they will be at the same site of the current border post.

The project components and layout is illustrated in Figure 6-21. The project schedule is provided in Figure 6-22.

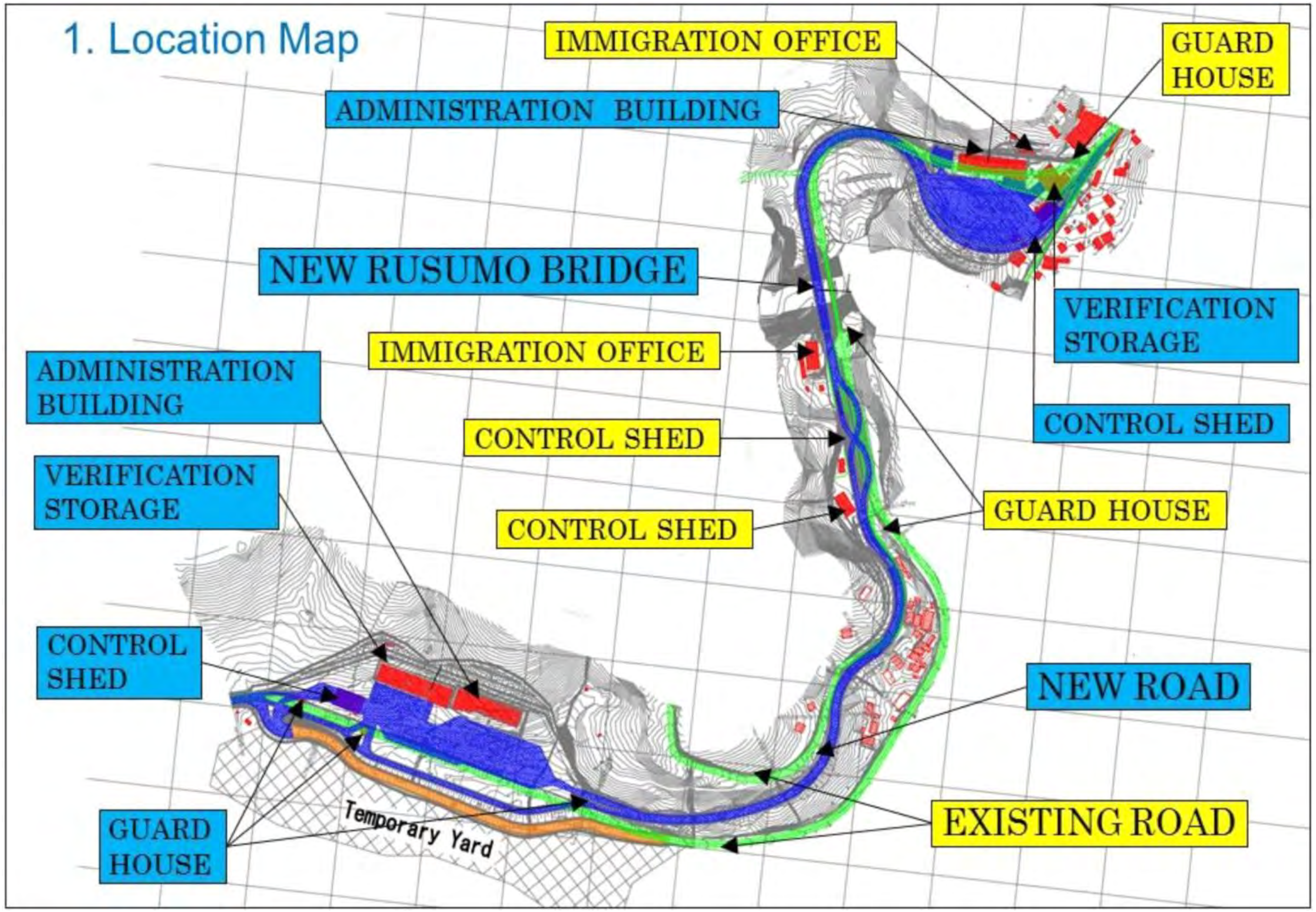


**Figure 6-21 Components and Layout of Rusumo International Bridge and One Stop Border Post Project**

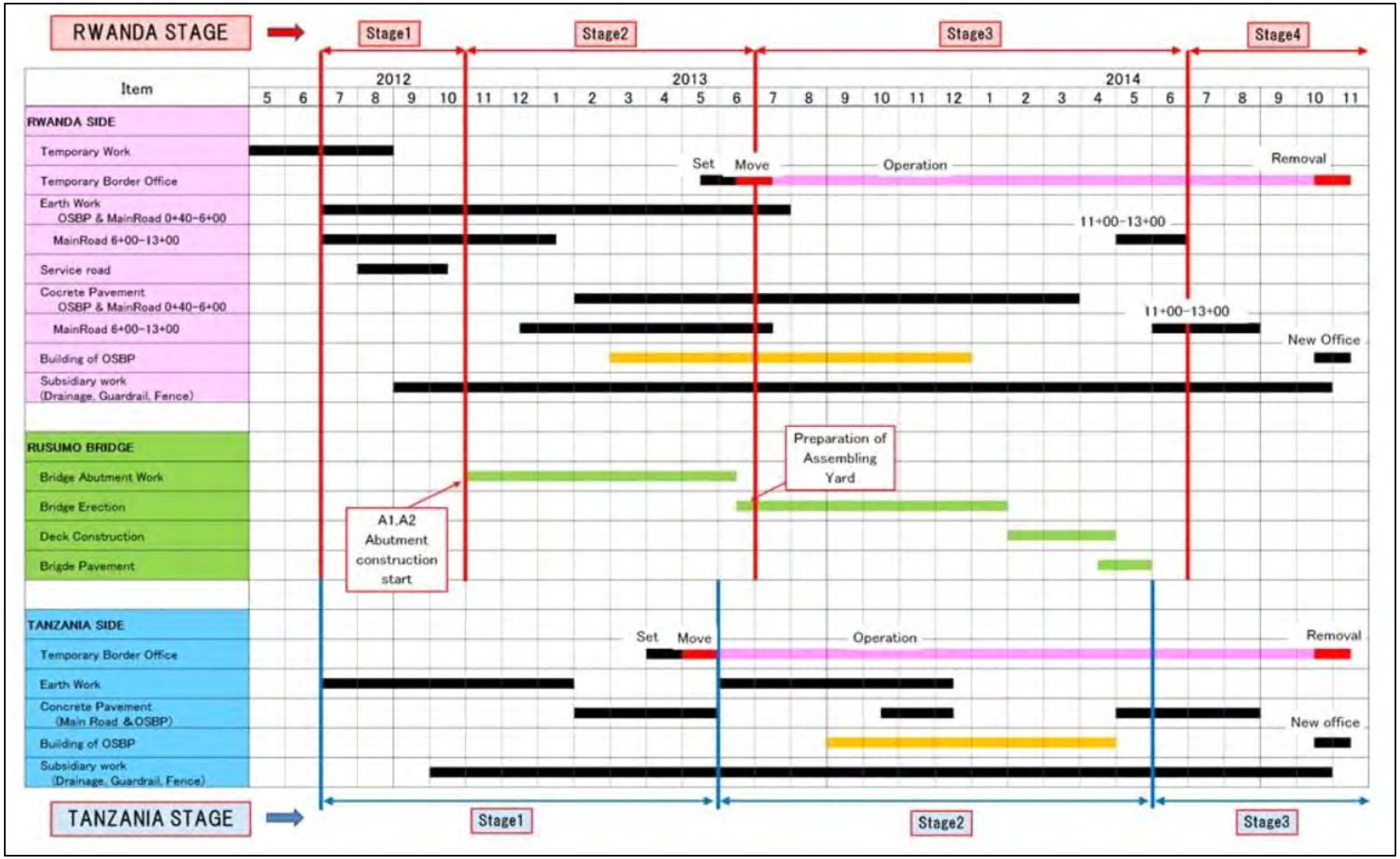


**Figure 6-22 Implementation Schedule for the Rusumo International Bridge and One Stop Border Post Project**

### 6.8.3. Interactions and Cumulative Impacts with Projects at the Rusumo Falls Site

The projects which potentially could interact with the dam and powerplant project comprise: (i) the Isaka-Kigali / Keza-Gitega-Musongati Railway Project and (ii) the Rwanda International Bridge and One Stop Border Post. The hydroelectric projects upstream are not expected to interact or cause cumulative impacts. However, the Nyabarongo II Hydroelectric Project may cause reduced river flow and consequently reduced power production by the Rusumo powerplant.

***Timing***

In terms of timing, the dam and powerplant construction works will start in Q2 2015 and continue through to the end of 2018, manufacture of the electromechanical plant will start in Q2 2015 and installation is expected to start in Q3 2017 and continue through to the end of 2018. Commissioning will start at the end of 2018.

The construction schedule for the Isaka-Kigali / Keza-Gitega-Musongati Railway Project is unknown. Works were anticipated to start in 2014, but the project has been delayed. It is unlikely that work will start in 2014, but could start before the end of 2018.

The Rwanda International Bridge and One Stop Border Post project construction is currently underway and is expected to be terminated end of 2014. There will therefore be no period of overall when construction on both projects will be underway simultaneously, unless the progress with the One Stop Border post is delayed.

***Overlapping of Facilities***

The layout of the facilities provided in Figure 6-23 shows how the layout of the facilities for dam and powerplant are located in relation to the facilities for the the Isaka-Kigali / Keza-Gitega-Musongati Railway Project and the Rwanda International Bridge and One Stop Border Post.

It can be seen that there is no overlapping of facilities, with the exception of the borrow area N°1 for the dam and powerplant which is located where the Rwanda OSBP is currently being constructed. The action to be taken for this is that an alternative location be found by the construction contractor.

The construction of the dam will require the construction of a temporary deviation channel on the Rwanda bank and this will require that a temporary bridge for the existing road (and future new road) leading to the existing (and future new road bridge) be constructed. This is included in the dam design.

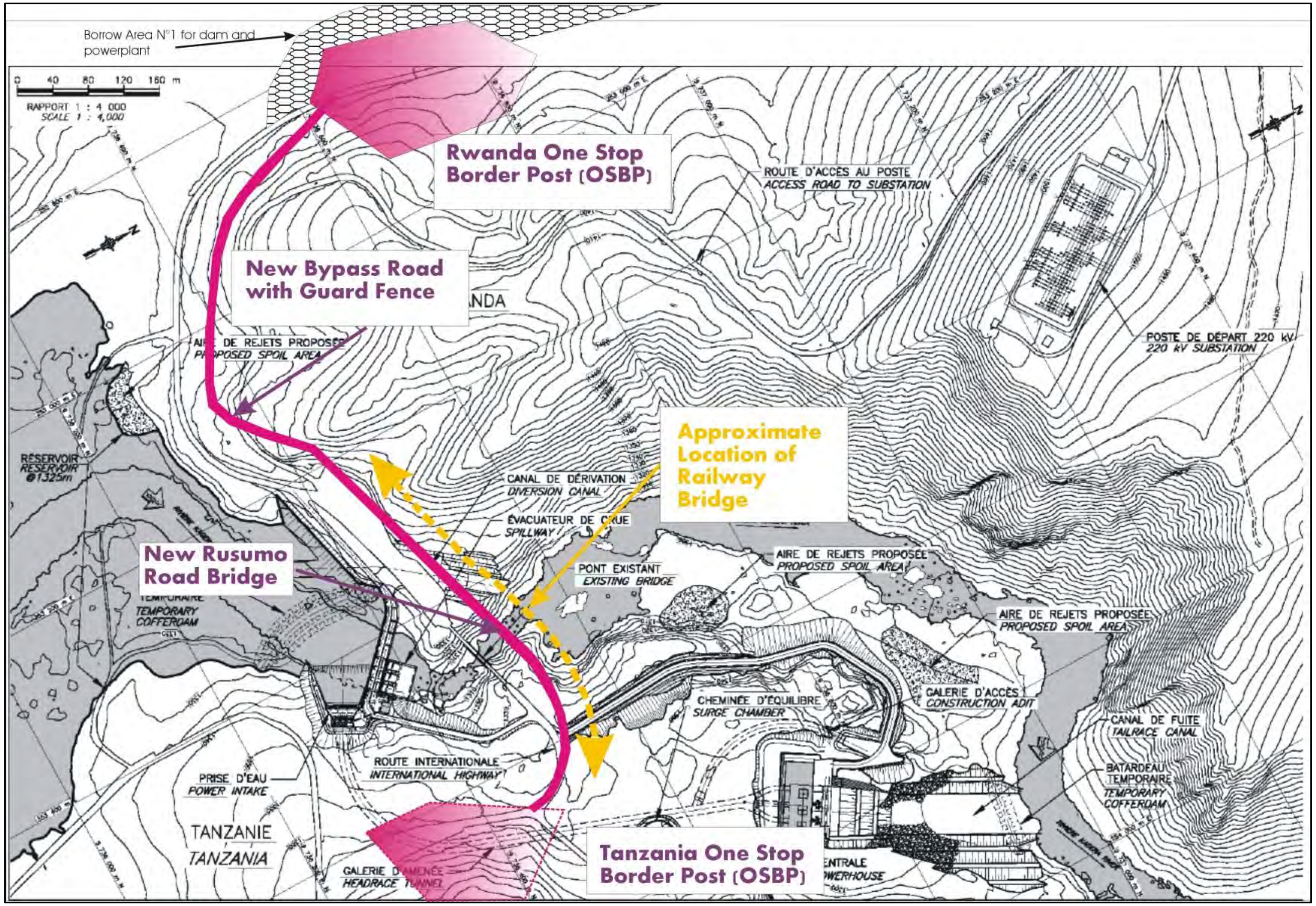


**Figure 6-23 Layout of Neighbouring Projects at Rusumo in Relation to the Dam and Powerplant Project**

*Cumulative Impacts*

If the One Stop Border Post is completed as per the planned implementation schedule, there should be no cumulative impacts. Howver, if project progress is delayed there are potentially some cumulative impacts on the residents of the villages of Rusumo East (Rwanda) and Rusumo (Tanzania):

- There will be increased impact on ambient air quality and noise levels caused by the combined dust and exhaust fumes and noise from the two projects for the duration of the simultaneous construction works if the two projects are running simultaneously;
- There will also be an increased risk of road accidents associated with the increased number of vehicles on the roads around the site during the period of simultaneous works;
- There will be increased demand for services which will contribute to the economic development but also increase the difficulties of managing the influx of people and the risk of the creation of spontaneous settlements, which in turn increase the risk to public health.

Similar issues could occur between the Rusumo dam and powerplant construction works and those of the Isaka-Kigali / Keza-Gitega-Musongati Railway Project if the later starts before the end of 2018.

### 6.8.4. Cumulative Impacts on Flows and Water Levels in the Kagera River Basin above and below the Rusumo Falls

There will be an increase in the water levels of the Kagera River upstream from the dam. However, the increase in water level will not extend as far as the Rweru River some 80 kilometres upstream. The dam will function as a Run-of-River Scheme with the water level will be maintained at 1,320 metres asl.

During the period May to October (dry season), the inlet flow rate to the marshlands from Lake Rweru declines, and under natural conditions the water level is reduced. The presence of the dam will create a permanently flooded area upstream, but there will be no water storage and there will be no change in river flows or water levels of the Kagera River downstream from the dam. Also, there will be no daily fluctuation in river flow. The flow rate will be constant on a daily basis.

During the period October to May when there are rains and the river flow increases to a maximum, and the water level at the dam site will be very similar to that of natural conditions. The outflow from the powerplant combined with any water discharged trough flood spill ways and the environmental flow will be the same as natural situation. Consequently there is no change in river flows or water levels of the Kagera River downstream from the dam. Also, there will be no daily fluctuation in river flow. The flow rate will be constant on a daily basis.

### 6.8.5. Cumulative Impact on Water Quality and Aquatic Habitats Upstream and Downstream of the Proposed Dam Site

Because the dam will function as a Run-of-River scheme, there is minimum storage of water. However, there will be creation of 977 ha area of permanently flooded marshland. The vegetation that will be flooded is the papyrus, which is naturally seasonally flooded. The creation of a permanent area will not completely submerge the papyrus and no degradation is expected and consequently no water quality issues are expected. Some water quality issues could occur downstream from the dam during the construction phase related to discharge of treated sanitary wastewater and accidental spills and leaks of hazardous materials. However, this risk should be minimised with the implementation of the environmental management plans.

### 6.8.6. Cumulative Impact on the Ecological Integrity of Protected Areas

The protected areas which are of concern are the Akagera National Park (Rwanda), Kimisi Game Reserve (Tanzania) downstream from the dam and the Lake Rweru upstream from the dam. Because no change in downstream hydrology is expected, no impacts on ecological integrity of the downstream protected area are expected. Figure 6-25 illustrates the location of the protected areas in relation to the Rusumo Falls.

### 6.8.7. Cumulative Impact Related to Sedimentation in the River System Upstream of Rusumo Falls

During the operation phase, there are some concerns with regard to sediment:

*At the dam site*: The waters of the Kagera River are naturally high in sediment load and this could increase with time due to the effects of deforestation and erosion in the catchment basins. The physical presence of the dam could be a physical barrier for sediment transported by the river water, and there is concern that sediment will accumulate at the base of the dam.

Sediment deposition upstream of the dam was studied using hydraulic modelling to determine the quantity of sediment deposited in the Intermediate Development Scheme reservoir. The modelling took into account the results of sediment grain size analysis of samples taken from the water of the Nyabarongo, Mbuye, Rusumo Falls in the Kagera River, and in the Ruvubu River near its confluence with the Kagera River. The analysis shows that 80% of the solids consist of grains of equivalent diameter less than 0.05 mm and that 100% of the grains are smaller than 0.1 mm. The sediment grain size is very fine and mostly clay.

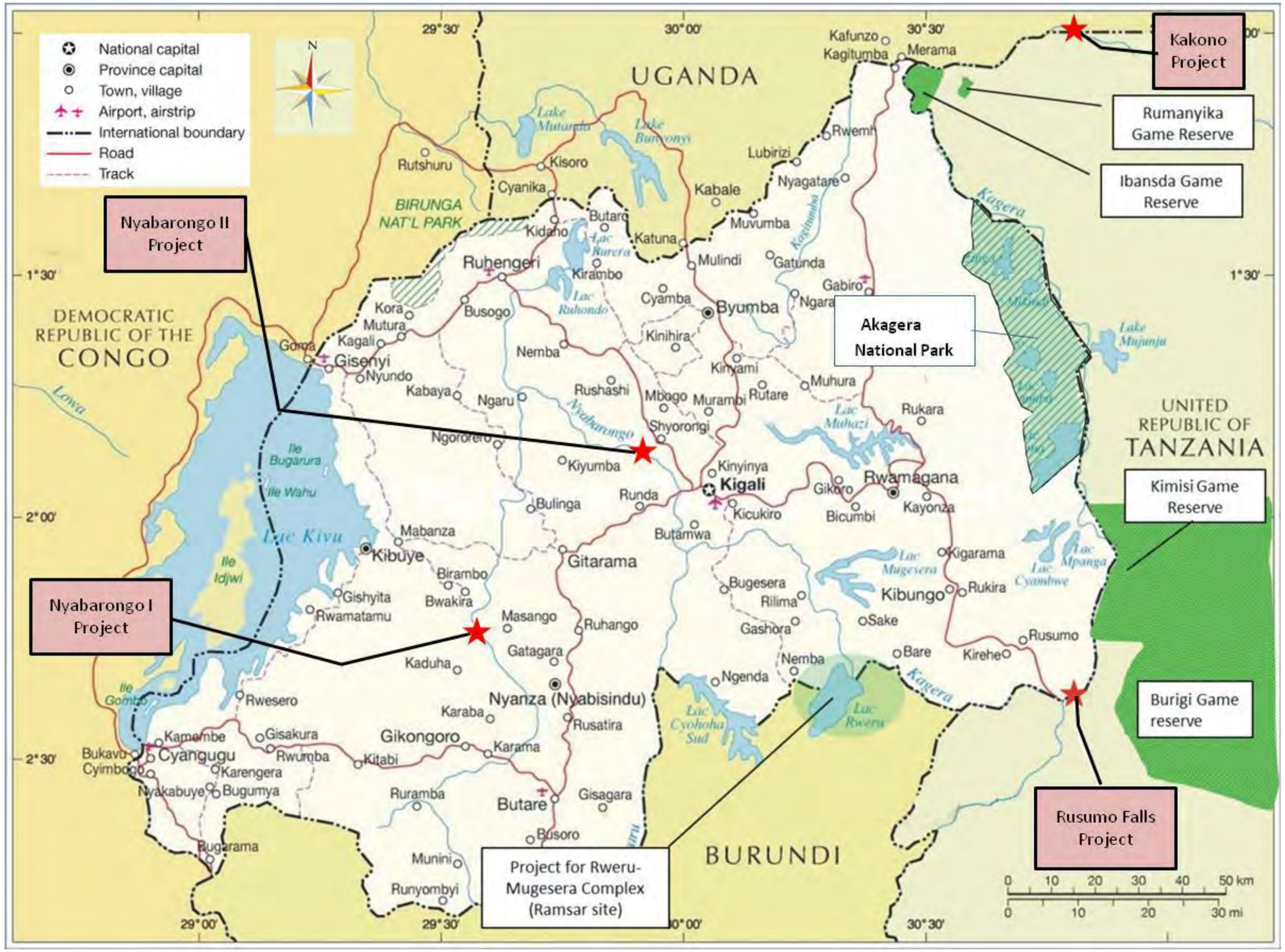


**Figure 6-24 Protect Areas and Neigbouring Hydropower Project in Relation to the Rusumo Falls Site**

The modelling study found that sediment deposition would be negligible and that it would not affect power production capacity. During the detailed design the modelling study (See ESMP PAP-06) will be updated to take into account the river hydrology of the run-of-river scheme and additional sediment load data from tributaries of the Kagera River which were not taken into account in the first study. It is expected that the study will demonstrate that sediment deposition will not be an issue because the run-of-river scheme will not create a reservoir where slow flowing waters will allow the fine sediment to settle. The sediment will therefore be transported with the riverwater to powerhouse, through the turbines and be released back into the Kagera River downstream form the dam. The powerstation and turbines will be designed to withstand the presence of sediment.

*Downstream from the dam*: As a result of the physical presence of the dam and any trapping of sediment (if any), the consequence could be reduced sediment load in the river waters downstream of the dam and risk of modifications to river morphology. This risk is thought to be low and will be confirmed through a sediment deposition study (See ESMP PAP-06). Nevertheless sediment deposition will be monitored (see ESMP PAE-05).

### 6.8.8. Cumulative Impact of Current and Anticipated Socioeconomic and Settlement Patterns

The Project Affected People in the villages of Rusumo and Rusumo East comprise 244 households. The people have confirmed that they wish to be compensated in cash and not with land or to be relocated to a resettlement village. The people wish to remain close to their villages as they anticipate that the Rusumo and Rusumo East villages will develop economically as a result of the project. A land availability appraisal has been carried out as part of the Resettlement Action Plan and land is currently available. However, there are signs of speculation with people from outside the area buying land, thus increasing the price of land and reducing availability. The project could also create a “boom town effect” and result in an influx of people. There is a risk of a cumulative impact related to the reduced land availability due to combined effect of Project Affected People from the Rusumo Project, the new bridge project and the railway project receiving compensation and seeking to buy land in the vicinity, and this combined with a “boom town effect”.

This issue will be managed through a number of action plans: (i) the Resettlement Action Plan (RAP), (ii) the management plan for interaction with neighbouring project (see ESMP PAP—07), (iii) the management plan for management of spontaneous settlements (see ESMP PAP-08) and (iv) various construction contractor plans dealing with recruitement, management of public health and management of temporary camps (See ESMP § 7.5.2).

### 6.8.9. Summary of Cumulative Impacts and Interactions

**Table 6-15 Summary of Cumulative Impacts and Interactions**

| Project | Interaction, cumulative impact | Management Programme |
|---|---|---|
| **Project that can interact with Rusumo dam and powerplant project** | | |
| Nyabarongo I hydroelectric proeject | Run-of-river scheme - no interaction / no cumulative impacts | None |
| Nyabarongo II hydroelectric project | Project will divert upstream water to an irrigation scheme - 6% reduced water flow in Kagera river – reduced power production capacity – may be compensated by increased precipitation and river water flow as a result of climate change | Monitoring of river hydrology (see ESMP) |
| Kano hydroelectric project | Located downstream of the Akagera national park, no interaction with Rusumo dam and power plant | None |
| Isaka-Kigali / Keza-Gitega-Musongati Railway Project | Construction schedule and line alignment unknown, potential interaction with dam and powerplant construction works if construction starts before end of 2017<br>Potential issues related to increased impact on air quality, noise levels, road safety, demand for services, spontaneous settlements | Management plan for coordination with neighbouring projects (see ESMP) |
| Rwanda International Bridge and One Stop Border Post. | If construction proceeds as per planning the start of the dam and powerplant construction will be after rge One Stop Border Post construction has terminated<br>Potential issues in the case of delays are related to increased impact on air quality, noise levels, road safety, demand for services, spontaneous settlements | Monitoring and management plan for coordination with neighbouring projects (see ESMP) |
| **Protected areas, valued ecosystems and game reserves upstream and downstream of Project** | | |
| Akagera National Park (Rwanda) | Rusumo dam and powerplant does not modify downstream river hydrology – no impact on hydrology<br>Dam may trap sediment causing reduced sediment transport downstream – causing changes in river morphology and reduced sediment transport to Lake Ihemat | Sediment transport study to be carried out during detailed design, taking into account recent data available on sediment transport upstream of Rusumo Falls.<br>The dam and water inlet design will be adapted to maximise the trans<br>Monitoring of sediment transport and changes in river morphology |
| Akagera wetland (Tanzania) | As for Akagera National Park above | As for Akagera National Park above |
| Kimisi Game Reserve (Tanzania) | As for Akagera National Park above | As for Akagera National Park above |
| Ibanda and Rumanyika Game Reserves (Tanzania) | Unlikely that the impact on sediment | As for Akagera National Park above |

## 6.9. IMPACTS FROM DECOMISSIONING

### 6.9.1. Decommissioning of Temporary Facilities and the End of the Construction Phase

The decommissioning of the temporary facilities is described in § 3.6, and summary of the principal aspects is as follows:

- The temporary river diversion channel will be plugged with concrete at both the inlet and outlet and the channel will be backfilled using material from the deconstruction of the coffer dam and closure dike;
- The cofferdams and closure dike will be deconstructed by progressively removing the construction material using mechanical shovels and earth moving equipment. The removed material can be used for the backfilling of the temporary river and for road construction. The remaining material will be deposited in the designated spoil areas which are indicated on Figure 3-9.

The plugging and backfilling of the diversion channel will not generate an impact on river hydrology or the aquatic environment. The movement of the earthmoving equipment from the deconstruction of the cofferdams will be along existing tracks land in the immediate vicinity of the diversion channel will already have been impacted during the construction of the channel, and no further impact will be incurred on the land use or land cover.

The deconstruction of the cofferdam and closure dike upstream from the dam will not affect river hydrology. There may be some increased sediment load in the river water of which some will be transported with the water to the powerhouse and released at the tail race discharge and some may accumulate at the base of the dam. The quantity of sediment released and deposited is expected to be negligible and the release of short duration. The deconstruction of the cofferdam upstream of the tail race discharge will also result in a increased sediment load in the river, but again the quantities will be negligible and for a short duration.

The material from the deconstructed cofferdams and dike will be in part used for backfilling the temporary diversion channel. The rest will be deposited in the designated spoil areas. Addressed in impacts on land use (§6.3.2). The spoil areas will be managed by the construction contractor through the implementation of an action plan (see ESMP PAC-02: Management of borrow areas and spoils).

The transport of the material by earth moving equipment and truck will create some dust and noise emissions and these are addressed with impacts on air quality (see §6.3.3).

At the end of the decommission activities the disturbed areas will rehabilitated and revegetated by the construction contractor (see ESMP PAC-07: Site revegetation and rehabilitation plan).

### 6.9.2. Decommissioning at the End of the Operating Life

The operating life of the dam and powerplant is expected to be in the order of at least 50 to 80 years or even more. When the decision is taken to terminate production and deconstruct the scheme, the dam and associated structures will be deconstructed and the excavated material will be disposed of in accordance with the regulations in force at that time. The material could be used for road construction or disposed of at suitable spoil areas which will be defined with local authorities. The tail race and head race tunnels will be blocked with concrete plugs. The electromechanical equipment will be dismantled, and scrap iron and steel recycled. Buildings will be deconstructed and the waste materials managed as for the deconstructed material from the dam. All other equipment will be removed and disposed of, or recycled when possible.

The deconstruction of the dam and associated structures will result in a temporary increased sediment load in the river downstream from the work site, the sediment originating from the dam structure material. The quantities released will be negligible compared to the total quantities of sediment naturally transported per year by the river and no detectable impacts are anticipated. Once the dam structure has been removed, any sediment which has been trapped upstream of the dam during the operating life will then be progressively transported downstream by the flow of the river. It is expected that there will not be significant quantities of sediment trapped (to be confirmed through modelling during the detailed design phase), and the increased sediment load in the river is therefore expected not to be discernible.

The deconstruction of buildings and dismantling of electromechanical equipment will result in the creation of both hazardous and non-hazardous waste. Because the decommissioning will be performed in 50, 80 or even 100 years-time it is not possible to plan in detail how the waste will be managed. Nevertheless, much of the waste will be inert building waste that could be reused in building works and the disposal of the inert waste in suitable spoil areas is not expected to be of environmental concern. Scrap metal can be recycled and hazardous waste will probably comprise waste that has been used to store chemicals, hydrocarbons and other hazardous materials.

A decommissioning plan will be prepared before the start of the decommission operations and which will address the regulations in force at that time and will include management of job losses.

## 6.10. IMPACT ANALYSIS AND MITIGATION MEASURES

The impacts discussed in §6.2 – 6.8 are summarised in the following tables, which characterise impact, rank impact magnitude and significance and provide details of the control and mitigation measures that are described in detail in the ESMP (Chapter 7).

**Table 6-16 Summary of Environmental Impact Analysis and Mitigations**

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impact on hydrology | Construction phase – temporary river deviation | No flow over Falls and along bypassed section of river | Rusumo Falls and 100 stretch of Kagera River downstream | Negative, direct / Major (local scale) | During construction | Duration of construction (5 years) | Reversible | N/A | High local Significance | Environmental flow (included in design) |
| | Operation phase – river deviation | No flow over Falls and along bypassed section of river | Rusumo Falls and 100 stretch of Kagera River downstream | Negative, direct / Major (local scale) | Operation | Duration of functioning of dam | Reversible | N/A | High local Significance | Environmental flow (included in design) |
| | Operation phase – maintaining upstream water level at 1,320 m | Change in seasonal marshland flooding regime | Kagera valley marshlands extending 15 km upstream | Negative, direct / Minor – Moderate (local scale) | Operation | Duration of functioning of dam | Reversible | N/A | Low local Significance but creates significant impacts on flora, fauna and socio-economics | None |
| Impact on land use | Land take for construction works | Change in land use | 61 ha located at Rusumo West, Rusumo East and Rusumo villages | Negative, direct / Major (local scale) | Pre-construction | Duration of functioning of dam | Reversible | N/A | High local Significance | Minimisation of construction area footprint (Contractor E&S specification) |

**Table 6-16 Summary of Environmental Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impact on land use *(cont.)* | Change in seasonal marshland flooding regime (impact on hydrology) | Loss of arable marshland | Between 187 – 700 ha | Negative, direct / Minor (local scale | Operation | Duration of functioning of dam | Reversible | N/A | Low local Significance but creates significant impacts on flora, fauna and socio-economics | None |
| Impact from sediments | Civil works, clearing of vegetation | Rainwater runoff transporting sediment into river | River area around Rusumo Falls and downstream (2 – 3 km) | Negative, direct / Negligible - minor | Construction | 5 years | Reversible | N/A | Low local Significance | 1. Contractor E&S specification<br>2. Management of spoils<br>3. Erosion and sediment control<br>4. Supervision of construction works<br>5. Monitoring |
| | Physical presence of dam trapping sediment upstream of dam | Reduced electricity production and operating life | N/A | Previous studies quantify as negligible – to be confirmed | Operation | Long-term | Not reversible | Unknown | Potentially high regional significance | Sediment transport (and adaption to dam design of necessary) |
| | | Reduced sediment load causing modification to river morphology | Kagera river downstream from Falls | To be confirmed by sediment transport study in detailed design | Operation | Long-term | Not reversible | Unknown | Potentially high regional significance | 1. Adaption to dam design to minimise trapping of sediment<br>2. Monitoring of sediment deposition and changes in river morphology |

**Table 6-16 Summary Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impact on water quality | Construction – wastewater discharge and accidental leaks and spills | Discharge of polluting substances into Kagera River | Kagera River downstream from Falls | Negative, direct<br>Potentially Moderate – Major<br>Negligible – minor with effective control measures | Construction phase | Short-term | Reversible | Low risk of major spills and pollution<br>Medium risk of negligible to minor spills | High local significance | 1. Contractor E&S specification<br>2. Hazardous substance management<br>3. Accidental spill and preparedness and response plan<br>4. Water quality monitoring and control<br>5. Supervision of construction works |
| Impact from noise and vibration | Construction activities, road transport | Noise and vibration | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct<br>Potentially moderate<br>Minor to moderate with effective control measures | Construction phase | Duration of construction (5 years) | Reversible | N/A | High local significance | 1. Contractor E&S specification<br>2. Management of noise and vibration<br>3. Management of road traffic and access<br>4. Noise and vibration monitoring and control<br>5. Supervision of construction works |
| | Operation of powerplant and associated facilities | Noise emissions | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct<br>Minor and localized | Operation phase | Duration of functioning of powerplant | Reversible | N/A | Low local significance | Design of power plant |

**Table 6-16 Summary Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impacts on air quality | Construction - civil works | Dust and exhaust emissions | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct<br>Potentially moderate<br>Minor to moderate with effective control measures | Construction phase | Duration of construction (5 years) | Reversible | N/A | High local significance | 1. Contractor E&S specification<br>2. Management of dust and air quality<br>3. Management of road traffic and access<br>4. Air quality and dust monitoring and control<br>5. Supervision of construction works |
| Impacts on climate | Operation, availability of electricity – reduction in burning fossil fuels | Reduced GHG emissions on regional scale | Region | Positive, indirect<br>Minor | Operation phase | Duration of functioning of powerplant | N/A | N/A | Moderate Regional significance | N/A |
| Visual impact | Physical presence of dam and facilities | Change in landscape and no water flowing over waterfall | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct /<br>Major<br>(local scale) | Construction | Long-term | Reversible | N/A | High local significance | Environmental flow<br>(included in dam design) |

**Table 6-16 Summary Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impacts on natural habitat and flora | Change in terrestrial land use | Loss of terrestrial natural habitat | Rusumo West and East Rwanda (2 ha)<br>Rusumo, Tanzania (27 ha) | Negative, direct /<br>Minor<br>(local scale) | Pre-construction and construction | Long-term | Reversible | N/A | Low local significance | 1. Contractor E&S specification<br>2. Site flora and fauna protection plan<br>3. Quarries management plan access<br>4. Site re-vegetation and rehabilitation<br>5. Supervision of construction works |
| | Bypassing Rusumo Falls and 500 m stretch of river (Impact on hydrology) | Negative direct<br>Degrading / loss of habitat | Rusumo Falls spray zone | Minor – Moderate<br>(local scale) | Construction phase and continued during operation | Long-term | Not reversible | N/A | Low local significance | 1. Environmental flow (included in design)<br>2. Supervision of of construction activities<br>3. Biodiversity monitoring |
| | | | Kagera River downstream from Falls – 500 m | Moderate<br>(local scale) | Construction phase and continued during operation | Long-term | Not reversible | N/A | Low regional significance | Environmental flow<br>(included in design) |

**Table 6-16 Summary Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impacts on natural habitat and flora *(continued)* | Operation phase – maintaining upstream water level at 1,320 m | Change in seasonal marshland flooding regime – creation of permanent flooded and additional flooded areas | Kagera valley marshland extending 15 km upstream from the dam | Positive Minor (local scale) | Operation phase | Long-term | N/A | N/A | High regional significance | Adoption of Run-of-River alternative |
| Impact on fauna | Construction – change in land use and physical presence of construction workforce | Physical disturbance, loss of terrestrial habitat | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct / Major (local scale) | Construction phase | Long-term | Not reversible | N/A | High local significance | 1. Contractor E&S specification<br>2. Site flora and fauna protection plan<br>3. Quarries management plan access<br>4. Site re-vegetation and rehabilitation<br>5. Supervision of construction works |
| | Bypassing of Rusumo Falls and downstream stretch of river | Loss of habitat | Rusumo Falls spray zone and 500 m stretch of downstream river | Negative, direct / Major (regional impact) | Construction phase and continued during operation | Long-term | Not reversible | N/A | High regional significance | 1. Environmental flow<br>2. Biodiversity monitoring |

**Table 6-16 Summary Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Impact on fauna *(Continued)* | Operation phase – maintaining upstream water level at 1,320 m | Change in seasonal marshland flooding regime – change in habitat | Kagera valley marshland extending 15 km upstream from the dam | Positive and negative, direct and indirect<br>Negligible – minor<br>(local scale) | Operation phase | Long-term | Not reversible | N/A | Low local significance | Biodiversity monitoring |
| Impact from waste | Construction activities in general – waste production | Inappropriate waste management | Vicinity of Rusumo West, Rusumo East and Rusumo villages | Negative, direct<br>Potentially Moderate – Major<br>Negligible – minor with effective control measures | Construction phase | Long-term | Reversible | Low risk of major pollution and contaminat-ion<br>Medium risk of negligible to minor contamina-tion | High local significance | 1. Contractor E&S specification<br>2. Waste management<br>3. Supervision of construction works |

## Table 6-17 Summary of Socioeconomic Impact Analysis and Mitigations

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures (enhancement for positive impacts) |
|---|---|---|---|---|---|---|---|---|---|---|
| Direct employment opportunities | Construction works | Temporary employment for local people for construction work | Up to 1,000 temporary jobs – priority to be given to local people | Positive, direct<br>Major<br>(local scale) | Construction | Short term | N/A | N/A | High local significance | 1. Contractor E&S specification (recruitment policy and procedure)<br>2. Workforce recruitment plan<br>3. Supervision of construction works |
| Induced and indirect employment | Construction works | Work for service companies – creation of job opportunities | Induced employment of between 100 – 200 jobs, and which could create up to 600 indirect jobs | Positive, direct and indirect<br>Major<br>(local scale) | Construction | Short term | N/A | N/A | High local significance | 1. Contractor E&S specification (recruitment policy and procedure)<br>2. Plan for contracting service companies<br>3. Supervision of construction works<br>4. Local Area Development Plan (LADP) implemented as part of the Resettlement Action Plan (RAP) |

**Table 6-17 Summary of Socioeconomic Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | **Control and mitigation measures** (enhancement for positive impacts) |
|---|---|---|---|---|---|---|---|---|---|---|
| Socio-economic benefits associated with the economic development of the Project site | Construction works | Increased income of local people | Villages around Rusumo site | Positive, direct and indirect<br>Major<br>(local scale) | Construction | Short term | N/A | N/A | High local significance | As for direct employment and induced/indirect employment above |
| Indirect socio-economic benefits associated with rural electrification | Rural electrification | Improved livelihood of local people | Regional scale | Positive, indirect<br>Moderate<br>(local scale) | Unknown | Long-term | N/A | Some uncertainty as to when benefit will occur as the rural electrification is not part of the Project | High local significance | None |
| Improved fisheries capacity | Permanent flooded area | Increased fish biomass | Area of marshland extending from dam 15 km upstream along Kagera valley | Positive, direct<br>Minor<br>(local scale) | During operation of dam | Long-term | N/A | N/A | High local significance | Monitoring of fish species and fisheries |

**Table 6-17 Summary of Socioeconomic Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Assistance to farms through LADP | LADP | Assistance to improve farming practices and crop production yields | Villages along the banks of Kagera valley extending 15 km upstream from the dam | Positive, direct<br>Minor<br>(local scale) | During operation of dam | Long-term | N/A | N/A | High local significance | Monitoring of fish species and fisheries |
| Impact on people and livelihoods | Land take for construction | Impact on houses, business and livelihoods | Rusumo East, Rusumo West and Rusumo | Negative, direct<br>Major<br>(local scale) | Year before start of construction | Long-term | N/A | N/A | High local significance | Resettlement, Compensation and livelihood restoration<br>(see RAP) |
| | Changes in season flooding regime of marshland | Loss of arable marshland | 8 villages (with potential impact on a total of 22 – to be confirmed through monitoring) | Negative, direct<br>Major<br>(local scale) | During operation of dam | Long-term | N/A | N/A | High local significance | Compensation and livelihood restoration<br>(see RAP) |

**Table 6-17 Summary of Socioeconomic Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Spontaneous settlements | Construction work | Influx of workers seeking work | Villages around Rusumo site | Negative, direct<br>Potentially major<br>Minor – moderate with control measures | Construction | Long-term | N/A | High risk – implementing control measures may be difficult | High local significance | 1. Plan for management of spontaneous settlements<br>2. Contractor E&S specification (recruitment policy and procedure)<br>3. Plan for recruiting<br>4. Supervision of construction works |
| Public health and safety related to construction work | Construction work | Nuisances – air quality, road traffic, noise | Villages around Rusumo site | Negative, direct<br>Potentially major<br>Negligible Minor –with control measures | Construction | Short-term | N/A | Low risk – control and mitigation measures are | Low local significance | 1. Contractor E&S specification<br>2. Public health management plan<br>3. Supervision of construction works |
| Infectious diseases | Worker migration to site | Increased prevalence of HIV/AIDS and other STDs | Villages around Rusumo site | Negative, direct<br>Potentially major<br>Minor-moderate with control measures | Construction | Long-term | Not reversible | High risk<br>Effective control measures may be difficult to implement | High significance | 1. Contractor E&S specification<br>2. Public health management plan<br>3. Supervision of construction works<br>4. Plan for prevention and fight against HIV/AIDS |

**Table 6-17 Summary of Socioeconomic Impact Analysis and Mitigations** *(Continued)*

| Type of Impact | Impact producing activity | Description | Extent / location | Nature / Magnitude | Timing | Duration | Reversibility | Likelihood (risk) | Significance | Control and mitigation measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Waterborne diseases | Creation of permanently flooded area – change in seasonal flooding regime of upstream marshland | Increased habitat for waterborne disease vectors | Villages around Kagera valley extending from dam to 15 km upstream | Negligible | During operation of dam | Long-term | Not reversible | Some uncertainty regarding magnitude extent of impact | Probably not significant | Monitoring of water related disease vectors |
| Workforce health and safety | Construction works | High accident rates | Construction workforce | Negative, direct<br>Potentially major<br>Negligible – minor with control measures | Construction | Long-term | Not reversible | Medium risk<br>Effective control measures may be difficult to implement | Low significance on local scale | 1. Contractor E&S specification<br>2. Workforce health and safety plan – and other plans also addressing H&S<br>3. Supervision of construction works |
| Impact on tourist industry | Construction works | Bypassing of Rusumo Falls and physical presence of dam | Rusumo Falls area | Negligible | Construction | Long-term | Not reversible | N/A | Not significant | None |
| Impacts on physical culturel heritage | Construction works | Chance find and disturbance of physical cultural heritage resources | Rusumo Falls area | Negative, Direct and major – but very unlikely | Construction | Long-term | Not reversible | N/A | Not significant | 1. Contractor E&S specification<br>2. Chance find procedure |

# 7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## 7.1. INTRODUCTION

### 7.1.1. Preamble

The role of the Environmental and Social Management Plan (ESMP) process is to identify the impacts which may be caused by the project and to develop a series of attenuating or mitigating measures which will be technically appropriate, financially acceptable and easily applicable in the context of the project. These measures are identified at the stage of the environmental impact assessment. The role of the ESMP is to complement this analysis by defining the operational context in which these measures will be implemented.

The present chapter therefore sets out the principles, the approach, the procedures and methods which will be applied to monitor and reduce the environmental and social impacts resulting from the construction works and subsequent operation of the structures projected at Rusumo Falls.

To this effect, the ESMP includes three complementary Action Programmes that are adapted to the phases of pre-construction, construction and operation of the structures at Rusumo Falls.

- *The Preliminary Action Programme (PAP),* which includes all the measures recommended during the pre-construction period. These measures essentially concern the organisation and training of the teams which will be responsible for environmental and social management during construction and operation of the project, as well as all the complementary studies and investigations identified during preparation of the ESIA and deemed to be necessary before starting the construction works.
- *The Programme of Actions adapted to the Construction period (PAC)*, which defines the principles of organisation and the environmental inspection procedures for the construction sites. This PAC also defines the contractors' obligations in relation to environmental and social management of the construction sites and camps.
- *The Operational Phase Action Programme (PAE)*, which defines the environmental quality controls (water, air and noise) applicable during the period of operation of the structures and necessary to evaluate the environmental efficiency and performance of the corrective measures put in place.

The present ESMP accordingly establishes and describes the context in which all the proposed corrective measures shall be implemented, under the following headings:

- The organisation to be established to ensure effective implementation of the corrective measures and the associated environmental monitoring;
- The role and responsibilities of the various parties to be involved in the Project;
- The principal tasks to be undertaken during the phases of preparation, construction and operation of the project;
- The complementary studies deemed to be necessary;
- The financial resources to be mobilised and their source.

The various management plans proposed will be drawn up according to the current state of engineering design of the Project. All the measures proposed in this ESMP are based on the results of the analysis of impacts and corrective measures outlined in previous Chapter 6 of the present ESIA, and in particular those presented in the Tables 6-16 and 6-17 of the same chapter. These aspects will not therefore be repeated here.

### 7.1.2. List of Environmental and Social Action Plans

Below is a list of the Environmental and Social Management Plans that will be used to manage the environmental and social impacts of the project. Table 7-2 links the management plans to the different impact.

**Table 7-1 List of E&S Action Plans**

| Reference | Title | Responsibiliy |
|---|---|---|
| **Key E&S Procedures (KPs)** | | |
| KP-01 | Communication Procedure | PIU |
| KP-02 | Management of Permits | PIU |
| KP-03 | Procedure for Handling Environmental Events | PIU |
| KP-04 | Recruitment Procedure | PIU |
| KP-05 | Grievance Procedure | PIU |

PIU: Project Implementation Unit

## Table 7-1 List of E&S Action Plans *(Continued)*

| Reference | Title | Responsibility |
|---|---|---|
| **Action Plan for the Preparation Phase (PAP)** | | |
| PAP-01 | Appointment of the PIU's CES | PIU |
| PAP-02 | Preparation of Communication Instruments | PIU |
| PAP-03 | Preparation of the Contractor E&S Specifications | PIU, delegates to OE |
| PAP-04 | Mobilisation of a Panel of Experts | PIU |
| PAP-05 | Design Environmental Flow with Spray System | PIU, delegates to OE |
| PAP-06 | Sediment Transport Study and Necessary Design Adaptations | PIU, delegates to OE |
| PAP-07 | Management of Interactions with Neighbouring Project | PIU assistance from OE |
| PAP-08 | Management Plan for Spontaneous Settlements | Local authorities* |
| PAP-09 | Prevention and Fight against HIV/AIDS and Other STDs | PIU/Local Authorities |
| PAP-10 | Establish International Border Coordinates | PIU |
| RAP | Resettlement Action Plan | PIU |
| **Action Plan for the Construction Phase (PAC)** | | |
| PAC-01 | Waste Management | CC |
| PAC-02 | Management of borrow areas and spoils | CC |
| PAC-03 | Hazardous Substance Management | CC |
| PAC-04 | Accidental spill and Preparedness and Response Plan | CC |
| PAC-05 | Erosion and Sediment Control | CC |
| PAC-06 | Site Flora and Fauna Protection | CC |
| PAC-07 | Site Re-Vegetation and Rehabilitation | CC |
| PAC-08 | Management of Permanent and Temporary Camps | CC |
| PAC-09 | Public Health Management Plan | CC |
| PAC-10 | Management of Air Quality, Dust and Noise | CC |
| PAC-11 | Management of Road Traffic and Access | CC |
| PAC-12 | Chance Find Procedures for Physical Cultural Heritage | CC |
| PAC-13 | Environmental and Social Training Plan | CC |
| PAC-14 | Workforce Recruitment, contracting of services and health and Safety Plan | CC |
| PAC-15 | Quarries Management Plan | CC |
| PAC-16 | Water Quality Monitoring | CC |
| PAC-17 | Biodiversity Monitoring | PIU |
| PAC-18 | Monitoring of Fish Species and Fisheries | PIU |
| PAC-19 | Monitoring of River Hydrology | PIU |
| PAC-20 | Monitoring of Sediment Deposition and Changes in River Morphology | PIU |
| PAC-21 | Implementation of Spontaneous Settlements Plan | Local authorities* |

PIU: Project Implementation Unit; Construction Contractor; OE: Owner's Engineer

* Coordination with PIU needed

**Table 7-1 List of E&S Action Plans** *(Continued)*

| Reference | Title | Responsibility |
|---|---|---|
| **Environmental and Social Supervision during Construction** | | |
| PAC-22 | Monitoring of Construction | OE |
| PAC-23 | Control of Air Quality and Noise Monitoring | OE |
| PAC-24 | Control of Water Quality Monitoring | OE |
| **Action Plan for Operation Phase (PAE)** | | |
| PAE-01 | Monitoring of Water Quality | PIU |
| PAE-02 | Monitoring of Biodiversity | PIU |
| PAE-03 | Monitoring of Fish Species and Fisheries | PIU |
| PAE-04 | Monitoring of River Hydrology | PIU |
| PAE-05 | Monitoring of Sediment Deposition and Changes in River Morphology | PIU |
| PAE-06 | Monitoring of Water Related Diseases Vectors | PIU |
| LADP | Local Area Development Plan (included in RAP) | PIU |

PIU: Project Implementation Unit; OE: Owner's Engineer

### 7.1.3. Summary of Potential Impacts and Mitigation Measures and Environmental Monitoring

The potential impacts and corresponding mitigation measures which are included in the Environmental and Social Management Plan are presented in the Table 7-2. See also Table 7-6 for summary of overall cost of mitigation and monitoring.

### 7.1.4. Environmental Monitoring

The environmental monitoring is integrated into the ESMP and the action plans (§7.5) included monitoring actions. The environmental monitoring plan is presented in § 7.6, Table 7-5.

### 7.1.5. Resettlement and Compensation

Resettlement and compensation of Project Affected People is addressed in a Resettlement Action Plan (RAP) which is issued as a separate document.

### 7.1.6. Public Consultation and Disclosure

A Public Consultation and Public Disclosure Plan has been prepared and is included as an annex to the RAP. A summary is provided in Appendix J and an overview is presented in §1.5.

## Table 7-2 Summary of Environmental and Social Management Plan

| Project Phase | Activity | Impact | Mitigation Measures | Responsibility | Estimated Cost (USD) |
|---|---|---|---|---|---|
| Pre-construction and Construction | ESMP Management | All aspects | Management of ESMP by Project Implementation Unit | PIU | 1,005,000 [*] |
| | | | Assistance for Management of ESMP by Owner's Engineer | OE | 972,000 [*] |
| | | | PAP-04: Mobilisation of panel of experts | PIU | 350,000 [*] |
| | Dam construction - bypassing of Rusumo Falls and 100 m stretch of rapids | Impact on fauna and flora resulting from change in habitat | PAP-05: Spray system to maintain spray conditions of spray zone (design and construction), study to optimise environmental flow and design and construction of a downstream weir | PIU | 1,000,000 |
| | | | Environmental flow | PIU | [a] |
| | Construction activities in general (including quarry areas) | Impact on fauna and flora resulting from change in land use and physical disturbance | PAP-03: Preparation of Contractors E&S Specifications | PIU [c] | [b] |
| | | | PAC-06: Site flora and fauna protection | CC | [a] |
| | | | PAC-15: Quarries management plan | CC | [a] |
| | | | PAC-05: Site re-vegetation and rehabilitation | CC | [a] |
| | Discharge of wastewater | Impact on water quality | PAC-03 hazardous substances management | CC | [a] |
| | Accidental pollution | Impact on soils and water quality | PAC-04: Accidental spill and preparedness and response plan | CC | [a] |
| | Erosion and transport of sediment by rainwater runoff from work site areas and spoil disposal areas | Impact from/on sediment | PAC-02: Management of borrow areas and spoil areas | CC | [a] |
| | | | PAC-05: Erosion and sediment control | CC | [a] |
| | Waste generation | Impact from waste | PAC-01: waste management | CC | [a] |
| | Construction works, earthmoving, traffic, | Impacts from noise vibration, dust and air quality | PAC-10: Management of air quality, dust and noise and vibration | CC | [a] |
| | | | PAC-11: Management of road traffic and access | CC | [a] |
| | Land take | Need for resettlement and compensation | Resettlement Action Plan (RAP) | PIU | [d] |

**[a] Included in budget for Construction Contractor (CC)**
**[b] Included in budget for Owner's Engineer (OE)**
**[c] Responsibility delegated to OE – included in OE budget**
**[*] Total budget for the duration of the pre-construction and construction (5 years)**

## Table 7-2 Summary of Envirnmental and Social Management Plan *(Continued)*

| Project Phase | Activity | Impact | Mitigation Measures | Responsibility | Estimated Cost (USD) |
|---|---|---|---|---|---|
| Pre-construction and Construction | Civil works | Degrading or damage to physical cultural heritage | PAC-12: Chance find procedures for physical cultural heritage | CC | [a] |
| | Presence of workforce | Health and safety of workforce and local communities | PAC-08: Management of permanent and temporary camps | CC | [a] |
| | | | PAC-09: Public health management plan | CC | [a] |
| | | | PAC-21: Implementation of plan for managing spontaneous populations | Local Authorities [g] | 250,000 [*] |
| | | | PAP-09: Prevention and fight against HIV/AIDS and other STDs | Local Authorities [g] | 250,000 [*] |
| | Road traffic and transport | Noise, dust, risk of accident | PAC-11: Management of road traffic and access | CC | [a] |
| | Recruitment | Population influx – spontaneous settlements | PAP-08: Preparation of plan for managing spontaneous settlements | Local Authorities [g] | [e] |
| | | | PAC-14: Workers recruitment, contracting of services and health and safety plan | CC | [a] |
| | Construction works in general | Workforce health and safety | PAC-14: Workers recruitment and health and safety plan | CC | [a] |
| | | | PAC-03: Hazardous substances management | | [a] |
| | Interactions with other projects at the same location | Cumulative impacts | PAP-07:Management of interactions with neighbouring projects | PIU | [e] |
| Operation | Bypassing of Rusumo Falls and 500 m stretch of rapids | Impact on fauna and flora resulting from change in habitat | Environmental flow | PIU | [a] |
| | | | PAP-05: Spray system to maintain spray conditions of spray zone (design and construction), study to optimise environmental flow and design and construction of a downstream weir | PIU | [f] |
| | Physical presence of dam | Trapping of sediment | PAP-06: Sediment transport study | OE | 75,000 |
| | ESMP Management | All aspects | Management of ESMP by Project Implementation Unit | PIU | 590,000 [**] |
| | | | Assistance for Management of ESMP by Owner's Engineer | OE | 93,600 [**] |
| | | | PAP-04: Mobilisation of panel of experts | PIU | 210,000 [**] |

**[a] Included in budget for Construction Contractor (CC)**
**[b] Included in budget for Owner's Engineer (OE)**
**[d] Cost of RAP is budgeted separately**
**[e] Cost included in budget for management of ESMP by Project Implementation Unit**
**[f] Budgeted in the construction phase**
**[g] Assistance from PIU required**
**[*] Total budget for the duration of the pre-construction and construction (5 years)**
**[**] Total budget for the for the first 5 years of operation**

## 7.2. DESCRIPTION OF THE ORGANISATION FOR IMPLEMENTING THE ESMP

### 7.2.1. General Principals

At this level of the Project preparation, it is assumed that the Rusumo Falls dam and powerplant component project will be developed under the following conventional conditions:

- The Project is a joint development undertaken by the Governments of Burundi, Rwanda and Tanzania. The role of project owner is delegated to a Special Purpose Vehicle Project Company (SPV). The SPV shall be responsible for all aspects of project management, including those associated with its environmental and social issues.
- Appointment of an Owner's Engineer (OE) to assist the Owner for the correct design and construction of the Project;
- Appointment of Construction Contractors, the role of Head Contractor being dedicated to the one in charge of main civil works.

Three levels of organization, fully complementary, will be set-up:

- The SPV, which will have to provide for all aspects related to environment and social (i) supervision of activities carried out prior, during and after construction of the project and (ii) coordination with other stakeholders including other Government Agencies and the World Bank. The SPV will create a unit referred to as the Project Implementation Unit (PIU) which will be responsible for E&S aspects;
- The Owner's Engineer Environmental and Social Management Team (OE-ESMT), who is to provide coordination and supervision for all environment-related activities during construction, and to report regularly to the PIU Project Director;
- The Contractor Environmental Management Group (CC-EMG), who is to provide resources for, and effective implementation of, all measures which are defined in the ESMP and in the contract documentation. There will be one CC-EMG if a Head Contractor is overtaking coordination responsibility for all contractors or one CC-EMG for each major Construction Contract (for example civil works, electro-mechanical and transmission line).

Environmental staffs in the PIU, OE and CC are intended to be independent of construction staff. Environmental staff will work alongside construction staff, however they will report through separate management up to the Project Director for the OE and to the executive management level of the CC.

### 7.2.2. Organisation

***Project Implementation Unit (PIU)***

NELSAP will serve as Project Implementing Unit (PIU) for the ESMP (and RAP and LADP), with a team dedicated to carrying out the respective activities, and coordinating with the two governments. The PIU will operate on site, in interaction with the project affected people and direct cooperation with the district authorities. The PIU will report to the SPV Manager.

The PIU as regional implementation unit will operate from Kigali as well as directly at the Project site, with a local Project office. The key implementation processes of the ESMP require continuous presence in the project area and continuous communication with district authorities.

A project office at the Project site (location yet to be determined, in the Rusumo villages) will maximise efficiency and accessibility of the PIU staff. Hence, the PIU team will be reinforced by staff permanently based at the project office.

The PIU will be responsible for (i) informing the political and financial agencies of the correct implementation of the ESMP and (ii) ensuring effective compliance in terms of E&S obligations and procedures in the implementation of the Project. To do this, it will appoint a Lead Safeguard Specialist (LSS), whose role will be (i) to supervise the Project's environmental and social activities in the name of the Governments of Burundi, Rwanda and Tanzania and (ii) to ensure coordination with the international agencies (funding agencies, investors, panel of experts) and national agencies (other Government Ministries, NGOs). The PIU will in particular supervise operations relating to compensation and resettlement of people resulting from the implementation of the project. The LSS will be assisted in this supervisory role by Consultants which will work on a temporary but regular basis right from the pre-construction period and through to the end of the first year of operation of the project.

The PIU team will comprise the following members:

- The Lead Safeguard Specialist (LSS), who will oversee:
- Social development and resettlement officer*
- Communication officer*
- Environmental management officer
- Project database coordinator
- Monitoring officer

- Compensation accountant*
- Community liaison officers (3)*
- Grievance management assistant
- Project database manager
- Monitoring assistance
- Compensation officer*
- Support staff (driver, secretary, office maintenance

* Will be involved part-time or full-time with the Resettlement Action Plan and Local Area Development Plan

The OE will set up within its Engineering Team an Environmental and Social Management Team (ESMT) which will monitor implementation of the environmental measures and their performance. This team will be under the responsibility of a Director Environment and Social (DES) assisted by engineers and technicians responsible for environmental aspects directly related to the construction activities and social aspects related to health and safety on the sites, complaints expressed by the population, any disturbances or harmful impacts they are subjected to, claims for compensation for temporary disorders related to the construction activities and liaison with the traditional local authorities or representatives of the State. The ESMT will include a team of Site Inspectors.

Each CC (or the Head Contractor) having responsibility for one of the main contracts will set up its own environmental team responsible for providing the interface with its construction team. Depending on how the contracts are distributed, certain contractors may group together to set up a common environmental team. Each E-team will have an Environmental Coordinator (CE) and Health-Safety-Environment (HSE) Inspectors.

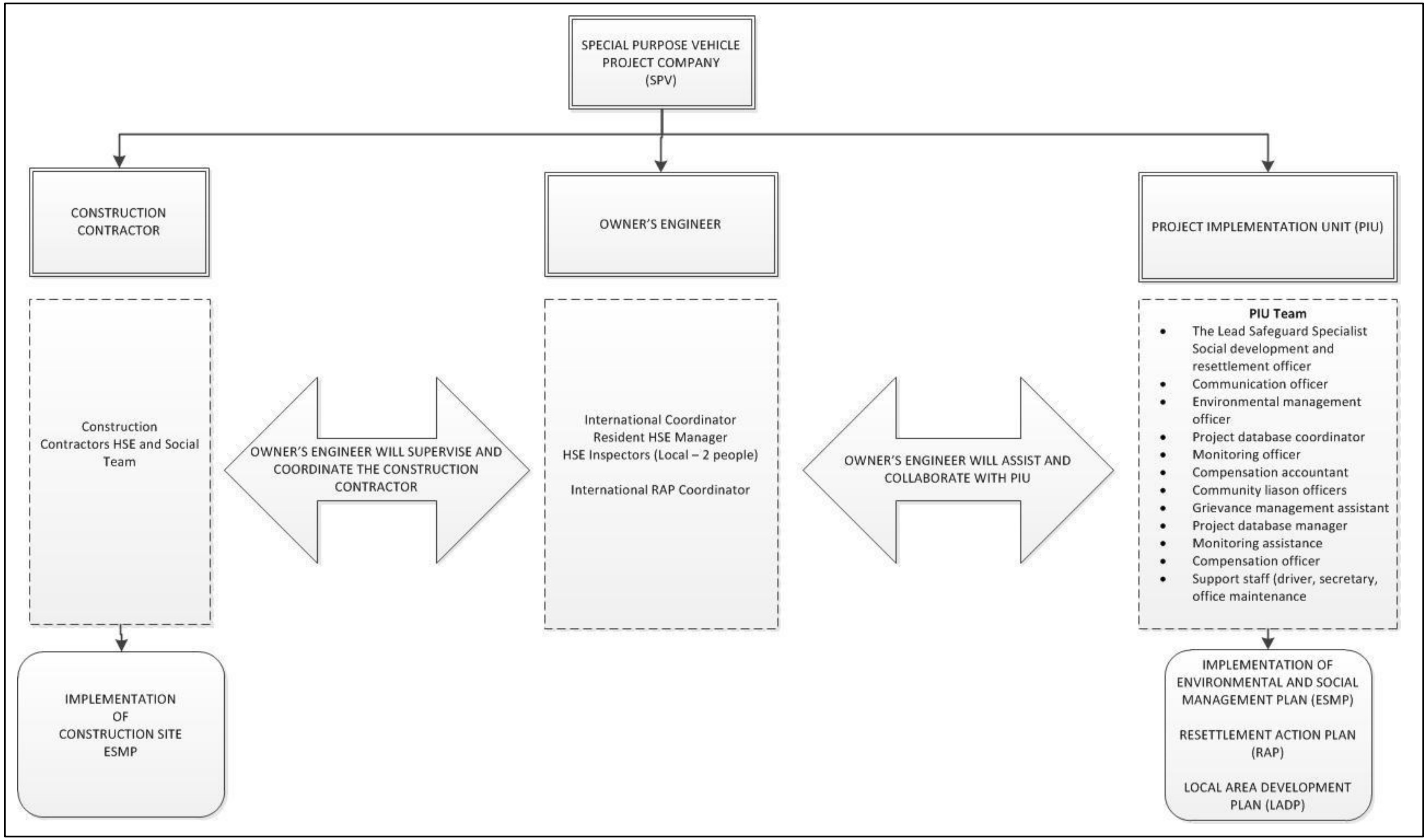


**Figure 7-1 Organization of the ESMP Implementation**

## 7.3. DESCRIPTION OF THE RESPONSIBILITIES AND AUTHORITIES FOR IMPLEMENTATION OF THE ESMP

### 7.3.1. Role of the Lead Safeguard Specialist (LSS)

The position of LSS is within the PIU organisation.

***Project Preparation Phase***

- Coordinate, with those concerned, the definition of the environmental measures at the level of detailed design and prepare the corresponding environmental obligations of the contractors as General and Particular Specifications in the Tender Documents;
- Participate in evaluation of the tenders and negotiation with the contractors for all the environmental and social aspects;
- Ensure coordination with the financial institutions involved, in order to guarantee compliance with their specific environmental and social requirements;
- Ensure, with those concerned, the monitoring and coordination of all consultations with the local population;
- Coordinate with the Government Authorities concerned, the land acquisition and compensation operations required before the start of construction works.

***Construction Phase***

- Ensure coordination of activities with the Owner's Engineer-Environmental and Social Management Team (OE-ESMT);
- Participate in environmental coordination meetings with the representatives concerned from the staff of the Engineer and Contractors;
- Directly refer results and problems encountered to the PIU-Project Director;
- Contribute to E&S aspects to the monthly and/or quarterly Works Progress reports for the attention of the PIU, of the Government of Burundi, Rwanda and Tanzania and the World Bank;
- Provide liaison with the central environmental authorities (Ministries);
- Provide liaison with the decentralised authorities.

*Operating Phase*

- Alongside the site operating manager, ensure coordination and supervision of the recommended environmental and social monitoring programmes;
- Ensure monitoring of the environmental activities required on the site;
- Coordinate the post-evaluation of the dam's impacts and efficiency of the corrective measures put in place;
- Ensure effective completion of the measures to rehabilitate the sites used during construction.

### 7.3.2. Role of the Director Environment and Social (DES)

The DES is part of the Owner's Engineer organisation.

- Organise and control the work performed by the Environment and Social Management Team (ESMT);
- Ensure coordination with the PIU-LSS;
- Ensure that all environmental plans and programmes requested from the CCs (this generic term covering all the main Contractors) have been submitted without objection prior to the start of works;
- With his inspectors' collaboration, check whether the Contractor's environmental obligations have effectively been complied with on the sites, and refer to his manager (the OE-Project Manager) any detected case of non-conformity for formal action;
- Report any observed case of non-conformity and ensure that it is remedied by the concerned CC within the imposed time limit;
- Participate in the site monitoring meetings and prepare a monthly environmental site monitoring report;
- Prepare the monthly evaluation report, recording the Contractor's environmental efforts, which may if necessary be used to justify a deduction on the monthly claim for payment presented to the PIU;
- Ensure the regular implementation of compliance monitoring programmes (water and air quality) and present the interpretation of results in the context of the monthly report;
- Provide liaison with authorities and the local communities concerned for any social aspect including health, respect of recruitment procedures, land use agreements, handling of complaints and compensation for damage to private property;
- Organise a database for storing all environmental documentation generated during construction of the project;
- Prepare the documentation required prior to the project's environmental and social audits.

### 7.3.3. Role of the ESMT-Site Inspectors (Owner's Engineer)

- Organise regular visits to the construction sites and the camps (frequency will be adjusted according to the environmental risks, sensitivity of the environment and contractors' performance);
- Establish reports on all detected cases of non-conformity and follow up their correction by the CC;
- Regularly provide input to the environmental database, in particular the reports on non-conformity, the records of non-conformity correction and the supporting photographic documents.

### 7.3.4. Role of the Environmental Coordinator (Construction Contractor)

The CE's activity must be devoted solely to the CC's environmental and social management. He must be sufficiently high-ranking in the organisation to be capable of imposing his decisions on the Works Supervisors and Foremen. In particular, the power to stop construction activity, for reasons of environmental protection or safety, is a fundamental prerogative to ensure efficient environmental management on construction sites.

The CE, with the support of his team, will have the following responsibilities:

- Adapting construction activities to ensure they comply with the environmental and social obligations defined in the Tender Documents and the Terms of the Contract;
- Ensuring that all sub-contractors of his company comply with the same environmental and social obligations;
- Preparing the environmental plans and programmes specified by the Tender Documents, in particular the monitoring programmes;
- Supervising the environmental good practices for construction activities on all construction sites used by the Contractor or his sub-contractors, by calling on his inspectors to make regular inspection visits;
- Treating cases of non-compliance notified by the DES and instructing the construction teams to apply the necessary remedial measures immediately;
- Preparing the weekly and monthly activity reports for presentation to the DES;
- Organising and performing E&S training of CC staff (management & workers).

# 7.4. GENERAL E&S PLANS AND PROCEDURES

## 7.4.1. KP-01: Communication Plan

***Internal Communication***

The efficiency of environmental and social management is dependent upon the clear organisation of communication among the stakeholders. In particular, there has to be a clearly defined channel for handling all possible environmental disorders rapidly and efficiently implementing the necessary remedial actions, especially in emergency situations.

The following table presents the key links with regard to internal communication among the stakeholders during the construction period. This procedure must be laid down in greater detail before the start of the project in accordance with the Contractor health, safety and environmental (HSE) policy and the final Project organisation.

***External Communication***

External communication will be the prerogative of the PIU through the intermediary of his LSS, assisted by the PIU's Director of Communication. This communication will essentially concern exchanges of information with the media, with NGOs and with Government representatives at Central and District levels. The OE-DES and the CC-CE will only intervene in these exchanges when expressly invited to do so by the PIU.

The PIU-LSS will regularly supply an E&S activity report to the World Bank, various government organisations and NGOs in Burundi, Rwanda and Tanzania. The PIU-LSS will represent Burundi, Rwanda and Tanzania in the context of national/international presentations relative to the project (congresses, symposia, workshops). The PIU-LSS will post the half-yearly report from the Panel of Experts on the internet site dedicated to the Project and accessible to the public.

## Table 7-3 Principal Phases of Internal Communication

| Origin | Recipient | Frequency | Subject |
|---|---|---|---|
| OE-Project Manager | OE-DES | Weekly | Updating the construction programme; specific construction activities in the coming period and their location |
| OE-Project Manager | PIU-LSS,<br>OE-DES | Ad hoc | Additional needs for land, or notification of a change in construction techniques |
| OE-DES | OE-Project Manager | Weekly | Weekly report on environmental events (EE) detected and their treatment;<br>programme of activity of the ESU for the coming week |
| OE-DES | OE-Project Manager | Ad hoc | Communication of EE of levels I to III |
| OE-DES | OE-Project Manager | Monthly | Monthly report on activity and results of monitoring for review and approval before forwarding to the PIU-LSS |
| OE-DES | OE-Inspectors | Weekly | Updating the construction programme; specific construction activities in the coming period and their location, particular directives |
| OE-Inspectors | OE-DES | Weekly | Weekly activity report, list of observed EE of level IV |
| OE-Inspectors | OE-DES | Immediate (same day) | Observed EE of levels I to III;<br>particular problem requiring technical assistance;<br>observation of construction activities outside specified areas |
| Contractor-CE | OE-DES | Monthly | List of training modules followed in the past month and the personnel concerned |
| Contractor-CE | OE-DES | Fortnightly | Updating of new activity zones for the coming 2 weeks (for the transmission line in particular) and operations presenting a particular risk for the environment;<br>result of monitoring of the previous 2 weeks |
| OE-Project Manager | PIU-LSS | Immediate (same day) | Memo to inform on any observed non-compliance on level I-II; proposal to suspend the works on the incriminated site if justified |
| OE-Project Manager | PIU-LSS | Monthly | Transmission of the monthly activity report as prepared by the DES |
| OE-DES | OE-Project Manager | Quarterly | Summary report on significant environmental events (Levels I to III) observed, on the decisions taken, and on the measures implemented;<br>proposal, if necessary, to modify certain mandatory thresholds or obligations on the Contractor |
| OE-Project Manager | PIU-LSS | Quarterly | Summary report on significant environmental events (Levels I to III) observed, on the decisions taken, and on the measures implemented;<br>request for approval of the proposed modifications |

**PIU-LSS** (Project Implementation Unit Lead safeguard Specialist) – **OE-DES** (Director Environment & Social from Owner's Engineer) – **CC-CE** (Contractor's Environmental Coordinator) - **EE** (Environmental Event = detected non-conformity)

### 7.4.2. KP-02: Management of Permits

Authorizations are needed for building and operating the hydropower plant facilities as well as for certain construction works. Close ties should therefore be established with the appropriate authorities so that the authorizations can be obtained within the required time frame. The area where the project is to be carried out has long been occupied by local communities and is subject to the laws of customary authorities, whose traditions are essential to respect. Failure to do so could lead to social disturbances and end up delaying the project. In this case, too, the Project needs to establish close ties with the customary authorities concerned so that constraints on project implementation can be discussed, ways to proceed negotiated and the necessary authorizations obtained within the required time frame.

The PIU-LSS will nominate a person responsible for managing permits and the key actions will be as follows:

- Establish a register of national authorizations required;
- Establish a register of regional and local (prefecture and sub-prefecture) authorizations required;
- Establish a register of authorizations to be obtained from customary law authorities on the basis of the sites that will be affected by the project (e.g., sacred sites).
- Prepare a timetable for obtaining the permits and authorizations required as they relate to the timetable for construction, commissioning and closure.
- Establish a master register of all permits and authorizations required, specifying deadlines, dates permits obtained, authorities concerned, and the contact information of the person or persons responsible for issuing the permits or authorizations, and update the table monthly.
- Ensure that all permits are obtained in a timely manner.

### 7.4.3. KP-03: Procedures for Handling Environmental Events

An important element of the process of communication among the parties is the ranking of events which do not meet the obligations and environmental objectives assigned to the project. These situations detected on site by the OE-ESMT must then be notified to a higher level but following procedures that are graduated according to the extent of the risk and the urgency of remedial action. These environmental events could be ranked according to the system of quality assurance applied to the construction works, in which case their subdivision would be variable according to the subdivisions taken into account for non-conformity of a technical nature. In the present ESMP, considering the absence of information on the project's future quality assurance plan, preference is given to an evaluation system specific to environmental aspects, better adapted to the problems encountered and which represents a proven and reliable system, which can work satisfactorily even in the absence of an efficient quality assurance system.

Environmental events correspond to non-conformities and are subdivided into three levels. The communication and handling procedures depend on the level of non-conformity. Level III represents the most serious incidents, while level I represent the incidents of least gravity.

*Level I (Minor Incident):* Situations on Level I are addressed on a day-to-day basis at the time of site visits and routine meetings; the recommended measures are generally discussed on the spot with the construction teams concerned. Formal communication takes place through the EE report prepared by the ESMT Inspector and handed to the OE-DES for official notification to the concerned CC-EC.

*Level II (Moderate Incident):* The EEs of Level II are notified by the OE-DES to the OE-Project Manager and the CC Site Supervisor the same day as the situation is observed, and within three days to the PIU-LSS. The PIU-LSS informs the PIU Project Director of the situation and details the proposed corrective measures, which must be implemented as rapidly as possible.

*Level III (Major Incident):* The OE Project Manager and the PIU Project Director must be informed on the day an event is observed. The corrective measures must be applied within three days. Should more time be required to implement a corrective measure, or if the risk is imminent, the OE Project Manager may order suspension of the works concerned until the observed situation returns to normal.

This procedure is often implemented on complex work sites, and generally gives satisfactory results. It also offers three advantages:

- A mechanism allowing the works to be stopped if the situation is deemed to be hazardous;
- Provision for feedback so that the site inspectors monitoring implementation of the requested measures can ensure that the remedial action has been taken;
- The possibility of initiating an incident enquiry in order to determine the deep-seated causes of the incident and to assess whether they justify changes in the specifications, the requirements or the methods, to prevent reoccurrence of such a situation in the future.

### 7.4.4. KP-04: Recruitment Procedures

It is recommended that decentralised recruitment centres to be opened, in order to avoid a massive spontaneous influx of the population to the site.

The Contractor will be asked to include its forecast of labour requirements for each phase of construction in its bid, so that the recruitment centres can anticipate the requirements which will be announced later. The contractor will be responsible for ensuring that the recruitment procedure is respected by each of his sub-contractors. The OE will likewise be responsible for ensuring that this procedure is respected.

Recruitment will include a systematic medical examination of each employee, covering the candidate’s general condition and his or her hearing and visual capacities. To avoid any discrimination, the tests relating to infection risks (tuberculosis, malaria and other forms of parasites, STD) will be performed after the candidate has been recruited.

The precise procedures to be put in place will be defined before the start of construction works and coordinated between the PIU and the national administrations concerned. These procedures will include all aspects related to recruitment (criteria), including gender empowerment and equal access to job opportunities, responsibilities and organisation, the contract conditions, the minimum salaries to be respected, and the corresponding complaints and monitoring procedures.

### 7.4.5. KP-05: Grievance Procedure

Separately from the specific procedure for settlement of conflicts established in the context of compensation and resettlement, it is planned to establish a procedure for settling complaints which will be available to all the population concerned by the possible disturbances resulting from the construction activities; this procedure will allow problems encountered during daily operations to be notified to the project management level. The most common complaints which are likely to be made will concern:

- Noise and/or dust close to the actual work accesses (particularly along the electricity transmission line) and on the routes followed by delivery lorries;
- Appeals related to the recruitment procedures;
- Complaints related to properties damaged by the construction activities (construction truck or equipment reversing into a field or a garden and destroying part of the crop, damage to fences or other structures, trucks running over hens or livestock, etc.).

Three systems will be in place to allow complaints to be lodged with the project management:

- Opening of a complaints ledger at the entrance(s) to the site, where plaintiffs will be able to write down their grievance. The ledger will be maintained by the team of guards and the pages will be numbered. The information to be given will include the name of the plaintiff, his address and the reason for his grievance. These documents will be collected once a week by the Engineer's Inspector in charge of social issues for rapid treatment;
- Availability of a complaints ledger so that the population can also lodge complaints in the town;
- For complaints by residents along the site access roads and tracks, the problems will be identified during the regular visits by the OE-Inspector in charge of social issues and during discussions with the community leaders.

The registered complaints and the solutions provided will be presented in the monthly activity report drawn up by the OE-DES.

## 7.5. ACTION PLANS

### 7.5.1. Action Plan for Preparation Stage (PAP)

All the elements described above reflect the main details of the organisation to be set up for supervision and monitoring in the construction phase. However, it is essential to ensure that the necessary means and references are available and totally operational from the time the works start. To this effect, a certain number of activities are to be undertaken before the start of construction works. These actions cover the aspects of recruitment, organisation and training for the PIU, and the performance of specific studies.

***PAP-01: Appointment of the PIU's LSS***

The PIU will appoint its Chief Environment and Social (LSS) early enough for this person to contribute to preparation of the Tender Documents and for preparation, initiation and monitoring of all the studies to be carried out before construction work starts on the project. The LSS will be assisted at the beginning of his mandate by an environmental consultant who will train the LSS and assist him (i) for the preparation of tenders regarding all the studies to be carried out before the start of the construction, (ii) for the selection of the Consultants, (iii) for the follow-up of the studies.

***PAP-02: Preparation of Communication Instruments***

In support of the first public consultations, it is important to prepare the appropriate communication material rapidly, allowing the PIU to present, before starting the works, clear information on the design of the project, on the phasing of construction work, on the recruitment procedures and on the environmental and social measures which will be implemented.

Preparation of proactive communication is indispensable, to ensure the widest possible circulation of the information at the most critical time, since it is during this period prior to the start of works, when important decisions and negotiations are in progress, that information on the Project must be available in a completely transparent manner. The communication tools to be developed include:

- Flyers and posters;
- Articles in the press and radio or TV messages;
- Making the technical documents of the ESIA available for consultation by any person, at the level of the country and District concerned.

***PAP-03: Preparation of the Contractor E&S Specifications***

Effective consideration of the environment during construction activities presupposes the production of a clear, complete and detailed contractual document at the time the contract is awarded. This means including the specifications which will lay down the environmental and social obligations to be imposed on contractors by the Project Owner in the Tender Documents. These requirements dictated by the Owner will be presented in a document entitled *'Environmental and Social Obligations of the Contractors under the Rusumo Falls Project*", which will be prepared together with the Technical Specifications (General and Particular) of the Project. For that purpose, the PIU will appoint, under the supervision of the LSS, a specialized Consultant.

The document will set out the measures that the contractors involved in construction will have to take to comply with the recommendations and measures identified in the course of the ESIA and set out in the form of Action Plans. Without being exhaustive, these documents will include the EHS management directives for contractors and the directives concerning the process of classification, investigations and analysis related to the EHS events as well as general clauses concerning the overall incident prevention programme for the construction sites.

These obligations will be articulated around the principal themes of environmental and social management for all construction activity related to the Rusumo Falls project, which will lay down:

- The general specifications for good environmental management which will be applicable to the contractor at any point within the work site and at all times, covering areas such as: training/awareness of employees on protection of the environment, management of hazardous substances and waste, protection of biodiversity, prevention of water and air pollution, preservation of soils, rehabilitation of sites;
- The contractor will be required to demonstrate that land use compatability theory has been adhered to. Incompatible uses such as sewage disposal against wetland, oil and chemical spillage against water resources, solid waste against settlements must be avoided and analused to ensure compatibility.
- The minimum conditions to be established in the contractors' camps and installations, covering aspects related to housing, catering, waste management, drinking water, sewerage and conditions of public hygiene;
- The minimum conditions to be observed by the contractor in the field of employees' health and safety;
- The minimum conditions to be observed by the contractor with a view to protecting the environment of the site as well as that of the areas contiguous with the construction sites, a particularly important aspect considering the Rusumo Falls spray zone and protected fauna species that have been observed in the area downstream from the falls and in the marshlands upstream;
- The minimum conditions to be observed by the contractor in managing the social aspects of construction activity; this heading includes in particular the procedure which the contractor will be required to follow in case of damage to any private property.

A specific monitoring programme will be set up to ensure that the contractors fulfil their environmental and social obligations, detailed in the following section relating to the Construction Phase. In practice, the selected contractors will be asked to draw up a number of specific environmental plans, within a specified period of time after the contract is notified, describing how these contractors (and their sub-contractors) will be organised and how they will work together to meet their environmental and social obligations. In principle, the list should cover the following:

1. Solid waste management plan,
2. Spoil management plan,
3. Hazardous substances management plan,

4. Accidental spill response plan,
5. Erosion control and sedimentation management plan,
6. Site re-vegetation and rehabilitation plan,
7. Camps (permanent and temporary) management plan,
8. Public health management plan,
9. Air pollution, dust and noise management plan,
10. Road traffic and access management plan,
11. Cultural resources protection plan,
12. Recruitment and workforce health and safety;
13. Quarries management plan,
14. Environmental training plan,
15. Water quality monitoring plan.

***PAP-04: Mobilisation of a Panel of Experts***

Because the project receives the assistance of the World Bank, the mobilisation of an International Panel of Experts for environmental, social and safety aspects will be required. The responsibility of identifying and mobilising such a Panel is incumbent on the PIU, which will set up this Panel at least 2 years before the start of construction works. This Panel, covering environmental, social and safety aspects (which could possibly be grouped together with the Panel required for the Project's technical and financial aspects) will in principle consist of 3 experts, and its role will be to make a critical review of all existing documentation, to make any pertinent recommendation in regard to the anticipated actions in the context of the ESMP and the Compensation Plan, finally to make recommendations – in a consultative capacity – to the Government of Burundi, Rwanda and Tanzania and the PIU. Visits at half-yearly intervals would seem appropriate before and during construction.

***PAP-05: Design of Environmental Flow and Downstream Weir***

Because the bypassing of the Rusumo Falls and a stretch of 100 metres of river during the construction phase, and a 500 metre stretch during the operation phase, there is a significant impact on the Rusumo Falls spray zone, which is a natural habitat. However, it has been established through field investigations that the habitat is neither critical nor unique. The scope is to carrying out a study to evaluate the feasibility of reducing the environmental flow. The proposed environmental flow is 23 $m^3/s$ (10% of the annual average flow rate) and a lower flow rate may still maintain the environmental conditions to an acceptable level. The study will also evaluate the feasibility of constructing a weir at a suitable point along the bypassed section of downstream river in order to maintain the water level in the river and create an artificial area of turbulence.

***PAP-06: Sediment Transport Study and Necessary Design Adaptations***

The waters of the Kagera River are naturally high in sediment load and this could increase with time due to the effects of deforestation and erosion in the catchment basins. The physical presence of the dam could be a physical barrier for sediment transported by the river water, and there is a risk that sediment will accumulate at the base of the dam and this in turn will reduced sediment load in the river waters downstream of the dam. The consequences of this could be modifications to downstream river morphology as a result of erosion and deposition. There is a need to conduct a sediment transport study to confirm the findings of the modelling conducted for the FDS/IDS feasibility study to confirm that the conclusion are still applicable for the RoR alternative. Modelling is to take into consideration recent sediment transport data which has become available. The detailed design of the water intake structures to optimise the transport of the sediment.

***PAP-07: Management of Interactions with Neighbouring Project***

The location of the Project facilities and structures around the Rusumo Falls will interact with other projects that are implemented at the same location, these comprise : the *“Rusumo International Bridge and One Stop Border Post”*, and the *“Multinational Tanzania-Rwanda-Burundi Isaka-Kigali/Keza-Gitega-Musongati Railway Project.”*

There is currently no master plan or coordination committee for the works carried out at Rusumo by the different project. The different organisations that are involved in the projects coordinate in an informal manner.

It is proposed that the PIU takes the initiative to create a coordination committee to manage the possible interactions between projects. It is recommended that there be one designated member of each organisation and that regular coordination meetings be organised on a two-monthly basis for the period leading up to the start of the Rusumo Falls dam and powerplant construction.

### *PAP-08: Management Plan for Spontaneous Settlements*

The number of workers at the site will increase with the waves of hiring that take place following the start-up of the construction phase and the commissioning of the hydropower plant. The prospect of finding employment with Project or its suppliers, or in the businesses and services that grow out of the resulting economic development, will attract many migrants to settle in the area with their families. This migration may well give rise to a range of problems, however: competition for access to land, increased pressure on natural resources, cultivable land and public services (management of waste and wastewater, supply of drinking water and household water, etc.), health problems, increased conflicts, and transformation of traditional social and cultural structures. At the same time, if the development resulting from the influx of migrants is managed properly, it could lead to sustainable economic growth in the region.

It is proposed that a plan be prepared for the management of spontaneous settlements, and that the responsibility for preparing and implementing the plan during the construction stage be with local authorities.

The plan will address the following themes:

- Restricting the influx of migrants and their families temporarily or permanently around the construction and operation sites of the hydropower plant.
- Limiting adverse social and environmental impacts of the migration.
- Development of a tri-national, regional and local strategy for regular communication that is clear and transparent, in cooperation with administrative services authorities.
- Public awareness and communication programme for workers, new arrivals, local residents and local authorities on the potential effects of the resulting migration.
- Recruitment policy, procedures and specification of construction contractors;
- Interface with government authorities and other local and regional development organisations with respect to the day-to-day management of the issue;
- Support to government authorities and other development organisations with respect to planning and organizing intake sectors for new arrivals.

It is proposed that the Project Owner, although not responsible for preparing the plan will liaise with local authorities to ensure that such an plan be prepared.

***PAP-09: Prevention and Fight against HIV/AIDS and Other STDs***

The HIV/AIDS situation needs to be given special consideration because of the prevalence of this infection. The situation with respect to other sexually transmitted diseases (STDs) is also serious. The number of workers at the site will increase with the waves of hiring that take place following the start-up of the construction phase and the commissioning of the dam and hydropower plant. These new arrivals increase the risk of the spread of infectious diseases (STDs, HIV/AIDS, etc.) at the site and in the surrounding communities. Attention will be paid to the prevention of these diseases.

A management plan will be prepared by the PIU in association with the local authorities. The objectives will be to:

- Keep prevalence of these diseases among workers and in surrounding villages to a minimum;
- Ensure a workplace free of discrimination for workers suffering from any of these diseases;
- Raise awareness of, and educate, the local population and workers about preventing STDs, including HIV/AIDS, and
- Guarantee access to appropriate care for employees and their family members who have tested positive for HIV/AIDS.

The management strategies for the workforce will be for the construction contractor to prepare a number of inter-related management plans of which the following will address HIV/AIDS and other STDs (i) PAC-08: Management of Permanent and Temporary Camps (ii) PAC-09: Public Health Management Plan, and (iii) PAC-14: Workforce Recruitment, Contracting of Services and Health and Safety Plan.

The management strategy for people in neighbouring villages will be to:

- Initiate partnerships and contracts with local NGOs to provide services for implementation of information and prevention initiatives for people affected by the project (hygiene measures, causes of disease transmission, pregnant women, risks of contamination and infection associated with widespread practice of excision, etc.).
- Provide support for existing organizations that offer free, voluntary testing and free care for people who are infected
- Promote access to care for people suffering from HIV/AIDS.
- Support prevention initiatives and the provision of health care services to prostitutes (male and female). Prostitution, a persistent problem near worksites, is a major vector in the spread of the HIV/AIDS pandemic and other STDs.

- Cooperate with medical services and local administrative authorities on educational initiatives that focus on promoting safe sex practices, including the free distribution of good-quality condoms at several locations around the worksites.

***PAP-10: Establish International Border Coordinates***

The construction of the dam and the creation of the permanently flooded marshland extending upstream from the dam for a distance of approximately 5 kilometres could affect the visibility and/or position of the Kagera River main channel, which is the international border between Rwanda and Tanzania. The electronic coordinates of the border will be taken jointly by both countries to ensure that there is no future dispute regarding the exact position of the boundary.

***Resettlement Action Plan***

The Resettlement Action Plan (RAP) is plan is prepared as a stand-alone document at the same time as this ESIA. Part of the plan will be implemented prior to the start of construction in order to expropriate and compensate the residents of the villages of Rusumo West (Rwanda), Rusumo East (Rwanda) and Rusumo (Tanzania).

It should be noted that the RAP does not cover the borrow areas, spoil areas or the quarry, as the final selection of these areas will need to be validated with the construction contractor and local authorities. The PAC-02 for the management of borrow and spoil areas and PAC-16 for the quarry include requirements for the construction contractor to deal with this.

### 7.5.2. Action Plan for Construction Phase (PAC)

The following Programme of Action will be implemented during the construction phase:

***PAC-01: Waste Management***

The waste management programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner’s Engineer (PAP-03).

A waste management programme will be established and will be mandatory for contractors and their sub-contractors. The programme will include two waste management plans which will be prepared and implemented by the contractors following the common directives fixed by the Owner. The first relates to wastes of the domestic type (essentially generated by the camps) and non-hazardous wastes generated on the construction sites, while the second is related to hazardous wastes. The objectives of the programme are:

- To minimise the generation of wastes by carefully considered use of raw materials;
- To sort and treat the wastes in order to limit their environmental impact;
- To raise awareness and train personnel in good waste management practices.

These plans will include procedures, in accordance with local regulations or with international best practice, concerning the handling, transport, storage, treatment and elimination of wastes according to their category:

- *Non-hazardous wastes (Group A):* putrescible wastes from the camps and canteens, paper, cardboard, plastics, wood and vegetation, inert wastes from construction or demolition (concrete, scrap iron, bricks, breezeblocks, etc.);
- *Hazardous wastes (Group B):* wastes that are corrosive, explosive, toxic, representing a degree of danger for humans or for the ecosystem. In the context of the Rusumo Falls project, this will essentially be engine oils and used hydraulic fluids, the residues of paints, solvents and resins, fluids from transformers, hospital wastes, sludge from septic tanks, various concrete additives (but with a lesser degree of danger for the latter). Explosives used in excavation works may also generate hazardous wastes.

*Non-Hazardous Waste Management*

A controlled landfill will be used for burying non-hazardous wastes, and will be laid out according to international standards, implying placement of a watertight clay lining or an appropriate watertight geo-synthetic membrane with collection and treatment of leachate. The site will receive mainly household waste from the worker camps and non-hazardous wastes that are not recycled. The site will be developed with a view to its long-term use, so that it can serve the needs of the future operator village of the Rusumo Falls facility.

A system of waste segregation at source, ensuring separation of metal products (including drink cans or food cans), plastic products (bottles, cartons, wrapping, etc.), glass bottles, paper and cardboard, will be set up on the landfill site. All these products will, as far as possible, be made available for collection by outside contractors responsible for recycling.

The workers' camp and operator's village will be provided with two types of covered bins for selective collection of the various products listed above: putrescible in one, for recycling in the other. The contractor will carry out systematic awareness campaigns among residents of the camps to promote efficient use of these refuse bins.

On the construction sites, metal wastes that have not been polluted by hazardous substances (oils, acids, paints, etc.) will be collected in containers for recycling. The same applies to wood and cardboard and plastic packaging. It will be absolutely forbidden to burn plastic or lubricants.

Concrete and plaster debris that is not reused will be collected and dumped with residual excavation materials.

The Contractor will prepare a detailed Action Plan indicating the anticipated volumes of non-hazardous waste to be produced, the procedures for management, collection and disposal, the technical means implemented, the location and dimensions of the controlled landfill, the contact details of the companies involved in waste recycling, as well as the training programs to raise awareness among workers on this subject.

*Hazardous Waste Management*

Sludge from septic tanks will be placed in the basins for treating leachate from the controlled landfill or could be gradually injected into the waste water treatment system of the Operator's village.

Used engine lubricants from the maintenance of construction plant and vehicles and the floating oily residue from oil separators will be collected in 200 litre drums with a view to recycling. The drums will be stored in a dry and covered area, surrounded by a bund the height of which will ensure retention of a volume equal to at least 110% of that of the largest container stored in the area, and equipped with an oil separation system at its outlet. The contractor will identify an acceptable recycling point (refinery) or a plant where the waste can be burned (fuel for industrial use such as a cement factory or metal foundry). A register will be maintained to record all handling of used lubricants, for the purpose of monitoring wastes. Machine and plant maintenance operations will be centralised in appropriate areas allowing collection of the used oils and hydraulic liquids.

Used chemical substances: the principal action to limit the management of used chemical substances is to use ones with low toxicity values and use the minimum quantity of chemical substances required for efficient operation. Used chemical substances will be stored in containers or drums in the same storage areas as used oils, as long as these substances are compatible. Otherwise, they will be stored in a safe area protected from inclement weather. The possibility of reuse in situ will be evaluated; failing this, the materials will be returned to the supplier or to appropriate waste treatment installations.

Supplies: batteries, vehicle batteries, oil filters, printer cartridges from the site will be sorted and deposited in separate containers. The contractor will identify a circuit for elimination of these products and will submit his choice to the Supervision Engineer for non-objection.

Medical wastes will be placed in appropriate, identified and secure containers at the medical centre in the Operator's village and will be burnt in an incinerator to be identified at a later date.

Metal or plastic drums that have contained hazardous or toxic chemical substances will be recycled (if recycling is possible locally) or will be returned to their suppliers. In particular, metal drums shall not be given to the local population if they have contained toxic substances. If rinsing is used to remove residue, the rinsing water must be treated with the waste water. When no longer usable, the drums must be crushed to avoid their uncontrolled reuse by the local population and buried in a controlled tip.

In the case where no satisfactory and accessible circuit were to be identified for recycling or elimination, the Project will establish an appropriate site for burying such wastes before the end of the construction period, where all the hazardous wastes produced by the Project will be buried.

***PAC-02: Management of Borrow Areas and Spoils***

The management of borrow areas and spoils programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

The technical studies (at the stage they have reached at the time of preparation of the present ESIA) show that there could be a surplus of materials resulting from removal of surface soils and excavation, which will have to be stored in a manner that is most respectful of the environment and the least penalising in terms of land use.

The contractor responsible for the civil works will therefore be asked to produce a plan for managing these materials which respects the objectives set out in the Tender Documents; these are as follows:

- Minimise these surplus volumes at the detailed design stage or maximise their reuse for fill which does not require specific geotechnical characteristics;
- Use them wherever possible as landfill in the areas excavated to produce laterite, in order to minimise the use of land of value for forestry

or agriculture; in particular, it is recommended that the material be deposited in areas bordering or inside the future reservoir;

- Deposit materials resulting from removal of the surface soils (topsoil) separately in order to reuse them during restoration works, particularly to vegetate the banks of the head race and the public open spaces of the camps and villages;
- Store material in conditions that will ensure security in terms of stability and erosion; to this effect, a maximum height of 6 m should be imposed, with a berm half way up the slope;
- Provide drainage at the foot of the stockpiled material and anti-erosion measures on the slopes;
- Do not install the stockpile in an area of natural drainage; if necessary, replace or preserve such drainage;
- Place a layer of topsoil on the deposits, which will ensure that they are more rapidly covered with natural or artificial vegetation.

In particular the spoils deposit locations proposed by the Contractor will be reviewed jointly by the Owner's Engineer and the PIU prior to non-objection.

There will be a need once the borrow and spoil areas have been finalised to identify and compensate the land owner in accordance with the compensation rates defined in the RAP.

It is also to be noted that the borrow area N°1 proposed in the feasibility study overlaps with the Rusumo One Stop Border Post and an alternative borrow area will need to be located.

***PAC-03: Hazardous Substance Management***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03). A plan for the management of chemical substances will be prepared by the Contractor, detailing the measures planned for minimising pollution risks. The programme will be applicable to all project activities involving the handling, storage and use of substances catalogued as hazardous. The information set out in this programme will cover the following aspects:

- Procedure for registering and monitoring any substance of a hazardous nature including in particular the drafting of a safety data sheet per substance;
- Procedure for identification of alternative and less hazardous substances;
- Handling and storage conditions, including details on compatibility of the substances;
- Emergency procedures in case of a spill;

- Conditions for final treatment of residues or recycling.

Chemical substances will be stored in a locked container located on a watertight floor surrounded by a bund, capable of storing at least 110% of the volume of the largest receptacle placed there. Each storage site will be provided with a substance collection pit, absorbent products and extinguishers. Standard signs will warn of the presence of toxic substances.

The substances' safety data sheets will be available on the site and from the Environmental Coordinator of the contractor concerned. All chemical substances stores will be regularly inspected in order to detect any possible leakage or damage to the containers.

The largest volume of chemical substances anticipated under a project of this type concerns hydrocarbons (diesel). The programme will lay down the conditions to be respected for storage and refuelling of vehicles and construction plant.

The programme will specify the pollution control equipment to be installed by contractors at the storage sites: anti-pollution kits, extinguishers, substance description sheets, etc.

At each site, the employees in charge of handling chemical substances will be given special training relative to best practice and emergency measures in case of an incident (see PAC-04 below).

***PAC-04: Accidental spill and Preparedness and Response Plan***

The plan will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03). An anti-pollution program will be established to define the intervention procedures in case of leaks or accidental spills of liquid hazardous substances. This programme will include a description of the organisation planned for such situations and the work stations of key people. Specific training will be given for the activities to be performed in case of emergency intervention, for all staff and workers involved in any stage of the procedure.

Spills of less than 200 litres may be managed at the local level by the Contractor EC present on the site, as representing an environmental event (non-conformity) of Level I. For greater volumes, they will be considered as an EE of Level II and will therefore require consultation of a higher level in the organisation. The authorities and local departments to be advised in case of an emergency at the local and regional level will be identified and informed of the response procedure put in place. Such a situation may occur in case of large accidental spill into the Kagera river which could threat fauna and population downstream. In order to meet the objectives of this program, a Risk Response Plan will be prepared by the Contractor in conformity with (i) the emergency procedures and the response to major risks which will also be demanded by the Owner's Engineer and (ii) the requirements of ISO 14001.

***PAC-05: Erosion and Sediment Control***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

Erosion control measures will be applied to all land that is stripped or excavated, all embankments and temporary or permanent deposits of materials in order to minimise and control the resulting sediment loads before they reach the river. This protection will involve, on one hand, the implementation of methods for stabilising slopes and, on the other, collection of surface water runoff.

Erosion control will include methods that are incorporated into construction practices, including the provision of temporary protection of a mechanical nature (geotextile covering sheets, sediment barriers) or temporary re-vegetation of the areas concerned.

Drainage of the entire area of any construction operations will be provided prior to the start of any other activity. Drained water will be channelled towards one or several sedimentation basins, designed following accepted best practice and sized to contain the rainwater falling in 24 hours with a return period of two years.

The contractor will present a Drainage and Erosion and Sedimentation Control Plan setting out the applicable principles and practices adopted for the Project. For each site to be opened for construction activities, a detailed plan of the drainage system and the proposed anti-erosion measures will be prepared by the contractor and submitted to the OE-DES for non-objection at least three weeks before starting works on the site. The drainage channel and sedimentation basins will be built as a priority before any other activity is carried out.

***PAC-06: Site Flora and Fauna Protection***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

*Vegetation*

The Construction Contractor will prepare a plan regarding the protection of vegetation and minimisation of areas affected by the works and facilities. The objectives will be to:

- Minimize areas where plant cover is disturbed, and
- Avoid disturbing vegetation next to construction work areas.

The general strategies that will be applied comprise:

- Avoid crossing or disturbing plant communities of interest, as much as possible.
- Protect natural vegetation along drainage ditches, ravines and gorges as much as possible by maintaining a buffer zone.
- Obtain prior authorization from the environment officer before proceeding with any clearing of land.
- Restrict movements of vehicles and machinery to the designated access roads and work areas.
- Strictly prohibit harvesting of plant resources by workers in the project area.

*Fauna*

Project construction and operation activities may disturb wildlife or result in the destruction and/or deterioration of wildlife habitats. Disturbances may be caused by:

- Loss of habitat from clearing of land;
- Motor vehicle traffic and potential risk of collisions;
- Noise and dust from worksites;
- Night lighting, and
- Hunting.

The general objectives will be limit disturbances of wildlife and destruction or deterioration of wildlife habitats. The general strategies to achieve the objectives will include the following

- Fence the working areas to prevent fauna to interfere with construction and operation activities.

- Prohibit workers from hunting, catching or gathering.
- Prohibit firearms on site.
- Encourage workers to remain within worksite boundaries at all times and inform them of risks to wildlife and how to behave if they do go off site.
- Limit the speed of vehicles on dirt roads and in areas with high wildlife potential.
- Restrict clearing to essential areas.
- Manage waste on worksite to prevent proliferation of undesirable species and to prevent animals from becoming accustomed to seeking food there.
- Use sediment traps downstream of areas susceptible to erosion to limit disturbances and deterioration of aquatic habitats.
- Educate workers about wildlife management strategies and wildlife species that may be found in the project area.

***PAC-07: Site Re-Vegetation and Rehabilitation***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

Protection of the soil by re-vegetation will be undertaken on the sites either during construction works (stabilisation and erosion control) or on completion of construction works (rehabilitation). A sowing and planting program will be drawn up by the contractor showing the proposed methods and the species to be used. The Plan will be reviewed by the OE and the PIU management for non-objection prior to implementation.

In all cases, indigenous plant species, approved by PIU will be preferred.

Temporary re-vegetation (or mechanical protection against erosion) will be required for any area that is to remain bare, without being consolidated or reused, for a period of more than six months. This will be the case with the stocks of topsoil to be preserved when stripping the land for later reuse during re-vegetation operations.

The general objectives and strategies will be:

- Re-establish plant cover on decommissioned areas as soon as possible.
- Use endemic species for site replanting and if possible plants with special status (endangered, at risk of extinction, etc.) if the new edaphic conditions are favourable.

- Reuse the topsoil that was set aside at the start of construction work, to rehabilitate decommissioned areas.
- Ensure that it will be possible to maintain or improve the soil productivity of rehabilitated sites, that the sites are safe physically (no risk of landslide, falling material or similar dangers) and that they are stable and not subject to erosion.
- Maximize the reuse of excavated material when restoring affected areas, in order to reduce the volume of material to be eliminated.
- Ensure that sites are restored in keeping with the surrounding environment, while favouring the establishment of vegetation having high environmental value as fauna habitat and/or a return to preconstruction land use.
- Ensure that natural drainage is re-established and avoid pounding.
- Ensure that demobilized sites do not harbour any risks for the local population and are not liable to have environmental impacts as a result of contaminants in the soil or residual waste, for instance.
- Set up a communications program to inform workers that work camp facility will be dismantled after the construction phase of the project. Former workers will have to agree to move out when asked.
- If monitoring activity identifies area where corrections measures are necessary, proceed with diligence to avoid the deterioration of the site conditions.

***PAC-08: Management of Permanent and Temporary Camps***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

A permanent and temporary camp management programme will be prepared by the contractor responsible. The various aspects covered by such a programme will include:

- Choice of location for the camp, proposed organisation (manager and team), controlled entry;
- The installations proposed for water supply and sewerage, waste management, and drainage of rainwater;
- The equipment chosen for the sanitary facilities, collective equipment, bedrooms and dormitories;
- The anticipated catering and food supply services, particularly canteens; the measures adopted to allow the controlled introduction of shops selling basic products and small household equipment, means for monitoring the quality of foodstuffs stored and distributed in the camp;

- The policies implemented with regard to prevention of drug and alcohol abuse and protection of animal biodiversity.

A basic obligation for the main camp will be to have 24h guards to check all movements of people into and out of the camp, and to provide full and complete fencing around the perimeter of the camp.

The specifications of the Tender Documents will lay down the requirements regarding water supply and sewerage. In order to eliminate the risks of development of disease vectors, rainwater drainage will be provided. The ratios to be respected in terms of sanitation (number of toilets, showers and wash-basins) will also be defined. The standards applicable to bedrooms and their furnishing and fittings will also be detailed in the Tender Documents. In particular, the minimum floor space per person, the supply of impregnated mosquito nets, and mattresses, will be stipulated.

The procedures to ensure hygiene in all common facilities and in particular food hygiene procedures for storing and monitoring fresh products used by the canteens will be detailed by the contractor responsible for the main camp.

In order to prevent the abuse of drugs and alcohol, measures to raise the awareness of employees and specific control measures will be set up by the contractor responsible for the main camp.

Awareness-raising and controls relative to the protection of biodiversity will also be demanded by the Owner considering the location of the camp within a Protected Area: a program to raise awareness of residents in the camp, information posters, formally prohibiting the entry into the camp of any firearms, traps, bush meat or live wild animals. All these provisions form part of the set of measures to be taken.

The program will identify in particular the measures to be taken to promote market gardening and small-scale stock-breeding in the sector to meet the needs of the camp.

***PAC-09: Public Health Management Plan***

The plan will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

The concentration of a large population in a tropical zone where there are many health issues related to hygiene, parasites and STDs requires the implementation of a programme aimed at prevention of the uncontrolled development of communicable or epidemic diseases. Action must be taken first and foremost among employed workers and staff. For the results of this action to be fully effective, measures must also be taken among the resident population in the surrounding area.

The programme requirements will be described in detail in the Tender Documents and will cover the following main areas of action:

- Medical facilities established on the site of the Operator's village and the main workers' camp: a medical centre, its size, equipment and number of personnel to be in accordance with the needs identified in the present ESIA; the needs will be coordinated with a review of local hospital facilities and its improvement as required;
- Emergency intervention procedures in case of an accident;
- Evacuation procedures in case of serious injury, to local hospitals or to another country (international evacuation);
- Employee surveillance measures: medical check-up on recruitment, annual medical check-up;
- Provision of prophylactics for treatment of parasite infections detected (malaria, onchocercosis, amoebiasis, etc.);
- Regular pesticide treatment of residential areas (camps) to eliminate disease vectors (mosquitoes, blackflies, etc.) and cleaning of the drainage system;
- Regular cleaning of the sanitary facilities provided, in particular toilets and septic tanks;
- Waste management and regular cleaning of refuse bins;
- Systematic program to keep employees aware of good hygienic practices;
- Monitoring of distributed drinking water (in particular, search for faecal coliforms);
- Monitoring hygiene in canteens and in shops (as may be authorised) selling food products to employees (personal hygiene, cleaning of kitchens, storage of fresh produce);
- Program to make employees aware of STDs and HIV/Aids and supply of prophylactics.

Special attention is made prevention and fight against HIV/AIDS and other STDs, the objectives being:

- Keep prevalence of these diseases among workers and in surrounding villages to a minimum;
- Ensure a workplace free of discrimination for workers suffering from any of these diseases;
- Raise awareness of, and educate, the local population and workers about preventing STDs, including HIV/AIDS;

- Guarantee access to appropriate care for employees and their family members who have tested positive for HIV/AIDS.

***PAC-10: Management of Air Quality, Dust and Noise***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

A programme to limit atmospheric and noise emissions will be put in place in all areas likely to be affected by construction of the Project, in particular close to the construction sites and along the access roads.

Emissions of exhaust gases and fumes will be limited by the obligations regarding maintenance of construction plant and trucks, and by adopting particular measures when burning the vegetation residue resulting from vegetation clearing operations. Procedures will be imposed on the contractor in order to ensure combustion of biomass at high temperatures, thereby reducing the smoke emissions and corresponding disturbance. The combustion of any other waste (with the exception of wood or non-recycled paper) will be forbidden on the site.

Dust caused by road traffic on unpaved roads will be subject to reduction measures in inhabited areas (close to the workers' camps for example), by requiring the contractor to water spray the roads at regular intervals, i.e. at least two to four times per day during periods without daily rainfall. All loads of fine materials potentially causing dust to be spread during transport will be covered by a tarpaulin. In storage areas, watering will be recommended for all materials likely to generate dust, in particular during periods of strong winds. At the crushing plant, the contractor responsible for this activity will be required to sprinkle the conveyor belts regularly or install an automatic sprinkling system.

Noise will be the subject of regular monitoring by the OE to ensure that the limits laid down for the site are respected or that the employees exposed to higher noise levels are appropriately equipped. Measures will be taken to reduce noise levels and the corresponding disturbance on the site and along the access roads: maintenance of plant and vehicles, use of soundproofed equipment, reduction of the hours of use of certain installations (crushing plant, blasting).

The Tender Documents will define the thresholds to be respected by the contractor in terms of gas, dust and noise.

***PAC-11: Management of Road Traffic and Access***

The programme will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner’s Engineer (PAP-03).

Road traffic is the prime cause of accidents during the construction phase on major infrastructure projects. It is therefore essential to regulate traffic both on site and outside. Various measures will be considered and adopted by the contractors:

- Awareness-raising and training of drivers of light vehicles and trucks in the rules of elementary caution and on the risks encountered: driving under the influence of alcohol or drugs, excess speed, monitoring tyre wear, placing the load (stability);
- Checking the eyesight of all recruited drivers, and their ability to drive;
- Enhanced road signage, with additional signs, particularly in sensitive areas (villages, schools, areas likely to be affected by dust, road sections with bends, site entry/exit signs);
- Safety rules and temporary signage in case of a partial obstruction of the road, breakdown or accident;
- Provision of parking places for trucks separate from the roadway;
- Enforcing respect for speed limits, especially in inhabited areas;
- Measures to limit the occurrence of vehicles straying off their planned itineraries

Access to the construction sites will be indicated by appropriate signage. Access to the sites will be permanently closed by a barrier at a checkpoint open 24/24. The registration number of all transiting vehicles will be noted and this checkpoint may also be used to make rapid checks of the state of vehicles entering the site (general state, tyres and lights).

The Tender Documents will set out all these obligations as well as the penalties that will be applied to contractors and their sub-contractors in case of infringement.

***PAC-12: Chance Find Procedures for Physical Cultural Heritage***

No physical cultural heritage sites have been identified in the construction areas. However as a best practice a plan describing the chance find procedures will be prepared by the Construction Contractor, based on the specification prepared by the Owner’s Engineer (PAP-03).

***PAC-13: Environmental and Social Training Plan***

The plan will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03).

The objective of this plan is to ensure effective implementation of the measures proposed under the ESMP on the construction sites. This Plan will define the general training programmes (awareness-raising) for the attention of all personnel and the specialised training programmes intended for the employees involved in particularly sensitive activities from the environmental standpoint (management and distribution of hydrocarbons, hazardous waste management, management of the controlled landfill, etc.). Each new recruit must participate in the awareness-raising programme within 10 days following his recruitment. Each employee in charge of sensitive activities will follow a catch-up session every 6 months.

This training will be given by the Environmental Coordinators of the main Contractors or by a specialised consultant appointed by the contractors. All personnel will be trained, in the most appropriate language (local dialect, English). The sessions will be recorded in a register where the names of all participants will be noted.

The environmental management awareness programme on the sites will cover the following priority subjects:

- The rules for waste management within the sites;
- The rules for management of hazardous substances and wastes, particularly their storage authorised exclusively in specially adapted areas;
- Pollution control, in particular the response required in case of an accidental pollutant spill;
- Protection of biodiversity, imposing (i) strict prohibition of hunting or introducing firearms or traps on to the site, (ii) prohibition of fishing or introducing any fishing equipment within the limits of the camps (iii) prohibition to consume bush meat in the camps, (iv) prohibition to collect wood or non-ligneous forest products, (v) prohibition to make fires in wooded areas unless organised in the context of construction activities, (vi) prohibition to keep products taken from threatened species, (vii) prohibition to bring into the area any animal or plant species unless specifically planned or to contribute in any way to the propagation of invasive species; (viii) prohibition to capture and export any alive or dead animal.
- Protection of sites against forest fire;
- Protection of sites against erosion and sedimentation;

- The procedure to follow in case of discovery of a physical cultural resource;
- The road safety rules on public roads and on roads within the sites;
- The principles for saving energy and other resources;
- Penalties applicable in case of infringement against the established rules.

Complementary provisions will be made relating to hygiene, health and safety under all aspects that are not covered by the Health and Safety Programme and the corresponding training programmes.

***PAC-14: Workforce Recruitment, Contracting of Services and Health and Safety Plan***

The plan will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03) for the health and safety aspects and the Management of Spontaneous Settlements PAP-08) and recruitment procedure regarding recruitment.

*Recruitment*

In order to minimise and manage the influx of workers, recruitment will be organised away from the project site. However, the local resources should be developed and priority given to local people for recruitment. The Plan will described how the contractor will organise and carry out the recruitment in line with the Project's recruitment policy and procedures, inform interested parties regarding recruitment, interface with PIU, OE and authorities with respect to spontaneous settlements, monitor worker influx and develop local resources.

*Health and safety*

The plan will address the following themes:

- Regulatory context;
- Adopted health and safety standards;
- Identification of dangers;
- Health and safety procedures;
- Health and safety resources and organisation;
- Means of preventing accidents, injuries and diseases;
- Personal protective equipment (safety footwear, mask, hearing protection, protective clothing and safety eyewear)

- Equipment to ensure a safe working environment (ventilation systems, sanitary facilities, etc.).
- Monitoring and reporting.
- Audits
- STDs/AIDs

***PAC-15: Quarries Management Plan***

The plan will be prepared by the Construction Contractor(s) based on the specification prepared by the Owner's Engineer (PAP-03). The plan will comprise an Environmental and Social Management Plan for the extraction and transport of rock from the quarries to the Project site. The plan will provide details of quarry location, environmental and social baseline situation, including homes within the vibration affected area (including photographs – for documentation purposes for future damage claims), geochemical properties of the quarried rock, environmental protection measures and authorisations. There will also be the need to compensate the land owner in accordance with the compensation rates defined in the RAP.

***PAC-16: Water Quality Monitoring (by Contractors)***

The contractor will prepare a water quality monitoring plan which will be aimed at highlighting the quality of the environmental management implemented on the sites. This monitoring will verify discharge compliance, in other words it will concern all points where liquid effluents (waste water, drainage) leave the limits of the work site concerned to enter the natural environment. The contractor concerned will be under the obligation to ensure conformity with the applicable standards.

The contractor will be responsible for monitoring the quality of all discharges on a weekly basis or getting a competent consultant or local agency to do so. The parameters will be defined according to the type of discharge and detailed in the Tender Documents:

- Discharge of 'grey' water and rainwater drained off the camps;
- Discharge of rainwater at the outlet from the sedimentation basins;
- Discharge of rainwater drained from the areas for parking and maintenance of construction plant at the outlet from the oil separators;
- Discharges from particular sites such as concrete plant area, truck washing areas etc.;

- Discharges from the waste water treatment installations in the Operator's village and worker camps.

Drinking water distributed in the camps will be sampled regularly at source (spring, borehole) and at tap levels in the camp.

Sampling sites and parameters may change in the course of construction in order to adapt to the areas of activity and the types of activity observed.

The monitoring may vary from a weekly frequency (for drinking water distributed in the camps, for example) to monthly frequency for the other parameters (drainage, waste water).

This monitoring will be supervised by the OE-DES, who will incorporate control measurements at points identical to those surveyed by the contractor into his own water quality monitoring process (see the following section on monitoring of the sites).

Compliance monitoring will concern at least the following water quality indicators:

- Organic pollution: $BOD_5$, nitrates, phosphates, particularly related to the residential areas and the sewerage systems;
- Oils and grease, relating to drainage from the areas used for mechanical activities, storage of hazardous substances (hydrocarbons) and waste water from the canteens;
- Suspended solids in drainage water and performance criteria for the erosion control installations and sedimentation basins;
- Bacterial pollution: faecal and total coliforms, relating to the quality of the distributed drinking water;
- Residual chlorine, measured at points on the drinking water distribution network;
- Potential pollution of the water table at the landfill site: $BOD_5$, ammonia nitrogen, nitrates, chlorides, zinc, chrome, lead, mercury.

***PAC-17: Biodiversity Monitoring***

The biodiversity monitoring will that is carried out during the construction phase by the PIU will be the same programme as that carried out in the operation stage. Although some of the areas upstream from the dam that need to be monitored during operation are not expected to be affected during the construction, the monitoring will start during construction to obtain good baseline data and identify any trends before the operation start.

Refer to PAE-02 for a description of the monitoring plan.

***PAC-18: Monitoring of Fish Species and Fisheries***

As for the biodiversity monitoring above, the same fish species and fisheries monitoring programme as that carried out in the operation stage will be carried during construction to obtain good baseline data and identify any trends before the operation start. Refer to PAE-03 for a description of the monitoring plan.

***PAC-19: Monitoring of River Hydrology***

The river hydrology monitoring will that is carried out during the construction phase by the PIU will be the same programme as that carried out in the operation stage. Although the areas upstream from the dam that need to be monitored during operation are not expected to be affected during the construction, the monitoring will start during construction to obtain good baseline data and identify any trends before the operation start. Refer to PAE-04 for a description of the monitoring plan.

***PAC-20: Monitoring of Sediment Deposition and Changes in River Morphology***

The monitoring of sediment deposition and changes in river morphology that is carried out during the construction phase by the PIU will be the same programme as that carried out in the operation stage. Refer to PAE-05 for a description of the monitoring plan.

***PAC-21: Implementation of Management of Spontaneous Settlements Plan***

Once construction activities start, there will be a need to implement the plan for the management of spontaneous settlements that was prepared during the preparation phase. This will be the responsibility of local authorities. However, it can be expected that there will be a need for the PIU to liaise with the authorities and the construction contractor.

### 7.5.3. Environmental and Social Supervision during Construction

The Owner's Engineer, through the DES and his team, is responsible for ensuring the Contractor complies with its E&S obligations. The OE is the one that certifies payments to the contractor and as such, he can therefore 'negotiate' the deployment of plant or labour initially allocated to the works in favour of specifically environmental measures.

***PAC-22: Monitoring of Construction Activities (Owner's Engineer)***

Contractors' compliance with their environmental and social obligations will be the subject of a specific monitoring process, coordinated by the OE-DES. In order to ensure compliance with E&S requirements and efficient implementation of corrective measures an environmental monitoring program will be set up, including:

- E&S supervision of the contractors: Through regular site inspections the objective is to ensure that all E&S measures set out in the Obligations for Contractors and in the Action Plans prepared by the Contractors are effectively and efficiently implemented;
- Environmental quality monitoring: monitoring of changes in the quality of the environment in order to evaluate the efficiency of the mitigation measures applied and, if necessary, to modify acceptability thresholds or methods;
- Environmental compliance control monitoring: ensuring that all discharges from all project sites are compliant with environmental legislation or with related specifications in the Tender Documents (under the responsibility of the Contractor, see PAC-14 above). This monitoring will also confirm or not the validity of information supplied by the CCs on a weekly basis. Analysis will be performed on a limited number of parameters indicators of pollution from construction activities.

*Weekly Inspections*

Weekly inspection of the different work sites will be organised by the OE-DES and will be the subject of a report using a standard inspection sheet. This information sheet will check all the environmental specifications imposed on the contractor item by item, giving an immediate overview, during each inspection, of potential cases of non-conformity.

Each environmental event (EE) will be the subject of a standard record sheet to be filled in by the observer (Inspector) and submitted to the OE-DES for action. The record sheet signed by the OE-DES is handed over to the CC-EC who then completes the document by explaining the proposed corrective measure. If the solution is acceptable, the EE is closed after checking that the measure has been effectively and successfully implemented.

*Coordination Meetings*

Regular (weekly or semi-monthly) coordination meetings will be held between the CC-ECs (and their inspectors) and the OE-DES (and his inspectors), during which they will discuss the EE in progress, the remedial measures taken and any other subject of current concern such as the Action Plans presented by the CC-ECs.

***PAC-23: Control of Air Quality and Noise Monitoring (Owner's Engineer)***

The most crucial problems are caused by dust. No significant problem is seriously anticipated with exhaust emissions, except very locally.

There will not be regular sampling monitoring, but rather ad-hoc controls in residential areas along in the vicinity of the work sites. Action will be taken as soon as few complaints from residents have been collected for a particular location, or where visual inspection confirms that excessive dust is being generated.

The DES will make spot checks of noise levels on the various work sites and in certain residential areas during daytime and night, in order to check that standards applicable within the boundaries of the work sites or in the surrounding residential areas are respected.

***PAC-24: Control of Water Quality Monitoring (Owner's Engineer)***

In order to check the validity of information supplied by the contractor on a weekly basis, the OE-DES will conduct two types of monitoring throughout the duration of the construction period:

- Sampling will be conducted at different points on the Kagera and Ruvubu Rivers (see Figures 7-2 and 7-3), upstream and downstream from the principal zones of construction activity, in order to monitor in particular the turbidity and certain pollutants such as hydrocarbons and faecal coliforms, indicators of the extent of the impacts and efficiency of the attenuation measures adopted. Sampling to be done on a monthly basis.
- Ad hoc checks on the discharges from the work site at various points, using pollution indicator parameters (turbidity, faecal coliforms, hydrocarbons), to validate monitoring results from CC.

### 7.5.4. Action Plan for Operation Stage (PAE)

The implementation of environmental monitoring is necessary from the time the works are completed and commissioned, in order to ensure impacts and mitigation measures proposed happen as anticipated during the ESIA studies. The following paragraphs describe the principal Action Plans (PAE) that are to be set up by the Project during the first few years of the operating phase.

***PAE-01: Monitoring of Water Quality***

*River and Marshland Water Quality*

Alteration of upstream river and marshland water quality is not anticipated. However, as a best practice water quality monitoring will be carried out by the PIU. Monitoring will cover: Refer to Table 7-5 for details of the monitoring programme and Figure 7-2 and Figure 7-3 for location of monitoring stations.

*Wastewater Monitoring*

Wastewater treatment system implemented in the Operator's village will be sampled once a month to ensure the efficiency of the treatment. The monitoring organisation will be under the responsibility of the Operator. Parameters will include at least BOD5, Suspended Solids, pH.

*Drinking Water Monitoring*

Water supplied to the Operator's village will be controlled once a month for the presence of contamination (faecal coliforms).

***PAE-02: Monitoring of Biodiversity***

The monitoring of biodiversity will focus on those areas which have been identified as areas of concern and which comprise (i) the Rusumo Falls spray zone, and (ii) the upstream marshlands. The section of bypassed rapides downstream from the Falls is addressed through the monitoring of fish species and fisheries (PAE-03).

The monitoring indicators are presented in the following Table.

**Table 7-4 Biodiversity Monitoring Indicators**

| Zone | Indicators |
|---|---|
| Falls Spray Zone | - Extent of characteristic species of spray zone : *Tristicha trifaria; Philonotis sp; Algae* |
| Marshland extending 5km – will be permanently flooded | - Weed abundance (*Eichornia crassipes*)<br>- Change in the extent of the Papyrus vegetation<br>- Change in abundance of characteristic bird species of marshland (some common species: *Balearica regulorum, Bubulcus ibis, Egretta sp…*) |
| Marshland extending further than 5km and in which the receding of the flood waters will be slowed | - Change in abundance of characteristic bird species of marshland (some common species: *Balearica regulorum, Bubulcus ibis, Egretta sp…*)<br>- Change in the extent of the Papyrus vegetation<br>- Change in population of water birds, such as African skimmers… |

***PAE-03: Monitoring of Fish Species and Fisheries***

Regular monitoring of the fish population in the permanently flooded area upstream from the dam and in the downstream section of rapids (both in the bypassed section of river and downstream of the tailrace) will be carried out. Monitoring will be undertaken in order to assess in a quantitative manner the changes in fish diversity and in fishing activities as a result of project implementation. Fish catch composition and abundance will be monitored as will the status of endangered fish species *Barbus acuticeps* and *Marcusenius victoriae and* the vulnerable specie *Synodontis Ruanda.* The catches made by the fishermen will be monitored in order to evaluate the variation of fish biomass and of catches. The PIU will be responsible to sub-contract such monitoring. Refer to Table 7-5 for details of the monitoring programme and Figure 7-2 and Figure 7-3 for location of monitoring stations.

***PAE-04: Monitoring of River Hydrology***

River hydrology will be monitored, refer to Table 7-5 for details of the monitoring programme and Figure 7-2 and Figure 7-3 for location of monitoring stations.

***PAE-05: Monitoring of Sediment Deposition and Changes in River Morphology***

River hydrology will be monitored, refer to Table 7-5 for details of the monitoring programme and Figure 7-2 and Figure 7-3 for location of monitoring stations.

***PAE-06: Monitoring of Water Related Diseases Vectors***

Regular half-yearly inventories of potential vectors will be performed in the area of the permanently flooded area. Samples will be removed from the edges of the marshland at the same frequency in order to highlight any possible increase in the number of mosquito larvae, in particular those which carry malaria. At the same time, the statistics of morbidity due to water-borne diseases among authorised fishermen (if any), operator’s resident staff and will be analysed in order to detect the long-term trends which may result from the Project.

## 7.6. ENVIRONMENTAL MONITORING

The environmental monitoring plan is presented in the following Tables and includes those the monitoring components the action plans described in the action plans (see § 7.5).

## Table 7-5 Summary of Environmental Monitoring

| Activity | Potential Direct Impact | Parameter to be Monitored | Monitoring Frequency | Monitoring Location | Units / Elements | Target Level / Standard | Responsible | Annual Budget (USD) |
|---|---|---|---|---|---|---|---|---|
| **Construction** | | | | | | | | |
| Overall construction activities | Non-compliance | E&S specifications (See PAC-22) | Weekly | All construction contractor work sites | Inspections | E&S specifications | Owner's Engineer | [a] |
| Dam construction - bypassing of Rusumo Falls and 100 m stretch of rapids | Upstream and downsteram River hydrology | ▪ Water level<br>▪ Water level – flow relationship<br>(See PAC-19) | Continuous | H1 – H8 | Permanent measuring station | Compare to natural situation – follow evolution | PIU | 35,000 |
| | Change in sediment load | Sediment load (mg/litre) (See PAC-20) | Annual | S1 – S7 | Mobile units | Compare to natural situation | PIU | 10,000 (50,000 at the end of construction phase) |
| | Sediment deposition | Depth of accumulated sediment (See PAC-20) | Annual | SA1 – SA3 | Mobile units | Compare to natural situation | PIU | |
| | Impact on aquatic fauna and flora of spray zone, downstream section of rapids and upstream marshland | Biodiversity monitoring indicators (see PAC-17) | Annual | B1 – B5 | Mobile units | N/A | PIU | 50,000 |
| | | Fish species and fisheries (See PAC-18) | Annual | F1 – F3 | Mobile units | Compare to natural situation – follow evolution | PIU | 15,000 |

**[a] Included in budget for Owner's Engineer (OE) – See Table 7-2**

### Table 7-5 Summary of Environmental Monitoring *(Continued)*

| Activity | Potential Direct Impact | Parameter to be Monitored | Monitoring Frequency | Monitoring Location | Units / Elements | Target Level / Standard | Responsible | Annual Budget (USD) |
|---|---|---|---|---|---|---|---|---|
| **Construction (continued)** | | | | | | | | |
| Civil works and transport | Dust, noise and air quality | PM10, dB(A), SO2, NOx, CO (See PAC-10) | Monthly | All construction contractor work sites and facilities | Mobile units | E&S specifications | Construction Contractor | [b] |
| | | PM10, dB, SO2, NOx, CO (See PAC-23) | Random spot checks | Random | Mobile units | E&S specifications | Owner's Engineer | [a] |
| Terrestrial construction works | Impact on fauna and flora | E&S specifications (See PAC-22) | Weekly | All construction contractor work sites and facilities including borrow and spoil areas | Inspections | E&S specifications | Owner's Engineer | [a] |
| Construction camps and storage and use of hazardous materials | Discharged Water quality | Dissolved Oxygen<br>COD<br>Total coliforms<br>pH<br>Suspended Solids<br>Oils and grease<br>Phosphates<br>Ammonium<br>(See PAC-16) | Weekly | All wastewater discharge points of construction contractor work sites and facilities | Mobile units | E&S specifications | Construction contractor | [b] |
| | | As above | Random spot checks | All wastewater discharge points of construction contractor work sites and facilities | Mobile units | E&S specifications | Owner's Engineer | [a] |

**[a] Included in budget for Owner's Engineer (OE) – See Table 7-2**
**[b] Included in budget for Construction Contractor (CC)**

## Table 7-5 Summary of Environmental Monitoring *(Continued)*

| Activity | Potential Direct Impact | Parameter to be Monitored | Monitoring Frequency | Monitoring Location | Units / Elements | Target Level / Standard | Responsible | Annual Budget (USD) |
|---|---|---|---|---|---|---|---|---|
| **Construction (continued)** | | | | | | | | |
| General monitoring as best practice to detect any pollution from external third party sources | Surface water quality | Dissolved Oxygen<br>COD<br>Total coliforms<br>pH<br>Suspended Solids<br>Oils and grease<br>Phosphates<br>Phosphorus<br>Ammonium<br>(See PAE-01) | Twice per year (dry season and wet season) | W1 – W6 | Mobile units | Compare to natural situation – follow evolution | PIU | 20,000 |
| **Operation** | | | | | | | | |
| Bypassing of Rusumo Falls and 100 m stretch of rapids | Upstream and downsteram River hydrology | ▪ Water level<br>▪ Water level – flow relationship<br>(See PAE-04) | Continuous | H1 – H8 | Permanent measuring station | Compare to natural situation – follow evolution – verification of rating curve | PIU | 35,000 |
| | Change in sediment load | Sediment load (mg/litre)<br>(See PAE-05) | Quarterly of first 5 years then annually | S1 – S7 | Mobile units | Compare to natural situation | PIU | 10,000 |
| | Sediment deposition | Depth of accumulated sediment<br>(See PAE-05) | Quarterly of first 5 years then annually | SA1 – SA3 | Mobile units | Compare to natural situation | PIU | |

## Table 7-5 Summary of Environmental Monitoring *(Continued)*

| Activity | Potential Direct Impact | Parameter to be Monitored | Monitoring Frequency | Monitoring Location | Units / Elements | Target Level / Standard | Responsible | Annual Budget (USD) |
|---|---|---|---|---|---|---|---|---|
| **Operation** *(Continued)* | | | | | | | | |
| Bypassing of Rusumo Falls and 100 m stretch of rapids *(cont.)* | Impact on aquatic fauna and flora of spray zone, downstream section of rapids and upstream marshland | Biodiversity monitoring indicators (see PAE-02) | Annual | B1 – B5 | Mobile units | N/A | PIU | 50,000 |
| | | Fish species and fisheries (See PAE-03) | Annual | F1 – F3 | Mobile units | Compare to natural situation – follow evolution | PIU | 15,000 |
| Operation | Surface water quality | Dissolved Oxygen<br>COD<br>Total coliforms<br>pH<br>Suspended Solids<br>Oils and grease<br>Phosphates<br>Phosphorus<br>Ammonium<br>(See PAE-01) | Twice per year (dry season and wet season) | W1 – W6 | Mobile units | Compare to natural situation – follow evolution | PIUv | 20,000 |
| | Waterborne disease vectors | Incidence of malaria and prevalence of mosquito lavae | Annual | Villages surrounding and in permanently flooded areas | Mobile units | Compare to natural situation – follow evolution | PIU | 15,000 |

**Note**: Other social aspects related to resettlement and compensation (grievances) are addressed in the RAP. Monitoring of spontaneous settlements and effectiveness of prevention and fight against HIV/AIDs and other STDs will be performe by local authorities and is included in the budget for local authorities (see Table 7-2).

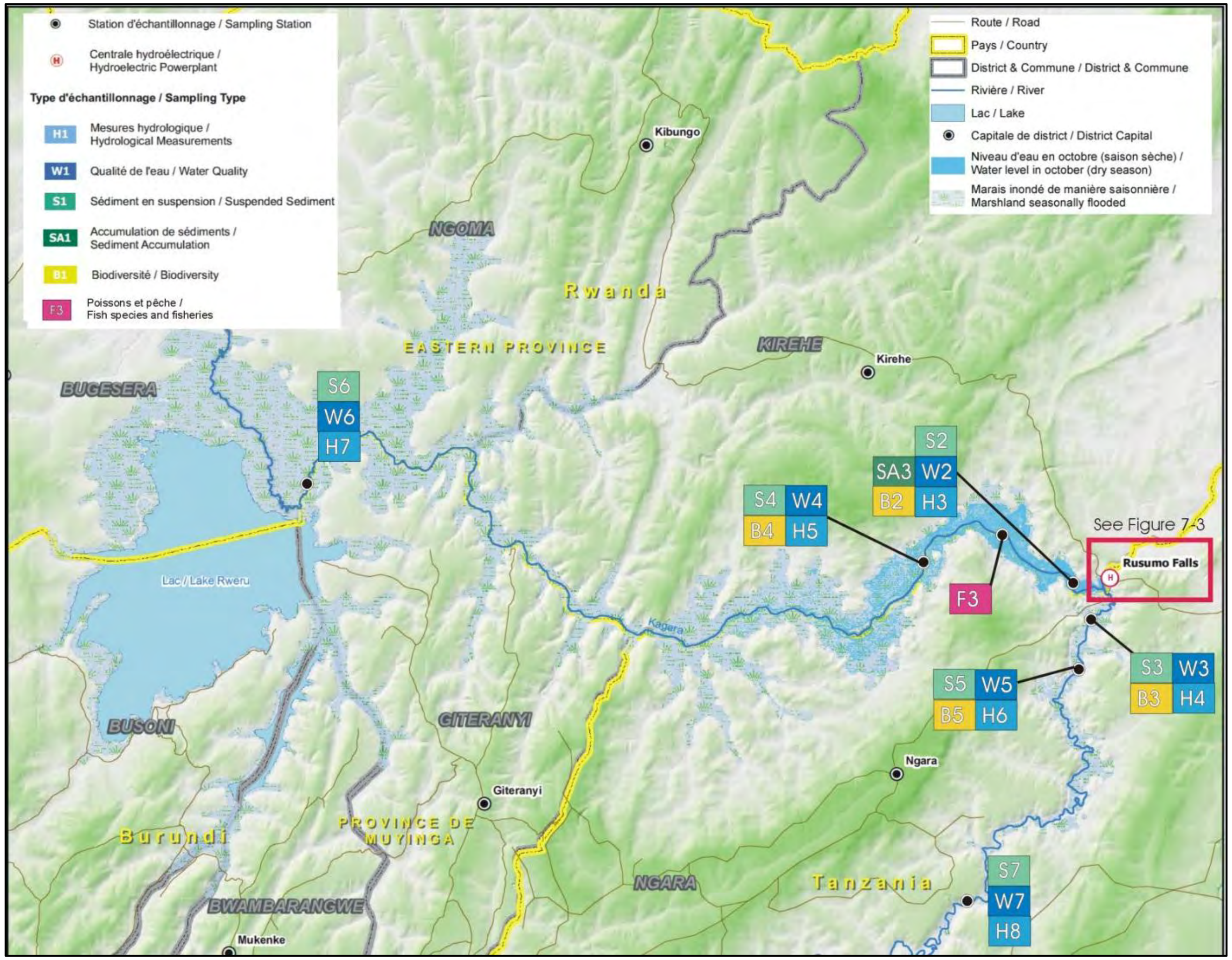


**Figure 7-2 Location of Monitoring Stations Upstream from Dam**


**Figure 7-3 Location of Monitoring Station at Construction Site**

## 7.7. IMPLEMENTATION SCHEDULE

The project is divided into three phases. The first one corresponds to the preconstruction year ($Y_0$). This year is characterized by the establishment of the Project Implementation Unit (PIU) and the integration, in the tender documents, of environmental and social mitigation measures.

This phase is followed by four years of actual construction ($Y_1$ – $Y_4$) during which the activities of the PIU will focus on the environmental monitoring of the construction site and the follow up of health and safety measures. Some environmental monitoring activities will be initiated during this period.

The last phase is the year when the reservoir is impounded and the power plant is commissioned ($Y_5$).

This year also marks the beginning of a period of four years ($Y_5$ – $Y_8$) when the environmental monitoring programs will be implemented. Some of these activities will be recurrent and continue throughout the life of the power plant ($Y_n$).

## 7.8. IMPLEMENTATION COSTS

The provisional implementation costs are detailed in the following Table.

It should be noted that these are the best estimate available at this time, a strong E&S team will be in place to monitor and manage the project adaptively both during construction and operation by responding to any issues that may arise. Correspondingly, actual budget allocations to individual activities may change, or new activities may be added as necessary.

## Table 7-6 Cost Estimate (USD) for the ESMP Implementation

| No | Item | $Y_0$ | Construction Period | | | | Operation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $Y_1$ | $Y_2$ | $Y_3$ | $Y_4$ | $Y_5$ | $Y_6$ | $Y_7$ | $Y_8$ | $Y_n$ |
| 1 | **PIU running costs** (personnel and expenses ) - not including RAP related work | 196 000 | 296 000 | 171 000 | 171 000 | 171 000 | 118 000 | 118 000 | 118 000 | 118 000 | 118 000 |
| 2 | **OE-ESMT** Costs (including expenses) - not including RAP | 276 000 | 228 000 | 124 800 | 124 800 | 124 800 | 93 600 | | | | |
| | **Action Plans** | | | | | | | | | | |
| 3 | Key E&S Procedures | Included in PIU running costs | | | | | | | | | |
| 4 | Action Plans for Preparation Phase - prepared by PIU | Included in PIU running costs | | | | | | | | | |
| 5 | Action Plans for Preparation Phase - PAP-03: Preparation of Contractor E&S Specification | Included in budget for OE | | | | | | | | | |
| 6 | Action Plans for Preparation Phase - PAP-04: Mobilisation orf a Panel of Experts | | 70 000 | 70 000 | 70 000 | 70 000 | 70 000 | 35 000 | 35 000 | 35 000 | 35 000 |
| 7 | Action Plans for Preparation Phase - PAP-05: Design of environmental flow | 1 000 000 | | | | | | | | | |
| 8 | Action Plans for Preparation Phase - PAP-06: Sediment transport study and necessary design adaptations | 75 000 | | | | | | | | | |
| 9 | PAP-08: Management plan for spontaneous settlements | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | | | | | |
| 10 | Action Plans for the Construction Phase (prepared by Construction Contractor) | Included in budget for CC | | | | | | | | | |
| 11 | PAP-09: Prevention and fight against HIV/AIDS and other STDs | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | | | | | |
| 12 | PAE-01: Monitoring of water quality | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 |
| 13 | PAC-17/PAE-02: Monitoring of biodiversity | | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 | 50 000 |
| 14 | PAC-18/PAE-03: Monitoring of fish species and fisheries | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 |
| 15 | PAC-19/PAE-4: Monitoring of river hydrology | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 |
| 16 | PAC-20//PAE-05: Monitoring of sediment deposition and changes in river morphology | | 10 000 | 10 000 | 10 000 | 50 000 | 10 000 | 10 000 | 10 000 | 10 000 | 10 000 |
| 17 | PAC-20//PAE-05: Monitoring of waterborne related disease vectors | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 | 15 000 |
| 18 | Environmental and social supervision during constuction (by owners engineer) | | Included in budget for OE (item 2) | Included in budget for OE (item 2) | Included in budget for OE (item 2) | Included in budget for OE (item 2) | Included in budget for OE (item 2) | | | | |
| | **Sub-total** | 1 732 000 | 839 000 | 610 800 | 610 800 | 650 800 | 426 600 | 298 000 | 298 000 | 298 000 | 298 000 |
| **Contingency & administration** | | | 167 800 | 122 160 | 122 160 | 130 160 | 85 320 | 59 600 | 59 600 | 59 600 | 59 600 |
| | **Total** | 1 732 000 | 1 006 800 | 732 960 | 732 960 | 780 960 | 511 920 | 357 600 | 357 600 | 357 600 | 357 600 |
| | | **Total for construction period** | | | | 4 985 680 | **Total (4 years of operation)** | | | 1 584 720 | 357 600 |

# 8. SUMMARY AND CONCLUSIONS

This Environmental and Social Impact Assessment (ESIA) has been prepared by Artelia Eau & Environnement on behalf of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), which has the responsibility of managing the Rusumo Falls hydroelectric Project ESIA.

The project is a Category A project with respect to the World Bank's OP/BP 4.01 for Environmental Assessment, and encompasses the construction and opereation of a concrete gravity dam spanning across the Kagera River upstream of the Rusumo Falls. The hydroelectric scheme will operate as a Run-of-River scheme and there will be no water storage reservoir created upstream of the dam. However the scheme will modify the seasonal flooding regime of the upstream marshland. Also the Kagera River flowing over the Rusumo Falls and along a 500 metre stretch of river downstream from the dam will be bypassed. There will be no changes in hydrology further downstream.

This ESIA addresses the environmental and social impacts associated with the construction, operation and decommissioning of the structures and facilities. The project area of influence encompasses areas in Rwanda (Kirehe district of the Eastern Province) and Tanzania (Ngara district of the Kagera region). However, there are no predicted impacts in Burundi.

The ESIA has involved modelling of the changes in hydrology of the Kagera and Ruvubu Rivers in order to predict impact on the natural and socioeconomic environment. Bibliographic review, interview with national experts and field surveys have been carried out to determine the environmental sensitivity of project affected areas.

A Resettlement Action Plan (RAP), including a Local Area Development Plan has been prepared in parallel to ESIA as is issued as a separate stand-alone document.

The findings of this ESIA do not result in recommendations for changing the design of the structures and facilities.

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