Rural Sector Support Project III (RSSP III)
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Final Report
For the
Environmental Impact Assessment (EIA)/ Environmental Management Plan (EMP) of works related to the Dam construction and Development of Irrigation infrastructure for rice production in Gacaca marshland (+500ha), Kayonza District of the Eastern Province

October 2012

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EXECUTIVE SUMMARY

1. Background
The Government of Rwanda (GoR) as expressed in its vision 2020 is pursuing a comprehensive Economic Development and Poverty Reduction Strategy (EDPRS). Agriculture is considered as an engine that drives the economy, with close to 90% of the Rwandan population income coming from Agriculture. In support of this Programme, the GoR is implementing the Third Rural Sector Support Project (RSSP3) under the Ministry of Agriculture and Animal Resources (MINAGRI). The RSSP3 aims at promoting diversification of economic activities in rural areas as a way of increasing and stabilizing rural incomes.

Under Component 1 of RSSP3 project, there are plans to carry out civil works related to the construction of dam and irrigation infrastructures to enhance irrigated rice production for up to ± 500ha in Gacaca marshland of Kayonza District. SHER Ingenieurs Conseils s.a was tasked to prepare a technical design of the construction works for rehabilitation of Gacaca marshland for the main purpose of large scale irrigation of rice paddies in the marshland. This study was completed by June 2012.

In order for RSSP III to guide its development and operation in an environmentally friendly manner, it was necessary to carry out an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) of the proposed Irrigation scheme for food self-sufficiency as directed by the Rwandan Organic Law on Environment Protection, World Bank safeguard policies and related International policies, hence this study.

2. Objectives of the study
The objective of the assignment is to assess the potential environmental and social impacts of the RSSP3 Project’s proposed dam construction and development of irrigation infrastructure of Gacaca marshland (±500 ha) in Kayonza District of the Eastern Province of Rwanda, propose mitigation measures which will effectively address the impacts and inform the project preparation process of the potential impacts of different alternatives, and relevant mitigation measures.

For this study to proceed, it had to be guided by environmental authorities. i.e. laws and safeguards.

3. Environmental compliance
An Environment Impact Assessment (EIA) is required by article 67 of the Organic law 04/2005 determining the modalities of protection, conservation and promotion of the environment in Rwanda and World Bank safeguard policies such as; Environmental Assessment- OP/BP 4.01, Involuntary resettlement- OP/B.P 4.12, Pest management-OP/B.P 4.09, Natural habitat- OP/B.P 4.04, Safety of dams- OP/B.P 4.37, for implementation of this kind of infrastructure. The study was done in compliance to the laws and safeguards.

4. Approach and methodology of the study
The methodology of the study involved a preliminary assessment of the project, known as the scoping study; where project literature, preliminary technical studies were reviewed and
field visits were done to understand the project, identify its boundaries and relevant stakeholders.

**Literature review** of Institutional, legislative and policy framework was done with a number of laws, policies, protocols and conventions such as; Organic law determining the modalities of environmental management in Rwanda, Organic law on land management, SPAT II, RSSPIII PAD, water and sanitation policy, EAC protocol on environment and natural resources, World Bank Safeguard policies, Ramsar convention UNFCC international conventions, among others.

**Field visits** were done, where public consultations were held with local stakeholders (mainly those in Murundi sector in particular Karambi cell and Ryamanyoni cell). Consultations were also held with other stakeholders, for example; Kayonza district authorities, RSSPIII, MINAGRI/LISP and MINIRENA. From the field visit, important baseline data was obtained presented in the form of physical, biological and socio-economic environment observed. Information obtained as baseline data, information from literature review and that from technical study done by SHER detailing the project activities, guided the consultants in anticipating project impacts (positive and adverse impacts) against which mitigation measures were proposed.

**Data analysis**- Impact analysis was applied to the anticipated impacts to evaluate the significance of the impacts. Criteria used were defined under the impact’s influence on a spatial scale, duration of influence, intensity and probability of occurrence. From this, a matrix analysis (appendix 4) would be applied to determine the significance of the impact, whether short term, long term, irreversible, cumulative, of no significance or significant and whether mitigation measures were required.

A comprehensive draft report including all collected data, analysis of the data, anticipated impacts, proposed mitigation measures, an Environmental management plan and monitoring plan was prepared. This was shared with RSSP III for inputs and constructive remarks, before the World Bank and finally REMA.

### 5. Project Description

**Site:** Gacaca marshland is located in the Eastern Province, Kayonza District, Murundi sector, covering an area from Ryamanyoni cell “Akagari” to Karambi cell “Akagari. (Figures 2.1.0, 2.1.1, 2.1.2). It situated at about 1350m absl, covers an area of 26km from South to North, the northern tip joining the Ntende- Rwagitima marshland. The site is classified under the savannah grassland with temperatures in the range 18-20°C and rains in the range of 900-1000mm/year. It has two rainy seasons which are generally distinguishable, one from March – May and the other from October – December.

Its watershed covers nearly 146km², however, the developable area for the irrigation scheme is fed by two watersheds. The main watershed (BV1) of 97.4 km² is drained by the Gacaca river, while the lateral watershed (BV2) of 24.4 km² is drained by River Kamunzi and Kayongo. The main water shed is divided into 7 sub-watersheds that drain into Gacaca river while the lateral watershed is divided in to 2 sub-watersheds that drain in the two rivers (Kamunzi and Kayongo). The most dominant soil series in the marshland is RW-Rwagitima series (Paleustollic Chromustert) uniformly favourable for rice cultivation.
In regard to the flora and fauna; the southern zone of the marshland has been degraded by bush fires and livestock grazing, where soles of ligneous pedophile plants of the genus *Acacia spp* and *Euphorbia candelabras* can be seen. The presence of *Sporobolus pyramidalis* indicates a state of advanced degradation of the indigenous species. The central zone is under cultivation of banana, maize, sorghum while the northern zone is most of the time flooded but appears to be the only portion of the marshland that still has original ecosystem dominated by riparian plants such as *Cyperus spp*.

The wild fauna identified for the Akagera wetlands complex under which this marshland is made of 16 species of amphibians, 13 reptile species, 54 bird species and 11 mammal species, however with human occupation of this area, these have since reduced.

**Project Activities:**
The project shall involve the construction of a dam upstream to irrigate a command area of 362ha at Gacaca upstream but with consideration of future downstream irrigation of 65ha of Ntende- Rwagitima and 302ha of Gacaca downstream. A tabular representation of main characteristics of the dam and irrigable area is shown below.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Main dam</th>
</tr>
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<tbody>
<tr>
<td>Watershed area (Km²)</td>
<td>97.4</td>
</tr>
<tr>
<td>Crest width (m)</td>
<td>5.2</td>
</tr>
<tr>
<td>Crest length (m)</td>
<td>261</td>
</tr>
<tr>
<td>Dam height (m)</td>
<td>9.1</td>
</tr>
<tr>
<td>Water height (m)</td>
<td>6.7</td>
</tr>
<tr>
<td>Free board (m)</td>
<td>2.4</td>
</tr>
<tr>
<td>Spillway (m)</td>
<td>8.55</td>
</tr>
<tr>
<td>Reservoir capacity (in 1000m³)</td>
<td>2,500</td>
</tr>
<tr>
<td>Reservoir coverage area (ha) at max. water level</td>
<td>108</td>
</tr>
<tr>
<td>Reservoir coverage area (ha) at normal water level</td>
<td>89</td>
</tr>
<tr>
<td>Irrigable area in Gacaca upstream</td>
<td>362ha</td>
</tr>
</tbody>
</table>

6. **Consideration of Alternatives**

The Project site has been under agricultural cultivation, with most of the indigenous ecosystem degraded under cultivation, no endangered plant or animal species identified and no cultural heritage within its perimeters. This coupled with that fact that the project is capable of managing a once flooded marshland into a 362 ha irrigable area under rice cultivation made this project the most appropriate for this marshland at the time.
7. Environmental and social impact assessment

Chapter 5, in form of a table, gives a summary of negative impacts likely to be caused by Gacaca marshland development that were anticipated by the locals during stakeholders’ and public consultation. Details of the public consultation are addressed in the Issues report in appendix 1.

Positive and negative impacts are discussed thoroughly in chapter 6; with positive impacts reflected and mitigation measures proposed for every anticipated negative impact.

The most outstanding negative impacts that will need to be addressed are; (i) destruction of water points without alternative sources, (ii) Fear of complete shift to monoculture cultivation of only rice in the region, (iii) resistance to change of current livelihood, (iv) water conflicts from the creation of irrigation scheme, (v) Water pollution of receiving water bodies, (vi) poor pesticide and agrochemical fertilizer management, (vii) loss of soil fertility from monoculture and use of inorganic fertilizers, (viii) water logging and salinization, (ix) High sedimentation levels for the reservoir, (x) increased spread of water related diseases from reservoir water.

Other impacts were; soil erosion, air and noise pollution, dangerous borrow pits, fire outbreaks, vandalism of irrigation infrastructure, canal siltation, oil spillage resulting in soil and water contamination, among others impacts discussed.

Mitigation measures were proposed for each of the adverse impacts anticipated, to an extent that they can be reduced, limited or eliminated hence manageable.

8. Environmental Management Plan (EMP) and monitoring plan

In chapter 7 and 8, presented in tabular form, an environmental and social management plan (EMP) and an Environmental Monitoring Plan indicating the mitigation measures, procedure to be followed, monitoring indicators, the responsible institutions to implement these measures and likely cost of implementing each of these mitigation measures have all been included in this comprehensive Environmental Impact Assessment (EIA) report.

The report ends with Chapter 10, making conclusions from the study findings and submission of summarised recommendations.

A number of recommendations have been proposed which include:

- Monitoring of water abstraction quantities to avoid water resource depletion is necessary.
- Integrated Pest Management (IPM) to guide pesticide application and a Resettlement Action Plan (RAP) to guide the process of compensation of those voluntarily or involuntarily displaced is recommended.
- Periodic soil tests to monitor soil, baseline and progressive water quality tests to manage non-point source water pollution.
- Establishment of a rice cooperative and Water User’s Association (WUA) for effective management of the Gacaca marshland development.
- Capacity building framework for project beneficiaries on modern agricultural techniques and land husbandry, among other relevant issues.
• A baseline socio-economic survey is recommended to determine the current status of the area upon which any project positive impacts can be assessed.
• A marshland development and catchment management plan is necessary to ensure sustainable management by locals of the resources in the marshland and its surrounding hillsides.
• Agrochemical pollution control can be achieved through application of required amounts of fertilizers under the supervision of trained agronomists. Furthermore, organic fertilizers can be applied along with agrochemicals with the option of eventually phasing out agrochemicals and only using organic manure.
• Water related diseases can be avoided by planting *Phytolaca acocandra* which will destroy the Bilharzia snails that serve as hosts of *schistosomiasis* along the shores of the lakes and river. Introduction of fish in the reservoir that feed on mosquito larvae shall reduce on their breeding. Provision of mosquito nets, sensitization on the importance of sleeping under a mosquito net and encouraging locals on proper hygiene will reduce on the likelihood of contracting water related diseases.
• Land husbandry techniques along the slopes surrounding the marshland are necessary. A green belt buffer zone of at least 50m along the reservoir and 2m buffer zone from the river is recommended to prevent encroachment of these water sources, act as filters to possible pollution and restrict children and livestock from drowning.
• Periodic manual removal of aquatic weeds from the reservoir to avoid the possibility of an uncontrollable invasion of the reservoir by weeds rendering it non-navigable and incapable of providing sufficient quantities to effective irrigate the command area.

In conclusion, given the nature and location of the development, the potential impacts associated with the proposed development are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures. As a matter of fact, compliance with the proposed mitigation measures and regular monitoring done as per the Environmental management and monitoring plans issued in the report, the Gacaca marshland irrigation scheme is bound to be executed in a sustainably efficient manner.
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<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>EAC</td>
<td>East African Community</td>
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<td>EDPRS</td>
<td>Economic Development and Poverty Reduction strategy</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<td>ESIA</td>
<td>Environmental Social Impact Assessment</td>
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<td>EWSA</td>
<td>Energy Water and Sanitation Authority</td>
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<td>RSSP III</td>
<td>Immediate Action Irrigation Government-Funded Irrigation</td>
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<td>IMCE</td>
<td>Integrated Management of Critical Ecosystems</td>
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<tr>
<td>LISP</td>
<td>Livestock Infrastructure Support Program</td>
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<td>LWH</td>
<td>Land husbandry Water harvesting and Hillside Irrigation</td>
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<td>MINAGRI</td>
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<td>National Land Centre</td>
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<td>PAD</td>
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<td>Sector Wide Approach Program</td>
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<td>WUA</td>
<td>Water Users’ Association</td>
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CHAPTER 1: GENERAL BACKGROUND

1.1 BACKGROUND TO THE PROJECT

The Government of Rwanda (GoR) as expressed in its vision 2020 is pursuing a comprehensive Economic Development and Poverty Reduction Strategy (EDPRS). Agriculture is considered as an engine that drives the economy, with close to 90% of the Rwandan population income coming from Agriculture. In support of this Programme, the GoR is implementing the Third Rural Sector Support Project (RSSP3) under the Ministry of Agriculture and Animal Resources (MINAGRI). The RSSP3 aims at promoting diversification of economic activities in rural areas as a way of increasing and stabilizing rural incomes. The RSSP3 has three components: two technical components and one implementation support component.

Component 1: Marshlands and hillsides rehabilitation and development. The objective of which is to expand irrigated area in cultivated marshlands and increase use of sustainable land management practices on associated hillsides to accelerate the pace of agricultural intensification.

Component 2: Strengthening commodity chains. The objective of this component is to support the commercialization of smallholder agriculture in targeted marshlands and hillside areas by intensifying production, promoting agricultural value addition, and expanding access to markets.

Component 3: Project coordination and support. The objective of this component is to ensure: (i) efficient execution of administrative, financial management, and procurement functions; (ii) coordination of Project activities among the various stakeholders; (iii) timely implementation and monitoring of environmental and land-use management frameworks mandated by World Bank safeguards policies; and (iv) establishment and operation of an effective monitoring and evaluation (M&E) system.

RSSP3 plans to carry out civil works related to the construction of dam and irrigation infrastructures to enhance irrigated rice production for up to ± 500ha in Gacaca marshland of Kayonza District.

In order for RSSP III to guide its development and operation in an environmentally friendly manner, it is required to carry out an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) of the proposed Irrigation scheme for food self-sufficiency as directed by the Rwandan Organic Law on Environment Protection, World Bank safeguard policies and related International policies.

A portion of the available budget has been allocated to the study of an Environmental Impact Assessment and management plan (EIA/EMP) for the works mentioned above. The EIA was done as due diligence in accordance with requirements of article 67 of the organic law No. 04/2005 of 08/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda and (ii) applicable World Bank safeguard policies, especially OP 4.01 Environmental Assessment, OP 4.04 Natural Habitats, OP 4.09 Pest Management and OP 4.12 Involuntary Resettlement. The objectives of the EIA are to ensure environmental due diligence according to Rwandan Law and the Safeguard policies of the World Bank.
In line with the General Guidelines and Procedures for Environmental Impact Assessment, RSSP III commissioned a consultancy firm with the required qualification and experience by the names of Eco-excellence consultancy Ltd (EIA and Audit Experts) to carry out the EIA and EMP of the proposed works related to dam construction and development of irrigation infrastructure for rice production in Gacaca marshland (+500ha), Kayonza District of the Eastern Province, Rwanda.

Eco-excellence consultancy Ltd is a Rwanda company established in 2008, consulting in Environmental, water supply, wastewater and sanitation, Renewable energy sectors. It operates under four main segments: Environmental Assessment and Planning, water supply, Wastewater treatment and Renewable energy. The firm has currently devoted most of its efforts to the environmental assessment and planning sector, wastewater treatment, and recently to the energy sector as it grows into an eventual renowned environmental, sanitation and energy service provider.

Under the Environmental Assessment, Planning and monitoring Segment, Eco-excellence consultancy Ltd draws from a unique team of experienced experts with different backgrounds to provide Water supply, sanitation, Contract management, Environmental Impact Assessments, Strategic Environmental Assessment and Environmental Management Plans (EIA, SEA and EMPs) services related to building and road construction, dam construction, irrigation scheme, wastewater treatment, public health and sanitation, agriculture and tourism. It also offers advice on issues pertaining environment and sustainable development on developmental plans, programs and policies.

1.2 OBJECTIVES OF THE EIA STUDY

The objective of the assignment is to assist MINAGRI to develop an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) to ensure that the RSSP3 is implemented in an environmentally and socially sustainable manner and in full compliance with Rwanda’s and the World Bank’s environmental and social policies and regulations. The specific objectives are; (i) assess the potential environmental and social impacts of the RSSP3 Project’s proposed dam construction and development of irrigation infrastructure of Gacaca marshland (±500 ha) in Kayonza District of the Eastern Province of Rwanda, whether positive or negative, and propose mitigation measures which will effectively address the impacts; and (ii) to inform the project preparation process of the potential impacts of different alternatives, and relevant mitigation measures.

1.3 SCOPING AND TERMS OF REFERENCE

Scoping study was undertaken by the consultant’s team with an intention of collecting enough and relevant information so as to ensure a focused EIA/EMP. The purpose of the scoping study for the Gacaca marshland irrigation project was:

- To consider the main environmental problems to be studied, alternatives and to ensure that the spatial and temporal scopes and extent of the environmental assessment is compatible with the size of the project;
To determine appropriate EIA methods relevant to the project’s potential environmental and socio-economic impacts;

To provide information to communities in areas affected by the project on the environmental problems and alternatives so that they may take part in identification and assessment of the project’s environmental and socio-economic impacts;

Scoping was a necessary step in formulation of detailed ToR for impact assessment by the developer.

The scope of this study was restrained to the boundaries of Kayonza District, Murundi sector, Ryamanyoni and Karambi cell, with exquisite focus on the Gacaca marshland and limited to its boundaries with Ntende marshland at Ngumeri II village.

This study investigated the influence of rehabilitation of +500ha of Gacaca marshland on the surrounding areas. This included; the area allocated for construction of the dam, reservoir, irrigable command area downstream, neighbouring communities and any off-shore influence.

Cumulative impacts on the nation, region and internationally was also reviewed, as a means of understanding the actual impact of the Gacaca marshland rehabilitation.

Terms of reference (ToR) were developed to outline conditions and expected output of the impact study. In brief, ToR included:

i) Identification of Issues to be assessed during the impact study,
ii) Description of the specific work/tasks for the EIA experts;
iii) Identification of Stakeholders to be consulted;
iv) Description of the experts required for the impact study;
v) Reporting format and;
vi) Duration of the study.

### 1.4 APPROACH AND METHODOLOGY OF THE STUDY

This study followed procedures stipulated in the World Bank Safeguard policies, General Guidelines and Procedures for Environment Impact Assessment. The study adopted the following approach: (i) scoping study/ preliminary assessment, (ii) review of secondary data on baseline information (iii) review of policies and regulations, (iv) review of previous meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the project site of Gacaca marshland in Kayonza district, Murundi sector (Ryamanyoni and Karambi cells), to gather information and data on various aspects of the project site. Site locations, land cover, proposed infrastructure were described fully with clear maps for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts. The methodology is detailed hereafter.

#### 1.4.1 Preliminary Assessment/ Scoping study

A scoping study was done involving consultation with the client (RSSPIII) technical staff, Murundi sector authorities, Karambi cell and Ryamanyoni cell authorities, local residents of Rwinyambo and Karambi villages,
The scoping exercise entailed a preliminary visit to the site area for the following reasons:

- Site reconnaissance to understand the spatial coverage of Gacaca marshland;
- Probable positions of the dyke, limits of the reservoir and limits of the command area;
- Identification of the likely stakeholders who will be involved in the public consultation;
- Preliminary findings of the existing environment; (primary, biological and socio-cultural environment)
- Preliminary predictions of likely positive and adverse impacts;
- And finally establishing clear boundaries of the study and focus on the relevant issues concerning the study.

The scoping study also involved literature review on; Preliminary technical study of the rehabilitation of Gacaca marshland, RSSP 3 project documentation, Strategic Programme for Agriculture Transformation (SPAT), other agriculture sector policies and regulations, Government Economic Development for Poverty Reduction Strategy (EDPRS), World Bank safeguard policies, organic law on the environment, project related policies, among others.

**1.4.2 Review of Institutional, legislative and Policy framework**

An intense deskwork was done of existing institutional legislation, policies, plans and programmes, which might influence the implementation of the project, maintenance and enhancement of the environmental resources.

Institutions reviewed included; Ministry of Agriculture and Animal Resources (MINAGRI), Ministry of Natural Resources (MINIRENA), Rwanda Environment Management Authority (REMA), Rural Sector Support Project 3 (RSSP3), Land husbandry, Water Harvesting and Hillside Irrigation Project (LWH), documents and former staff of Integrated Management of Critical Ecosystem project (IMCE), Kayonza district, Murundi cell, Ryamanyoni and Karambi cell authorities, among others.

The literature review involved but was not restricted to the following:

- Organic Law no. 04.2005 establishing the modalities of protection, conservation and promotion of the environment on,
- EDPRS,
- RSSP3 Project Implementation Manual (PIM);
- Preliminary Technical study of the rehabilitation of Gacaca marshland;
- Strategic Programme for Agriculture Transformation II (SPAT II),
- National Water Resources Management Policy
- Water and Sanitation Policy
- Marshland inventory of Rwanda
- Marshlands Development Master Plan
- Health Sector Policy
• Land Policy

Other than national policies and regulations influencing this project, this review paid considerable attention to regional protocols, World Bank safeguard policies and International conventions.

Regional protocols included among others:
• The Nile Treaty,
• EAC Protocol on Environment.

World Bank Safeguard Policies included;
• Environmental Assessment (OP4.01, BP 4.01, GP 4.01),
• Natural Habitats (OP 4.04, BP 4.04, GP 4.04),
• Forest Operational Policy 4.36,
• Pest Management Operational Policy 4.09,
• Projects on International Waterways Operational Policy 7.50,
• Involuntary Resettlement Operational Policy 4.12, and
• Safeguarding Cultural property Operations Directive 11.03.

International Conventions include;
• United Nations Convention on Biological Convention,
• Ramsar Convention on Wetlands among others.

1.4.3 Consultation with Stakeholders

Involvement of stakeholders

The study applied different participatory methods, namely interviews, one-to-one discussion, focused group discussions and official meetings with stakeholders as stipulated in the ToR. The consultation was first conducted with MINAGRI/ RSSP III staff, the developer/proponent, to get the details of the proposed activities. Stakeholders consulted were informed on the proposed project and asked to raise their concern on the proposed project (refer to appendix 1).

Identification of stakeholders’ concerns

The stakeholders pointed out a number of issues and concerns. An issue raised by one individual or a group of people was cross-checked by discussing it over with other individuals or groups. Concerns raised by stakeholders are summarized in Chapter five.

1.4.4 Baseline Data and Information

Information on the physical, biological, socio-economic environment, institutional and legal regimes was collected from a variety of sources, namely project documents and general literature review,
visual and inspection, expert opinion, consultations with selected stakeholders and discussions with RSSP III representatives.

Field data / information collection

This involved visits to the site earmarked for the project components and activities. The Consultant was accompanied to the sites for the scoping visit, by the RSSP III coordination and field staff, who included; RSSP III, Technical Advisor/ Rural Engineer, Environmental officer, Agribusiness officer and Community Development officer responsible for Kayonza. Subsequent field surveys were done to capture a broad picture of the prevailing situation at the site. Activities included:

i. Appraisal of physical and environmental conditions of the project site and areas that may be impacted by or may have influence on the proposed RSSP III project and its associated facilities and services, namely; Water, climate, topography, soils, drainage/hydrology, flora, fauna, etc.

ii. Appraisal of adjacent land use, alternative sites or technologies for the RSSP III project and assessment of other relevant socio-economic parameters.

iii. Understanding the detailed project description through comparison of the filed survey and the preliminary technical study.

iv. Opinions of locals on the project, their opinions on likely positive and adverse impacts, proposals on mitigation measures to adverse impacts.

1.4.3 Impacts Assessment

The environmental and social impacts assessment was done by superimposing project elements onto the existing environmental conditions of the project site. Environmental impacts were then identified, their significance assessed and mitigation/enhancement measures proposed. Simple matrices and Consultant’s expert judgement were used to assess the impacts.

1.5 REPORT STRUCTURE

This report is organised in eleven chapters. Chapter 1 gives a general background of the project; Chapter 2 deals with the project description, Chapter 3 gives a description of pertinent policy, legal and institutional framework within which the project will operate; and Chapter 4 presents the baseline data, environmental, socio-economic and cultural setting of the project site. Chapter 5 presents the findings of the Stakeholders’ consultation and public participation. Impacts identification, evaluation for significance and proposed mitigation measures are elaborated in Chapter 6, while Chapter 7 presents the Environmental management Plan.

An Environmental Monitoring is presented in Chapter 8, while a shallow cost benefit analysis is discussed in chapter 9. Chapter 10 discusses a preliminary decommissioning plan; and Chapter 11 provides conclusions and recommendations of the project.
CHAPTER 2: PROJECT DESCRIPTION

2.1 PROJECT AREA

2.1.1 Location

Gacaca marshland (locally called and comprising of the marshlands of Akanyerezo, Nyabugandu, Rwinyambo and Rwakabanda) is located in Kayonza District, Murundi sector, covering an area from Ryamanyoni cell “Akagari” to Karambi cell “Akagari.”

Access to the site is by the Kayonza-Nyagatarenational road, branching off at an earth feeder road leading to Rukara sector and eventually taking the road from Karuruma town centre to Murundi sector, Ryamanyoni cell. From Ryamanyoni different tracks lead to the different parts of the marshland.

The scope of this environment assessment is restricted to ±500ha of Gacaca marshland, at confluence with Ntende- Rwagitima marshland, Ngumeri II village, Karambi cell.

Figure 2.1.0 Administrative map of Rwanda with site location.
Figure 2.1.1 District-sector Administrative map with site location and watershed.
Figure 2.1.2 Sector-Cell Administrative map with site location and watershed.

2.1.2 Existing features observed

The Reservoir Area- Part of the area demarcated for the reservoir comprises of an earth feeder road of about 6m width, traversing the marshland connecting Ryamanyoni cell offices to Murundi sector offices. This road is in the area demarcated for the reservoir and based on the preliminary technical study, will be raised 2m so as to traverse the marshland, as part of the marshland rehabilitation project.

On the same road, a masonry bridge of about 4m span with a culvert under, built to allow Gacaca river (locally called River Misararo) to flow through was observed. From public consultation of the locals, it was observed that the Gacaca river is the main source of water for domestic and agricultural purposes; however, it dries up completely during the driest months of July and August. This could be a result of the dry season or loss of water through fault lines common in this area could be a cause. It might be worthwhile to consider investigating the likelihood of fault lines in this area, especially in the area proposed for the dyke and reservoir.
From an outlook of existing features, it appears that a number of households, fenced out livestock farms, banana plantations, maize and sorghum plantations will be inundated by the reservoir. This could possibly imply early signs of a need for voluntary and involuntary resettlement and hence a pre-requisite for compensation of households, land or plantations.

2.1.3 Overall Adjacent Developments

The proposed project site is located within rural areas of the country; this would mean that there are no major development activities apart from and livestock farming either under fenced paddocks or open field grazing on the hillsides and small subsistence plantations growing mainly banana, sorghum, maize and beans.

The type of houses in this area are mainly muddy houses with iron sheet roofing, a sign of poverty eradication under the Government campaign to eradicate grass thatched homes “Anti-Nyakatsi campaign”. The common type of transport means observed in the area are; bicycles, pedestrian (by foot) and on a couple of instances motorcycles but hardly any vehicles except small tipper trucks fetching sand from sand mines in the area.

Scattered earth made homes with iron sheet roofing were observed on the hillsides of the marshland, which are likely to fall in the perimeters of the project activities and hence may require resettlement and adequate compensation. This can only be determined after the final technical study for Gacaca marshland rehabilitation has been commissioned.

2.2. DESCRIPTION OF THE PROJECT ACTIVITIES

2.2.1 Project context

The Government of Rwanda has expressed it in Vision 2020, and it’s EDPRS (Economic Development and Poverty Reduction Strategy), that it considers agriculture as an engine that drives the economy. Therefore, it is committed to transform its subsistence agriculture into commercialized and professional agriculture that aims at fulfilling the objectives of poverty reduction and food security, as well as export earnings and industrialization. This calls upon increased and sustained productivity through mechanized and irrigated agriculture whereby the farmers consolidate their land and other resources for successful and continued production of high quality crops.

It is, however, a reality that the farmers of Rwanda have been operating individually and at most for own consumption. Consolidating land, capital and minds for production that meets economic size, market quality standard and continuity of supply has not been a tradition.

It is in this context that the Government of Rwanda (GoR) is pursuing a comprehensive Poverty Reduction Programme. In support of this Programme, the GoR is implementing the Third Rural Sector Support Project (RSSP3) under the Ministry of Agriculture and Animal Resources (MINAGRI). The RSSP3 aims at promoting diversification of economic activities in rural areas as a way of increasing and stabilizing rural incomes. The RSSP3 has three components: two technical components and one implementation support component.
Component 1: Marshlands and hillsides rehabilitation and development. The objective of this component is to expand irrigated area in cultivated marshlands and increase use of sustainable land management practices on associated hillsides to accelerate the pace of agricultural intensification.

Component 2: Strengthening commodity chains. The objective of this component is to support the commercialization of smallholder agriculture in targeted marshlands and hillside areas by intensifying production, promoting agricultural value addition, and expanding access to markets.

Component 3: Project coordination and support. The objective of this component is to ensure: (i) efficient execution of administrative, financial management, and procurement functions; (ii) coordination of Project activities among the various stakeholders; (iii) timely implementation and monitoring of environmental and land-use management frameworks mandated by World Bank safeguards policies; and (iv) establishment and operation of an effective monitoring and evaluation (M&E) system.

For this particular assignment, RSSP3 plans to carry out civil works related to the construction of dam and irrigation infrastructures to enhance irrigated rice production in Gacaca marshland (±500 ha) of Kayonza District and the focus of the study was to prepare an EIA/EMP for this project.

2.2.2 Project Scope and Activities

2.2.2.1 RSSP III Project components

In keeping with the preceding phase of the Adaptable Program Loan (APL) of RSSP2, RSSP3 has continued to have three components which reflect; (i) the evolving overall vision for the APL Program; (ii) lessons learned from RSSP2 and Land Husbandry, Water Harvesting and Hillside Irrigation (LWH); (iii) pre-identification technical RSSP 3 field activities conducted in early 2011 and preparation activities; and (iv) related consultations with the Government.

Component 1: Infrastructure for Marshland, Hillside and Commodity Chain Development:
- The objectives of which are to: (i) expand irrigation in cultivated marshlands through rehabilitation and development; (ii) promote sustainable land management practices on associated hillsides; and (iii) improve economic infrastructure in support of commodity chain development.
It is under component 1 and 2 that the Gacaca marshland development, technical studies of its viability and environmental assessment of the sustainability of this development, all laid.

The component has three sub-components described as follows:

Sub-component 1.1: Marshland Rehabilitation and Development: The sub-component will finance rehabilitation and development of selected irrigation schemes in marshlands totaling 6,000 ha with high potential for commercialized agricultural production.
It will finance preliminary, detailed feasibility and participatory design studies (some of which have already been completed or are on-going), construction and construction supervision. Investments will be demand-driven and a clear selection framework will be applied.
Criteria include: (i) readiness for investment; (ii) stakeholder interest; (iii) proximity to market; (iv) environmental and social sustainability; and (v) favorable economic rate of return.

The Project will promote lower-cost irrigation technologies in lowland areas where the shallow aquifer is appropriate for low-cost groundwater technologies. The Project will finance rapid groundwater assessments to identify the potential for groundwater exploitation in marshlands to be considered under the Project.

**Sub-component 1.2: Sustainable Land Management on Hillsides**- This sub-component will aim at the development of economically interesting sustainable land management (SLM) on the hillsides. Drawing from and adapting the successful approaches of the LWH as well as the best practices developed under RSSP1 & 2, RSSP3 will finance investments in improving productivity on 17,000 ha of those hillsides directly adjacent to the marshland irrigation schemes to be developed by the Project.

Activities supported by the Project will include: (a) promotion of sustainable land management on hillsides immediately adjacent to the marshlands where irrigation investments will be done, using the 3:1 area ratio used in RSSP2; and (b) promotion of cost-effective soil moisture retaining technologies on these hillsides for agricultural production.

In view of the positive potential impacts on hillside agricultural productivity, dissemination of the technologies is expected to be farmer-led.

**Sub-component 1.3: Rural Investments for Economic Infrastructure**- This sub-component will invest in the construction of economic infrastructure for developed marshlands and hillsides to support the integration of organized farmers in diversified value chains. These commercial infrastructure investments will support the economic activities handled by cooperatives or small farmer groups. A Community-Driven Development (CDD) approach will be used and be directly linked to business plans developed by cooperatives with support from sub-component 2.3.

Selection criteria have been developed to help prioritize the hillside cooperatives that can best benefit from similar investments. In addition to the selection criteria for marshlands and hillsides, the other criteria for economic infrastructure will include: (i) compliance with local development priorities and the project development objectives; and (ii) women and men, and districts that show interest to contribute either in kind or cash, towards the infrastructure construction; (iii) economic viability; and (iv) environmental sustainability.

Resettlement activities undertaken as part of Component 1 will follow the procedures laid down in the Resettlement Action Plan (RAP) and will be supported through counterpart funding.

**Component 2: Capacity for Marshland, Hillside and Commodity Chain Development**- The objective of Component 2 is to provide multi-level capacity needed to maximize beneficiary gains from the infrastructure investments and to ensure the sustainability of Project objectives beyond the life of the APL. Component 2 has three sub-components.

**Sub-component 2.1: Capacity Building for Farmer Organizations and Cooperatives**- This sub-component will support group formation where necessary (e.g., hillsides), and will strengthen Water User Associations (WUAs) and cooperatives to improve their governance and management capacity to deliver quality services to their members.
For farmers groups and cooperatives, the key activities will include: (i) mobilization and group formation (particularly on the hillsides); and (ii) management and governance principles.

For the Water Users’ Associations (WUAs), specific activities will include: (i) emergence, registration, governance of WUAs; (ii) water management and appropriate by-laws including enforcement procedures; (iii) infrastructure maintenance plans based on the recommended principles; and (iv) establishment, collection and management of water services fees.

These activities will be conducted in collaboration with RSSP3 engineers and District Implementation teams to ensure that WUA support is included in District Development Plans.

Sub-component 2.2: Capacity Building for Improved Production Technologies-
This sub-component will support activities to improve production and productivity in the marshlands and hillsides adjacent to marshlands.

In line with Government policy for extension and in collaboration with Rwanda Agricultural Board (RAB), the Project will support the up-scaling of the Farmers Field Schools (FFS). The FFS approach builds capacity and empowers farmers to use improved and economically viable practices for sustainable soil, water and pest management with a view of increasing agricultural productivity and profitability. RSSP3 will continue supporting cooperatives to become certified seed producers.

Project activities in this sub-component will include: (i) training-of-trainers; (ii) scaling up of the FFS in the marshlands and in the hillsides developed by RSSP2 and RSSP3; (iii) support to interested cooperatives to become certified seed producers in cooperation with RAB; (iv) LWH extension approaches to support intensification of rain fed hillside production, including the establishment of fruit tree nurseries and adapted fruit trees management techniques (grafting, pruning, root pruning, fertilization); and (v) support to innovations for productivity.

Sub-component 2.3: Capacity Building for Value Chain Development-
This sub-component will aim at building the capacity of farmers for value chain development through enhancing their understanding of agribusiness principles.

This sub-component will build the capacity of farmers for market oriented farming at three levels: the producer, cooperative and the agribusiness center level including half bulk markets. For the producer level which will involve lead farmers, core modules to be developed will include: (i) Development of farm budgets/business planning; and (ii) small enterprise management and this will also include study tours to visit well established cooperatives.

For the cooperative level, support will be provided to business oriented cooperatives through; (i) training of the Marketing Committees (cooperative leaders) on marketing of output for onward communication to farmers; (ii) facilitating the recruitment and hiring of professional cooperative managers; and (iii) facilitating the establishment of a mentoring programme for both cooperative staff and cooperatives leaders.

The project will support the establishment of Agribusiness Centres in at least three RSSP3 sites which will be selected based on the following criteria: (a) the expected volume of commodity transactions (e.g., rice, maize, potatoes, bananas); and (b) availability of a critical mass of matured cooperatives that provide specific services to their cooperatives’ members.

Component 3: Project Coordination and Support-
In keeping with the commitment of Development Partners (DPs) in the agricultural sector of Rwanda, the experienced and competent implementation team of RSSP 2 will be merged with the LWH implementation team (i.e., the PSTA Program 1 Implementation Team) to form one implementation unit embedded in the Ministry’s
structure. The proposed combined implementation team has adequate capacity to implement both RSSP3 and LWH.

2.2.2.2 Project Irrigation system

The irrigation system proposed is a gravitational irrigation for rice cultivation in Gacaca marshland for a coverage area of ±500ha. The system comprises of a number of components such as;

- **The Dam-** which consists of the dyke and reservoir.
- **The command area-** Which is downstream of the dam and the area irrigated. It is the part of the marshland area leveled, demarcated into plots and supplied with water from the reservoir by canals, all this for intensive cultivation of rice.

**Dam-** In our case, this is an earth embankment used to impound and divert water from rivers for irrigation purposes. Only one dam will be constructed impounding the Gacaca river and served by a watershed of 97.4km².

The proposed embankment is the modern zoned construction which is built in three sections: (i) upstream and relatively impermeable section, i.e. riprap and filter (of sand and gravel); (ii) central core or hearting of highly impermeable material e.g. clay (which with a below ground cutoff, will effectively seal the dam against seepage) and; (iii) downstream section of poorer, coarser material that allows frees drainage of the structure and which by its weight anchors the complete embankment to its foundation and prevents slip and other movement. *(FAO, 2010)*

The technical study of Gacaca marshland development by SHER, proposes construction of one dam for adequate irrigation of an area of 362ha of Gacaca upstream marshland (the scope of this study) and with the potential to irrigate the remaining section of 65ha of Ntende marshland and 302ha of Gacaca downstream marshland in the future.

A representative sketch of the dam is presented in the figure below, together with a table of the dimensions of one dam proposed for the Gacaca marshland.
Figure 2.2.0. A sketch of a dam.

![Sketch of a dam](image)

Source: FAO, 2010

Figure 2.2.1. Sketch of the upstream embankment of the dam.

![Sketch of the upstream embankment](image)

Source: FAO, 2010

**Table: 2.1. Summary of Dam and emissary dimensions for the main dam**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Main dam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed area (Km²)</td>
<td>97.4</td>
</tr>
<tr>
<td>Crest width (m)</td>
<td>5.2</td>
</tr>
<tr>
<td>Crest length (m)</td>
<td>261</td>
</tr>
<tr>
<td>Slope upstream of embankment</td>
<td>h/v = 3</td>
</tr>
<tr>
<td>Slope downstream of embankment</td>
<td>h/v = 2.5</td>
</tr>
<tr>
<td>Dam height (m)</td>
<td>9.1</td>
</tr>
<tr>
<td>Water height level (m)</td>
<td>6.7</td>
</tr>
<tr>
<td>Free board (m)</td>
<td>2.4</td>
</tr>
<tr>
<td>Spillway (m)</td>
<td>8.55</td>
</tr>
<tr>
<td>Reservoir capacity (in 1000m³)</td>
<td>2,500</td>
</tr>
<tr>
<td>Reservoir coverage area (ha) at max. water level</td>
<td>108</td>
</tr>
<tr>
<td>Reservoir coverage area (ha) at normal water level</td>
<td>89</td>
</tr>
<tr>
<td>Emissary width (m)</td>
<td>4</td>
</tr>
<tr>
<td>Emissary depth (m)</td>
<td>1.25</td>
</tr>
<tr>
<td>Length of Emissary (km)</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Other components:

*Water Intakes* - The marshland shall comprise 7 intakes on the main emissary. The intake structure, made of reinforced concrete, e allows on one hand to deliver the flow necessary to complete required irrigation water and on the other hand emptying the retained water in case of a need for maintenance.
Spillway- It will be partly reinforced concrete and masonry rubble and placed in the natural terrain embankment on the right hand side of the dam. It will be at a height of 8.55m above low ground level, with a weir 25m long for the main dam designed for a 100 year return flood with an estimated flow of 66m³/s, capable of a threshold flow of 1.3m water depth to act as a flood control structure.

Other structures include; coffer dams, sluice gates, among others.

Drainage and canals- Water from the river impounded by the dam will be distributed to the demarcated plots of the command area through canals categorised as; (i) Primary emissary which is the river from which water is impounded at the reservoir upstream and later drained downstream after use on the plots; (ii) Primary canals which are normally at the perimeter of the marshland and feed into secondary canals; (iii) Secondary canals supplying the sectors by feeding the tertiary canals; (iv) tertiary canals which distribute water to individual rice plots.

Command area- This is the part of the marshland, downstream of the dam that will be leveled and demarcated into plots for rice cultivation. It will be split into 6 sectors and a combination of plots will be considered as sectors. The sectors will be supplied by secondary canals, while tertiary canals will feed into the individual plots which comprise the sector. A schematic drawing of the plot demarcation and drainage canals is shown below.
A schematic irrigation network of water distribution by canals is presented here:

Source: SHER Report 2012

Figure 2.2.2. Schematic representation of the irrigation network.
2.2.3 Project Boundaries

The project impact area was divided into three categories namely core impact area, immediate impact areas and area of influence.

Core impact area

The core impact area refers to the area immediately and directly affected by the activities to be undertaken during the project implementation, and covers approximately 362ha. Other areas include the recipient of solid waste, and those impacted by dust and noise as well as source of support services such as water and energy.

Immediate impact area

This is the area that experiences project impacts directly or indirectly but with less intensity. Areas that might receive project materials like haulage soil wastes excavated from the site. They might be distantly located or can be bordering the project site at a certain distance and absorb the shocks of project impacts.

Area of influence

The area of influence refers to the greater area that is not subject to direct contact with the development but may be indirectly affected by the project, for example; sourcing of construction materials and labour, areas where trucks carrying building materials will pass. Among the areas benefiting from the development includes the Kayonza district, Kigali city, the nation in general and the neighbouring countries where the construction materials will be bought and where the crop yield will be sold.

2.2.4 Identified sources of construction material

Based on the technical study for the development of Gacaca marshland done by SHER, a number of sites with potential as sources of construction material for the project have been identified. Borrow areas investigated during the study indicated that rock material for riprap for the upstream face of the dyke and aggregate material for the semi-impervious layers of the up and downstream faces of the dyke suitable for the main dam construction were identified at sources about 3km from the site. For the lateral watershed, rock and aggregate material sources were identified about 1.5km from the site. Clay material of <80um required for the core impervious section of the dyke was identified at 500m from each of the two sites.
CHAPTER 3: RELEVANT POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS

3.1 NATIONAL LEGAL AND POLICY FRAMEWORK

3.1.1 Organic law determining the modalities of environmental management

This organic law determines the modalities of protecting, conserving and promoting the environment in Rwanda. It aims at conserving the environment, people and their habitats; setting up fundamental principles related to protection of environment, any means that may degrade the environment with the intention of promoting the natural resources, to discourage any hazardous and destructive means; promoting the social welfare of the population considering equal distribution of the existing wealth; considering the durability of the resources with an emphasis especially on equal rights on present and future generations; guarantying to all Rwandans sustainable development which does not harm the environment and the social welfare of the population and setting up strategies of protecting and reducing negative effects on the environment and replacing the degraded environment (Organic law, 2005).

The establishment of national policy of protection, conservation and promotion of the environment is the responsibility of the Government of Rwanda. It develops strategies, plans and national program aiming at ensuring the conservation and effective use of environment resources.

Conservation and rational use of environment and natural resources are dependent upon the five principles; protection through precaution and preventive measures from environmental impact assessments, sustainability of environment and equal opportunities of the generations, the polluter pays principle where pollution is penalised, sensitization of conservation and protection of the environment and the principle of cooperation which necessitates the institutions, private sector, locals to protect the environment at all levels.

This law covers all activities that might affect the natural environment (such as; soil, water resources or air and biodiversity) and human activities (such as; construction works, waste disposal, forest burning, fishing, mining, irrigation, etc.)

In the framework of implementation of this organic law, the Rwanda Environment Management Authority (REMA) is the public establishment with legal personality and authority to implement the articles of this law.

Under article 67 of the organic law 04/05, every project shall be subjected to environmental impact assessment, before obtaining authorisation for its implementation. This applies to programmes and policies that may affect the environment.

The ministerial order N° 004/2008 of 15/08/2008 establishes the list of activities or projects that have to undergo environmental impact assessment before commencement. This irrigation scheme fits the description of projects that require EIAs mentioned in annex 2 of this ministerial order.
Article 68 of the law, states the minimum requirements of an EIA:

- A brief description of the project and its variants;
- A study of direct or indirect projected effects on a place;
- analysis relating to the initial state of a place;
- measures envisaged to reduce, prevent or compensate for the damage;
- reasons based on selecting such a place;
- an explanation of the methods that will be used in monitoring and evaluating the state of the environment before, during the activities of the project, in using the installation but particularly after completion of the project;
- An estimation of the cost of the measures recommended to prevent, reduce or compensate for the negative effects the project may cause on the environment as well as the measures for examining and controlling the status of the environment.

An order of the Minister having environment in his or her attributions shall specify the details of the provisions of this article.

Article 69 of this law, directs that the environmental impact assessment shall be examined and approved by the Rwanda Environmental Management Authority or any other person given a written authorisation by the Authority. The environment impact assessment shall be carried out at the expense of the promoter.

3.1.2 Organic law on land management

For one to appreciate impacts on land of such irrigation schemes, it is relevant to understand what the organic law on land management requires. Rwanda land law institutes principles on land legal rights to be followed throughout the country together with land appendages, be they natural or man-made.

Article 3 of this law states that land is part of the public domain of all Rwandans; ancestors, present and future generations. With exceptions of the rights given to people, the state has supreme powers to manage all the national land, and this is done in public interest aimed at sustainable, economic development and social welfare, in accordance with procedures provided for by law. In that regard, it is the state that guarantees the right to own and use the land. The state also has rights to expropriation due to public interest, settlement and general land management through procedures provided by law and prior to appropriate compensation. (Organic law, 08/2005)

Article 4, 5 and 6 go on to state that any discrimination either based on sex or origin in matters relating to ownership or possession of rights over the land is prohibited. The wife and the husband have equal rights over the land. Any person or association with legal personality that owns land either through custom, or who acquired it from competent authorities or who purchased it are allowed to own it on long term lease in conformity with provisions of this organic law. Any person whether a Rwandan or a foreigner who invested in Rwanda, or an association with legal personality shall enjoy full rights of ownership of land reserved for residential, industrial, commercial, social or cultural and scientific services.
While Article 7 emphasizes the fact that this organic law protects equally the rights over the land acquired from custom and the rights acquired from written law. With regard to the law, owners of land acquired from custom are all persons who inherited the land from their parents, those who acquired it from competent authorities or those who acquired it through any other means recognized by national custom whether purchase, gift, exchange and sharing.

Article 19 of this law states that for the purpose of land exploitation, an efficient land structural exploitation chart is necessary to show settlement, agriculture, forestry, animal husbandry, factories, parks and general services areas, lakes and rivers, mining and quarries, marshes and other natural reserves. The exploitation of all these lands shall be regulated by specific laws.

Specific to article 20 and with particular emphasis on agricultural land, it is stated that in the public interest and in a bid to improve rural productivity, the Minister in charge of Agriculture and Livestock shall have the right to request the consolidation of smaller plots into sizeable land in conjunction with local authorities and the community in order to improve land management and productivity. Each land holder shall continue to keep their parcel of land.

Procedures for land consolidation and production shall be established according to the provisions of the decree of the Minister in charge of Agriculture.

Without prejudice to the first part of article 20 and when this law entered into force it is prohibited to divide the parcel of land of one or below a hectar. The land of five or below five hectares can be divided upon authorization given by the land commission at their level of jurisdiction.

### 3.1.3 Strategic Plan for Agricultural Transformation II (SPAT II)

The performance of the Rwandan economy depends mainly on the production of the primary sector, in which agricultural production, particularly of food crops, is essential. Although poor rains adversely affected the sector in 2003 and 2004, it attained an average annual real growth rate of 5% between 1999 and 2005 and the aim is to accelerate that growth. The sector’s growth rate slowed in 2006 and it recorded a slight decline in 2007. ([Strategic Plan for Agricultural Transformation II, 2008](#))

The Government of Rwanda had not only the will to maintain this performance but was also committed to specific actions geared towards improving it and ensuring a sustainable pattern of economic growth. Those lines of action have been developed in the context of the following national policy documents:

- The prospective long term *Vision 2020 for Rwanda*.
- The *National Poverty Reduction Strategy* and its successor, the *Economic Development and Poverty Reduction Strategy (EDPRS)*, both adopted by all development partners.
- The *National Investment Strategy*.
- Sector policies and strategies covering different priority areas.
The special context of poverty in Rwanda is the most fundamental motivating and organizing factor for sector policies and strategies, which always must be aimed first and foremost at improving people's standard of living.

The basic macroeconomic context of the Strategy is the EDPRS, which is the country’s medium-term economic development plan, providing the framework within which the Government seeks, over the 2008-2012 period, to consolidate the process of changing the structure of the economy and moving towards achieving the long-term targets, both laid down in Vision 2020 and that are the Millennium Development Goals. It aims both to increase economic growth and to reduce the incidence of poverty –the latter to 46 percent from its rate of 57 percent in 2005/06.

SPATI and II represent the operational framework through which the agricultural component of the EDPRS is implemented.

Agriculture is explicitly recognised in the EDPRS as being one of the four priority sectors of the economy that will both stimulate economic expansion and make the greatest contribution to poverty reduction –the other sectors being health, education and road maintenance. The overriding policy objective for the sector is for rural household incomes to be increased in a sustainable manner and for the sources of income to be diversified while, at the same time, food security is to be strengthened.

Another major pillar in policy framework of the Government of Rwanda is the Decentralization Policy adopted in 2000 in order to involve local administrations more directly in the development process. This framework has been incorporated into the design of this Strategic Plan for the Transformation of Agriculture (SPAT). Specific activities have been designed to facilitate a more complete implementation of the decentralization process.

As well as establishing the key areas of intervention, in the form of Programmes and Sub-Programmes, and what is to be achieved in each area, the Strategy specifies how the aims will be achieved. Both the definition of the areas of intervention and the specification of the modalities of intervention –the how– have been guided by a set of basic principles that underlie sector policy. These principles are eight in number of which seven were discussed and are enunciated hereafter.

National policies consider the agricultural sector to be the main springboard for the fight against poverty, and hence reducing poverty is the first basic principle of this Strategy and is a defining characteristic of the interventions. Economic growth in the primary sector should become the principal vehicle for raising rural households out of their situation of generalised poverty. At the same time, agricultural growth should spur progressive development in secondary and tertiary sectors, and this will further alleviate poverty by creating increasingly greater opportunities for off-farm employment.

The key to reducing poverty, in turn, is increasing productivity and competitiveness. This is the only sustainable manner of reducing poverty and is to be achieved through a number of simultaneous thrusts, starting with intensification of input use, improved management of soil and water resources, and farmer training (increasing the stock of human capital in rural areas). The actions will include increasing farmers’ access to physical capital in the form of livestock, to basic resources such as irrigation water and to rural infrastructure such as roads, collection points, and drying and packing facilities.
The third fundamental principle guiding the Strategy is that resource allocations and production decisions must be market driven. There are undoubted opportunities to increase productivity and production in Rwandan agriculture, but the full benefits of those efforts cannot be realized unless the outcomes, and hence the decisions, are linked to the markets from which higher farmer returns are obtained. This also means that the development of the sector rests increasingly on the role of the private sector, and the State will play a facilitating and regulatory role. A corollary is that appropriate incentive structures need to be put in place to drive the desired transformations of the sector. For example, coffee and tea producers merit quality premiums in the prices of the raw material they produce. In some cases, incentives can be transitory, until farmers become familiar with the benefits of new approaches and technologies and generate enough revenue to take on cost burdens themselves. Fertiliser use subsidies have now been a case in point.

Given the degradation of soils in Rwanda and the continuing fragility of the resource base, it was essential that the Strategy for Agricultural Transformation should reconcile intensification of agricultural activities with the preservation of the environment. Thus environmental sustainability is a fourth fundamental principle of the Strategy. It is a critical necessary condition for the continuation of benefits to the rural population. It includes not only the sustainability of new agricultural activities but also actions directed toward the recovery and recuperation of the degraded resource base, so that it can support more highly productive activities in the future.

**Participation in and local ownership of activities** is a fifth fundamental principle of the Strategy. Unless farmers are convinced of the soundness of approaches, they will not be adopted in a lasting manner. Equally, local participation in the design of projects, and in the carrying out of activities like adaptive research, improves the effectiveness of the interventions. In the end agricultural development requires changing attitudes and habits, and this will not happen unless the beneficiaries participate in the undertakings from the outset.

A sixth fundamental principle of the Strategy is institutional sustainability. In a first instance, this means developing fiscal mechanisms and capacity building strategies that ensure the sustainability of the role and functions of local governments. But more broadly, this principle means implementing activities and measures in ways that help create and strengthen sustainable modalities and private institutions. For example, credit operations conducted at the retail level directly by projects and government agencies are not sustainable, particularly when they are subsidised, and they tend to undermine the development of viable private financial institutional modalities in rural areas. Equally, input delivery must be carried out in ways that foster development of sustainable private networks (including producer cooperatives) for that purpose.

The seventh basic principle is that the Strategy is sensitive to the issues of gender, youth, and AIDS. In all phases and dimensions of its design and implementation, and in all locations, these themes must be taken into consideration in the planning and the carrying out of actions. The Constitution itself lays the basis for more gender awareness and actions directed at removing gender biases, and experience in rural development, in other countries as well as Rwanda, has shown that the participation of women in agricultural activities invariably increases their benefits in terms of household welfare.

Agriculture’s basic factors of production are physical resources (land, water) and human capital. The way in which these factors are enhanced and combined is critical for agricultural development.
For effective utilization of these factors in an environment like that of Rwanda, integration of farming systems is essential, along with farmer training, development of entrepreneurial capacities, and a strengthening of the supporting institutional framework. Accordingly, this Strategy develops agendas for action under the aegis of four interrelated Programmes that stress these themes and 20 Sub-Programmes that provide specific paths to implementation.

The four Programmes that lie at the heart of the Strategy are:

i) **Physical resources and food production**: intensification and development of sustainable production systems.

ii) **Producer organization and extension**: support to the professionalization of producers.

iii) **Entrepreneurship and market linkages**: promotion of commodity chains and the development of agribusiness.

iv) **Institutional development**: strengthening public and private sectors and the regulatory framework for agriculture.

Of all these programmes and relative to the kind of project this EIA study is meant for, focus was directed to programme 1 for a more comprehensive discussion.

**Programme 1: Physical resources and food production**: intensification and development of sustainable production systems

The objectives in this area are four-fold:

i) **Create needed soil and water management structures** such as progressive terraces, radical terraces and water harvesting structures in agricultural areas, always ensuring that the necessary complementary actions to restore soil fertility are undertaken. This is particularly necessary in the case of radical terraces, which may require up to 3-4 years of application of organic material and mineral fertilizers before being used for sowing crops. Equally, the progressive terraces need to be combined with the planting of appropriate agroforestry species.

ii) **Demonstrate to farmers and villagers the benefits** of maintaining and using these structures and other practices to enhance soil fertility, and **train them in those practices** using participatory approaches for training farmers and learning how to best adapt practices to each locality.

iii) **Increase ownership of livestock and improve and intensify animal husbandry practices** so that they provide more household income, are consistent with the limited endowments of land per farm household, and contribute to maintaining soil fertility.

iv) **Improve cultivation practices and develop sustainable production systems** in order to generate higher levels of production and farm incomes from the limited base of arable land and to reduce the perceived need to cultivate marginal and vulnerable lands.
Sub-Programme 1.1: Sustainable management of natural resources and water and soil conservation

The objectives of SP1.1 are: 1) to decrease sharply the rate of soil erosion; 2) to provide irrigation to hillside farms; 3) to increase the water retention capacity of watersheds.

The pillars of action for SP1.1 are:

- Investment in structures for water capture and conveyance.
- Investment in structures for erosion control.
- Training in appropriate practices for erosion control and water management.
- Investments, training and incentives for farmers in buffer zones around national parks and other areas that need protection.

Sub-Programme 1.2: Integrated development and intensification of crops and livestock

SP1.2.1 Crop diversification and intensification

The objectives of SP1.2.1 are to: 1) help place agricultural activities per se on a more environmentally sustainable basis, in addition to implementing the soil conservation measures referred to earlier; 2) diversify production to provide farmers with additional sources of income and more security in light of the fluctuating nature of weather variables and market prices; 3) introduce activities and technologies for significantly increasing yields and incomes on the small plots that characterize most of Rwandan agriculture and for providing rural non-farm income; and 4) to integrate livestock and cropping activities on small farms.

The pillars of action of SP1.2.1 are:

- Replicate on a significantly wider scale the successful experiences for integrated livestock-cropping systems.
- Incorporate agro-forestry, including forage species, into mixed cropping and livestock systems.
- Provide specialized expertise for marketing the high-value products that are starting to be produced through these systems.
- Where appropriate, integrate the intensified farming systems with pilots on pressurized irrigation (see below).
- Coordinate in given points in space (localities) the provision of the inputs and technical assistance required to develop and inculcate integrated approaches.

SP1.2.2 Animal resources development

The objectives of SP1.2.2 are: 1) to increase the productivity of livestock activities of all species and in all regions of the country; 2) to train farmers on appropriate methods of livestock husbandry; 3) to improve animal health conditions throughout the country; and 4) to increase the output and value of the fisheries and apiculture sub-sectors.

The pillars of action of SP1.2.2 are:

- Expanded ownership of livestock.
Promotion of zero grazing.
Genetic improvement.
Disease control.

**Sub-Programme 1.3: Marshland Development**

The **objectives** of SP1.3 are: 1) increase the amount of land under irrigation, which will facilitate double cropping, reduce weather risks to yields, and improve product quality, all of which should increase farmer incomes significantly; 2) train farmers in irrigation methods and develop appropriate local institutional mechanisms for management of irrigation systems.

The **pillars of action** of SP1.3 are:

- Investment in land development including drainage systems as well as irrigation infrastructure.
- Selection of high-value crops that warrant the cost of irrigation.
- Minimization of the environmental effects of these activities.
- Organisation of marshland farmers for water management, system maintenance and coordinated planting.
- Develop legislation for WUAs and the corresponding implementing regulations, applicable to irrigation on both hillsides and marshes.

**Sub-Programme 1.4: Irrigation development**

The **objectives** of SP1.4 are to develop successful, sustainable irrigation experiences in Rwanda by: 1) establishing an appropriate legal framework for water use rights and ownership of irrigation systems, 2) developing modern techniques of irrigation centred on pressurized irrigation, and 3) developing farmers’ capacity to manage, in associative form, irrigation systems.

The **pillars of action** of SP1.4 are:

- Establish the legal basis for water use rights and tenure rights for irrigation systems.
- Implement pilots for pressurized irrigation on hillsides and fertigation systems.
- Organise and train hillside farmers for water management, system maintenance, and management of finances for irrigation systems.

**Sub-Programme 1.5: Supply and Use of Inputs**

**Sub-Programme 1.5.1 Fertiliser and agrochemical supply and use**

The **objectives** of SP1.5.1 are: 1) increase rate of use of fertilisers and other modern inputs; and 2) create a sustainable private distribution system to ensure timely delivery of fertilisers to producers at reasonable prices.

The **pillars of action** of SP1.5.1 are:

- Developing demand for agrochemical inputs; the challenge is not only one of physical delivery of inputs to farms but rather it is more one of creating an
appreciation among the farming population for the value of modern inputs in the productive process, and hence creating a lasting demand for them. Farmers already use substantial amounts of fertilizer on crops like coffee, tea, potatoes and rice because they know the benefits that will accrue to it.

- Developing sustainable supply and distribution systems for inputs.
- Refining technical prescriptions for applications of fertilisers and other inputs, by crop, location and season.
- Implementing systems of quality control for the inputs distributed

**Sub-Programme 1.5.2 Certified seeds and other inputs**

The objectives of SP1.5.2 are: 1) increase the rates of adoption of certified seeds; 2) strengthen controls over seed development and multiplication to ensure quality; 3) ensure all cassava farmers have virus-free planting material; 4) promote the use of farm mechanisation in appropriate forms.

The pillars of action of SP1.5.2 are:

- Developing an appropriate legal and institutional framework for certified seeds.
- Increasing production of basic seed.
- Strengthening the activities devoted to seed multiplication and distribution.
- Promotion of demand for seeds.
- Promotion of appropriate farm mechanisation

**Sub-Programme 1.6: Food security and vulnerability management**

The objectives of SP1.6 are: i) to improve household food security and nutrition in rural areas, ii) to reduce the population’s vulnerability to external shocks and health threats.

The pillars of action of SP1.6 are:

- An early warning system regarding possible food shortages.
- Hermetic local storage to reduce food crop losses.
- Education, training and support on nutrition and health including HIV/AIDS.
- Promotion of gender-friendly crops and livestock.
- Improved household environmental health.

The objectives and activities of RSSP III irrigation project sums up nearly all the programmes mentioned above that were stipulated for SPAT II.

### 3.1.4 Water and sanitation policy

Likewise, as land will be used for this project, water too is a key resource for any irrigation to occur hence a review of the water and sanitation policy.
The overall objective of the sector is to improve the living conditions of the population through optimal use of water resources and access of all to water and sanitation services. The strategies of water and sanitation services are:

- Set up of politic, regulatory and institutional framework favourable to rational water resources management;
- Integration of gender to water resources management;
- Development of water supply systems and sanitation services;
- Development of storage and conservation of water infrastructures for multiple uses (agriculture, energy, environment, tourism, etc.);
- Promotion of river and lacustrian transport.

The sector-based strategy, in coherence with the national strategy for poverty reduction and international and regional goals, was developed taking into account the Sector Wide Approach (SWAP) approach, the good quality policy and the participation of all actors; in particular, all concerned communities in the good development of sector-based strategy and its implementation.

The Medium Term Expenditure Framework was used to ensure the coherence between the strategy and available resources within the sector. Also, the water and sanitation strategy is in complementary with national options such as: (i) labor intensive national policy; (ii) gender aspect; (iii) Information and Communication Technology; (iv) the HIV/AIDS; and (v) environmental concern.

The Government of Rwanda has engaged a preparation of strategic investment in the development and protection of the country’s water resources which are critical elements in the economic and social developments. The first phase of this program launched since 2003 comprised of the following elements:

- An Institutional component which will establish the policy basis, the legislative framework and the required institutional arrangements through which the function of water resources management will be undertaken by the government;
- A Technical component which intends in establishing: (i) an information system that enables the institutions in charge of water resources management to have better knowledge, at any time, of the current situation (water quality, quantity available) and to assess the critical issues on various sectors of the water use and to prepare the implementation of the pertinent solutions.
- A Human resource development component which ensuring the assessment of the human resource development and capacity building needs ensures that the water resources management functions are efficiently and well performed at all levels.

The current activities of Nile Basin Initiative strategic action plans and the African Ministerial Conference on Water, which Rwanda is a member, complement the activities proposed in this program.
3.2 REGIONAL POLICIES AND REGULATIONS

3.2.1 EAC protocol on environment and natural resources

This Protocol shall apply to the East Africa Partner States’ cooperation in the management of the environment and natural resources within their jurisdiction including trans-boundary ecosystems and natural resources.

Article 3 of this Protocol states that it is a protocol of general application and shall apply to all activities, matters and areas of management of the environment and natural resources of the Partner States, including the following: (i) sustainable environment and natural resources management; (ii) management of trans-boundary resources; (iii) conservation of biological diversity; (iv) management of forest and tree resources; (v) management of wildlife resources; (vi) management of water resources; (vii) management of wetland resources; (viii) management of coastal and marine resources; (ix) management of fisheries resources; (X) management and access to genetic resources; (xi) management of mineral resources; (xii) management of energy resources; (xiii) management of mountain ecosystems; (xiv) soil and land use management; (xv) management of rangelands; (xvi) combating desertification and mitigating the effects of drought; (xvii) protection of the ozone layer; (xviii) tourism development; (xix) biotechnology; (XX) management of chemicals; (xx) management of wastes and hazardous wastes; (xxi) pollution control and management; (xxii) environmental impact assessment and environmental audits; (xxiv) environmental standards; (xxv) military and hostile activities; (XXVI) environmental education and capacity building; (xxvii) public participation, access to information and justice; and (XXVIII) environmental disaster preparedness and management.

Most of the water bodies from which the RSSP III irrigation scheme is based, are shared trans-boundary resources and as such shall follow this EAC protocol.

3.3 INTERNATIONAL POLICIES AND REGULATIONS

3.3.1 World Bank Safeguard policies

3.3.1.1 Environmental Assessment- OP/BP 4.01

It is internationally required that environmental assessment (EA) of projects is proposed for financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.

It takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. Environmental Assessment considers natural and social aspects in an integrated way.

Generally, an environmental screening of each proposed project should be undertaken to determine the appropriate extent and type of Environmental Assessment. It involves classification
of the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

(a) **Category A**: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. Environmental Assessment for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the proponent is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral Environmental Assessment).

(b) **Category B**: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of Environmental Assessment for a Category B project may vary from project to project, but it is narrower than that of Category A Assessment. Like Category A Environmental Assessment, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

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

The Gacaca marshland development project may be classified as Category B project and as such requires an EIA.

### 3.3.1.2 Involuntary resettlement OP/BP- 4.12

International experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.

Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. For these reasons, the overall objectives of this policy on involuntary resettlement are the following:
(a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.

(b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.

(c) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

This policy also covers direct economic and social impacts that both result from investment projects, and are caused by:

(a) the involuntary taking of land resulting in; (i) relocation or loss of shelter; (ii) loss of assets or access to assets; or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or

(b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

This policy applies to all components of a project that result in involuntary resettlement, regardless of the source of financing. It also applies to other activities resulting in involuntary resettlement, that in the judgment of the responsible authorities, are: (a) directly and significantly related to the project, (b) necessary to achieve its objectives as set forth in the project documents; and (c) carried out, or planned to be carried out, contemporaneously with the project.

To address the impacts of this policy, it is necessary that proponent prepares a resettlement plan or a resettlement policy framework that covers the following:

(a) The resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are: (i) informed about their options and rights pertaining to resettlement; (ii) consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives; and (iii) provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project.

(b) If the impacts include physical relocation, the resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are: (i) provided assistance (such as moving allowances) during relocation; and (ii) provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site.

Where necessary to achieve the objectives of the policy, the resettlement plan or resettlement policy framework also include measures to ensure that displaced persons are: (i) offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed
to restore their livelihood and standards of living; and (ii) provided with development assistance in addition to compensation measures; (iii) such as land preparation, credit facilities, training, or job opportunities.

3.3.1.3 Projects on International Waterways- OP/BP- 7.50

This policy applies to the following types of international waterways: (a) any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states; (b) any tributary or other body of surface water that is a component of any waterway described in (a) above; and (c) any bay, gulf, strait, or channel bounded by two or more states or, if within one state, recognized as a necessary channel of communication between the open sea and any river flowing into such waters.

The policy concurrently applies to the following types of projects: (a) hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways; and (b) detailed design and engineering studies of projects mentioned above.

Through notification of riparian countries, it is necessary to ensure that the international aspects of a project on an international waterway are dealt with at the earliest possible opportunity. If such a project is proposed, the developer is required, if it has not already done so, to formally notify the other riparians of the proposed project and its Project Details. It should be ascertained whether the riparians have entered into agreements or arrangements or have established any institutional framework for the international waterway concerned. In the latter case, the responsible authority ascertains the scope of the institution's activities and functions and the status of its involvement in the proposed project, bearing in mind the possible need for notifying the institution.

The RSSP III irrigation project shares the Muvumba river with Uganda, while the two lakes Cyambwe and Nasho are at the periphery of Akagera river, which could imply that they the project actually lies in the Akagera basin and therefore would require notification of the proposed project to riparian countries before execution, in the event that it has not yet been done.

3.3.1.4 Pest Management- OP/BP-4.09

In assisting the proponent to manage pests that affect either agriculture or public health, a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides is necessary. The proponent addresses pest management issues in the context of the project's environmental assessment.

The proponent is required to use various means to assess pest management in the country and support integrated pest management (IPM) and the safe use of agricultural pesticides: economic and sector work, sectoral or project-specific environmental assessments, participatory IPM assessments, and investment projects and components aimed specifically at supporting the adoption and use of IPM.
For agriculture projects, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest.

With respect to the classification of pesticides and their specific formulations, the proponent may refer to the World Health Organization’s *Recommended Classification of Pesticides by Hazard and Guidelines to Classification* (Geneva: WHO 1994-95). The following criteria apply to the selection and use of pesticides in such projects: (a) They must have negligible adverse human health effects. (b) They must be shown to be effective against the target species. (c) They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them. (d) Their use must take into account the need to prevent the development of resistance in pests.

Finally, it is required that any pesticides be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable Internationally.

### 3.3.1.5 Natural habitat- OP/BP-4.04

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The proponent should, therefore, support the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The proponent is expected to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

In the areas of project intervention, the proponent should identify; (a) natural habitat issues and special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats), and (b) measures for protecting such areas in the context of the country’s development strategy. As appropriate, Country Assistance Strategies and projects incorporate findings from such economic and sector work.

Under the project design and implementation, the developer may promote and support natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the developer should promote the rehabilitation of degraded natural habitats.

The proponent is not expected to engage a project that involves the significant conversion or degradation of critical natural habitats.

### 3.3.1.6 Physical Cultural resources- OP/BP- 4.11

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have
archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people’s cultural identity and practices.

The objective of this policy is to assist countries to avoid or mitigate adverse impacts on physical cultural resources from development projects. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the national legislation, or its obligations under relevant international environmental treaties and agreements.

Impacts on physical cultural resources in projects needed to be addressed, as an integral part of the environmental assessment (EA) process. The steps elaborated below follow the EA sequence of: screening; developing terms of reference (TORs); collecting baseline data; impact assessment; and formulating mitigating measures and a management plan.

The following projects are classified during the environmental screening process as Category A or B, and are subject to the provisions of this policy: (a) any project involving significant excavations, demolition, movement of earth, flooding, or other environmental changes; and (b) any project located in, or in the vicinity of, a physical cultural resources site recognized nationally. Projects specifically designed to support the management or conservation of physical cultural resources are individually reviewed, and are normally classified as Category A or B.

To develop the TORs for the EA, the developer, in consultation with the relevant experts, and relevant project-affected groups, identifies the likely physical cultural resources issues, if any, to be taken into account by the EA. The TORs normally specify that physical cultural resources be included in the baseline data collection phase of the EA.

The developer identifies physical cultural resources likely to be affected by the project and assesses the project’s potential impacts on these resources as an integral part of the EA process, in accordance with the Bank’s EA requirements.

When the project is likely to have adverse impacts on physical cultural resources, the developer identifies appropriate measures for avoiding or mitigating these impacts as part of the EA process. These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost.

As an integral part of the EA process, the developer develops a physical cultural resources management plan that includes measures for avoiding or mitigating any adverse impacts on physical cultural resources, provisions for managing chance finds, any necessary measures for strengthening institutional capacity, and a monitoring system to track the progress of these activities. The physical cultural resources management plan is consistent with the country’s overall policy framework and national legislation and takes into account institutional capabilities with regard to physical cultural resources.
For the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. Because there are serious consequences if a dam does not function properly or fails, the World Bank is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent.

New Dams
When the Bank finances a project that includes the construction of a new dam, it requires that the dam be designed and its construction supervised by experienced and competent professionals. It also requires that the borrower adopt and implement certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works.

The Bank distinguishes between small and large dams.

(a) Small dams are normally less than 15 meters in height. This category includes, for example, farm ponds, local silt retention dams, and low embankment tanks.

(b) Large dams are 15 meters or more in height. Dams that are between 10 and 15 meters in height are treated as large dams if they present special design complexities. For example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials. Dams under 10 meters in height are treated as large dams if they are expected to become large dams during the operation of the facility.

For small dams, generic dam safety measures designed by qualified engineers are usually adequate. For large dams, the Bank requires:

a) reviews by an independent panel of experts (the Panel) of the investigation, design, and construction of the dam and the start of operations;

b) Preparation and implementation of detailed plans: a plan for construction supervision and quality assurance, instrumentation plan, an operation and maintenance plan, and an emergency preparedness plan;

c) Prequalification of bidders during procurement and bid tendering, and

d) Periodic safety inspections of the dam after completion.

The Panel consists of three or more experts, appointed by the borrower and acceptable to the Bank, with expertise in the various technical fields relevant to the safety aspects of the particular dam. The primary purpose of the Panel is to review and advise the borrower on matters relative to dam safety and other critical aspects of the dam, its appurtenant structures, the catchment area, the
area surrounding the reservoir, and downstream areas. However, the borrower normally extends the Panel's composition and terms of reference beyond dam safety to cover such areas as project formulation; technical design; construction procedures; and, for water storage dams, associated works such as power facilities, river diversion during construction, ship lifts, and fish ladders.

The borrower contracts the services of the Panel and provides administrative support for the Panel's activities. Beginning as early in project preparation as possible, the borrower arranges for periodic Panel meetings and reviews, which continue through the investigation, design, construction, and initial filling and start-up phases of the dam. The borrower informs the Bank in advance of the Panel meetings, and the Bank normally sends an observer to these meetings. After each meeting, the Panel provides the borrower a written report of its conclusions and recommendations, signed by each participating member; the borrower provides a copy of that report to the Bank. Following the filling of the reservoir and start-up of the dam, the Bank reviews the Panel's findings and recommendations. If no significant difficulties are encountered in the filling and start-up of the dam, the borrower may disband the Panel.

Existing Dams and Dams under Construction

The Bank may finance the following types of projects that do not include a new dam but will rely on the performance of an existing dam or a dam under construction (DUC): power stations or water supply systems that draw directly from a reservoir controlled by an existing dam or a DUC; diversion dams or hydraulic structures downstream from an existing dam or a DUC, where failure of the upstream dam could cause extensive damage to or failure of the new Bank-funded structure; and irrigation or water supply projects that will depend on the storage and operation of an existing dam or a DUC for their supply of water and could not function if the dam failed. Projects in this category also include operations that require increases in the capacity of an existing dam, or changes in the characteristics of the impounded materials, where failure of the existing dam could cause extensive damage to or failure of the Bank-funded facilities.

If such a project, as described above, involves an existing dam or DUC in the borrower's territory, the Bank requires that the borrower arrange for one or more independent dam specialists to; (a) inspect and evaluate the safety status of the existing dam or DUC, its appurtenances, and its performance history; (b) review and evaluate the owner's operation and maintenance procedures; and (c) provide a written report of findings and recommendations for any remedial work or safety-related measures necessary to upgrade the existing dam or DUC to an acceptable standard of safety.

The Bank may accept previous assessments of dam safety or recommendations of improvements needed in the existing dam or DUC if the borrower provides evidence that (a) an effective dam safety program is already in operation, and (b) full-level inspections and dam safety assessments of the existing dam or DUC, which are satisfactory to the Bank, have already been conducted and documented.

Necessary additional dam safety measures or remedial work may be financed under the proposed project. When substantial remedial work is needed, the Bank requires that (a) the work be designed and supervised by competent professionals, and (b) the same reports and plans as for a new Bank-financed dam be prepared and implemented. For high-hazard cases involving significant and complex remedial work, the Bank also requires that a panel of independent experts be employed on the same basis as for a new Bank-financed dam.
When the owner of the existing dam or DUC is an entity other than the borrower, the borrower enters into agreements or arrangements providing for the measures set out in paragraphs above to be undertaken by the owner.

**Policy Dialogue**

Where appropriate, as part of policy dialogue with the country, Bank staff discuss any measures necessary to strengthen the institutional, legislative, and regulatory frameworks for dam safety programs in the country.

<table>
<thead>
<tr>
<th>Safeguard Policies Triggered by the Project</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental Assessment (OP/BP 4.01)</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>The project will support investments in irrigation schemes, soil and water conservation that in some cases will involve heavy machine construction works. It has been classified under category B as per international categorisation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural Habitats (OP/BP 4.04)</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>Though the area of project intervention has been occupied, with land use activities such as agricultural farming and cattle keeping predominant. From field visits and analysis of the project components, there is still riparian fauna in the northern zone of the marshland that is constantly flooded in the wet season that could be affected by the marshland rehabilitation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pest Management (OP 4.09)</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>The project will support Sustainable Land Management (SLM) activities, including improved agricultural practices which may involve the need to control agricultural pests. IPM frameworks will need to be prepared to address the requirements of this policy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Cultural Resources (OP/BP 4.11)</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>This policy has been triggered due to the possibility of unexpected findings of cultural artifacts during the implementation of works, and chance findings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Projects on International Waterways- OP/BP- 7.50</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>This being an Irrigation project with its source of water from lakes and rivers in the Akagera basin shared by Nile basin riparian countries. It is very likely that this policy is triggered by the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Involuntary resettlement - OP/BP- 4.12</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>This being an Irrigation project there is a possibility of displacement of communities, which give rise to economic, social and environmental risks, impoverishment, social network weakening, kin groups dispersed, cultural identity dissolved. It is very likely that this policy is triggered by the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dam safety</strong></td>
<td>[X]</td>
<td></td>
</tr>
<tr>
<td>The project involves construction of a new dam, with the height for the main dam of 9.1m. This implies that the irrigation dam is categorized under the small dam but requiring qualified dam experts for its designs. Dam safety precautions of a small dam will be looked at by the technical design team especially with an indication that they have designed a number of irrigation dams with in Rwanda that are currently operating efficiently</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.3.2 INTERNATIONAL CONVENTIONS

3.3.2.1 Ramsar Convention

In 1971, the international Convention on Wetlands was adopted in Ramsar, Iran. The Ramsar Convention is an inter-governmental treaty for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention has been signed by 159 governments (contracting parties) of which Rwanda is part.

The Ramsar List of Wetlands of International Importance includes over 1,800 wetland sites, covering all regions of the planet. Ramsar makes grants in support of its objectives:

- Conservation and wise use of wetlands;
- Emergency conservation assistance at Ramsar sites; and
- Education and training in wetlands management.

3.3.2.2 United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC provides the basis for global action "to protect the climate system for present and future generations". The Convention has been universally signed by 189 countries. Rwanda is a signatory to this convention.

The main objective of this Convention is to achieve stable greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The Convention requires a framework for inter-government efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.

At the UNFCCC Convention, governments:
- Gather and share information on greenhouse gas emissions, national policies and best practices.
- Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries.
- Cooperate in preparing for adaptation to the impacts of climate change.

3.4 INSTITUTIONAL FRAMEWORK

For the Gacaca marshland development scheme to succeed, a number of key implementers shall be involved that include; MINAGRI, RSSPIII, REMA, MINIRENA, RNRA, RDB, Local government
and the World Bank. The roles and responsibilities of each of these implementers is elaborated hereafter.

**MINAGRI/ RSSP III**

In order for the proposed mitigation measures to be implemented in an environmentally friendly way, a number of institutions are required to actively participate in this regard. MINAGRI, acting on behalf of the Government of Rwanda as the borrower and project implementer shall oversee operations of the RSSP III. RSSP III considered as the project unit on the ground and coordinating the project activities on behalf of MINAGRI, has the required staff at the head office and district level to directly implement all proposed mitigation measures and proceed with procuring contractors for required construction works.

**World Bank**

The World Bank, as the lender, shall ensure that the Gacaca marshland project follows all World Bank safeguard policies that the project is found to trigger. These safeguard policies are internationally recognised and therefore shall apply to the Gacaca project. Also during mid-term review of RSSP III, the Gacaca marshland project will be one of the RSSP III projects reviewed environmentally to ensure proposed mitigation measures were applied and the entire project is a sustainable development.

**MINIRENA**

The Ministry of Natural Resources (MINIRENA) is considered as the Government’s arm responsible for establishing norms and practices for rational exploitation and efficient land management, Environment protection, Water Resources and evaluating their implementation. This implies that it shall oversee all aspects regarding environmental monitoring and appropriate natural resources exploited through project activities. MINIRENA delegates some of these responsibilities to REMA, RNRA and RDB.

**REMA**

REMA, as the authorised Government institution to determine modalities of protection, conservation and promotion of the environment in Rwanda, shall review the EIA report, authorise the project to proceed by issuing an EIA certificate and periodically monitor the Gacaca marshland activities to ensure mitigation measures and that it has no adverse impacts on the environment.

**RNRA**

It is the authority that leads the management of promotion of natural resources i.e. land, water, forests, mines and geology. It has been entrusted with supervision, monitoring and to ensure the implementation of issues relating to the promotion and protection of natural resources in programs and activities of all national institutions. RNRA will ensure that the project does not exploit resources to levels of depletion. Working independently like REMA, RNRA will periodically visit and assess the extent of project influence on natural resources in the area.

**Local Government**

Local government shall be considered under the jurisdiction of Kayonza district, Murundi sector, down to Ryamanyoni and Karambi cell. Local authorities that include District Mayor and Executive secretaries for the sectors and cells shall be at the forefront of; organizing local farmers into cooperatives, WUAs, participating in demarcation of plots in the marshland, compensation of
affected property, conflict resolutions amongst farmers, market access for farmers among others. All these activities shall be done in conjunction with RSSPIII coordination.
CHAPTER 4: BASELINE ENVIRONMENTAL CONDITION

4.1 PHYSICAL ENVIRONMENT

Physical environmental survey involves understanding the actual status of the area, in regard to; climate (temperature, rainfall), relief, hydrology, vegetation, soil, water and air quality. Physical parameters of both sites are discussed hereafter.

4.1.1 Climate

Rwanda is located within the equatorial belt; its climate is strictly not of the equatorial rainy forest type. It has a modified humid climate including rainy forest and Savannah types. The central and eastern part of the country is generally of semi-arid type owing to its position in the rainy shadow of the western highlands. With Kayonza district in the eastern part of the country, the Gacacasite qualifies for climatic classification under the savannah grasslands.

Savannas have warm temperature year round. There are actually two very different seasons in a savanna; a very long dry season and a very wet season. In the dry season only an average of about 4 inches (1200mm) of rain falls. Between December and February no rain will fall at all. Oddly enough, it is actually a little cooler during this dry season. But hot weather might not be expected; it is still a temperature averaging around 20° C.

4.1.1.1 Temperature

The average annual temperature for Murundi sector in Kayonza, the intervention area, is in the range of 18-20°C but might rise slightly above 21°C but not exceeding 25°C, during the dry season, while it might drop to 16°C in the wet season as the figure below indicates.

Figure 4.1.0 Average temperature
4.1.1.2 Rainfall

The rainfall characteristics for Rwanda are known to exhibit large temporal and spatial variation due to varied topography and existence of large water bodies in and near the country. However, two rainy seasons are generally distinguishable, one centred on March – May and the other on October – December. Temporal variability of the rainfall in some occasions has resulted in extreme events such as the floods of 1997/98 El-Niño phenomena and frequent droughts that have far reaching socio-economic impacts to the country.

For the areas of concern, rainfall averages in the range of 900-1000mm/yr., as may be observed from the figure below, part of the eastern region of the country.

![Figure 4.1.1Average Rainfall](image)

Gacaca marshland is saturated during rainy seasons due to the Gacaca river and longitudinal slopes of the area. River Gacaca dries during dry season mostly in the month of June up to August. With no rainfall gauges in the area, during the technical study, the closest rainfall data was obtained from Kiziguro meteorological station. Data ranging from 1931-2011 with about 7-8 years of data missing possibility lost in the period of war and post war times.

Results indicate that the monthly distribution of rainfall, as observed at Kiziguro located 25 km west the dam site, is maximum in April exceeding 120 mm/month during the main rainy season. During the period of September through December, a monthly rainfall greater than 60 mm is experienced.
4.1.2 Hydrology

The marshland is situated in a 26 km long valley. Its watershed covers nearly 146 km², however, the developable area for the irrigation scheme is fed by two watersheds. The main watershed (BV1) of 97.4 km² is drained by the Gacaca river, while the lateral watershed (BV2) of 24.4 km² is drained by River Kamunzi and Kayongo. The main water shed is divided into 7 sub-watersheds that drain into Gacaca river while the lateral watershed is divided in to 2 sub-watersheds that drain in the two rivers (Kamumzi and Kayongo). Watershed characteristics are presented in the table below.

Table: 4.1. Watershed characteristics

<table>
<thead>
<tr>
<th>Name</th>
<th>Area (Km²)</th>
<th>Elev. Min (m)</th>
<th>Elev. max. (m)</th>
<th>Elev. Av. (m)</th>
<th>Slope min. (%)</th>
<th>Slope max (%)</th>
<th>Slope Av. (%)</th>
<th>Hydr. Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV1</td>
<td>97.42</td>
<td>1353</td>
<td>1720</td>
<td>1511.5</td>
<td>0.0</td>
<td>64.4</td>
<td>14.2</td>
<td>27,107</td>
</tr>
<tr>
<td>BV2</td>
<td>24.41</td>
<td>1360</td>
<td>1661</td>
<td>1505.5</td>
<td>0.3</td>
<td>60.0</td>
<td>16.8</td>
<td>11814</td>
</tr>
</tbody>
</table>

Most of the marshland is inundated during the rainy season due to very low longitudinal slopes. The Gacaca river dries up completely during the dry season.

As no gauging data is available at the area of intervention, a rain-run off model was used to determine monthly inflows and floods coming from the two catchment areas BV 1 and 2, as per SHER, 2012 preliminary technical study report.

Kiziguro station rainfall data available from 1931 to 2011 was used with the rain run-off model filling the missing years, to prepare average, guaranteed rainfall as well as maximum rainfalls for the various flood return years.

Table: 4.2. Average and guaranteed rainfall based on Kiziguro station

<table>
<thead>
<tr>
<th>Rainfall</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. 5/10(mm)</td>
<td>44.2</td>
<td>83.1</td>
<td>107.1</td>
<td>136.1</td>
<td>91.4</td>
<td>16.7</td>
<td>7.1</td>
<td>22.3</td>
<td>56.0</td>
<td>85.9</td>
<td>96.0</td>
<td>68.4</td>
</tr>
<tr>
<td>Av. 8/10(mm)</td>
<td>25.0</td>
<td>46.4</td>
<td>60.2</td>
<td>99.6</td>
<td>62.6</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>30.6</td>
<td>53.8</td>
<td>66.8</td>
<td>38.7</td>
</tr>
</tbody>
</table>

Table: 4.3. Maximum rainfall based on Kiziguro station

<table>
<thead>
<tr>
<th>Return period</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Rainfall (mm)</td>
<td>66.66</td>
<td>76.67</td>
<td>89.32</td>
<td>98.70</td>
<td>108.02</td>
</tr>
</tbody>
</table>

Monthly inflow from BV1 and BV2 deduced on the basis of estimated runoff coefficient which have proved adapted in the area for similar projects indicated that; (i) during the agricultural season A highest inflows occurred in November with over 280l/s from BV1 and over 70l/s from BV2.
(ii) during season B highest inflows occurred in April reaching up to 502l/s from BV1 and up to 126l/s from BV2.

Floods flows were also estimated for 10, 25, 50 and 100 year return period. Two rain-runoff models used: Soil Conservation Service(SCS) and Orstom that gave results of among others, the 100 year
return flood on the main watershed (BV1) estimated to be ~110 m$^3$/s and ~60 m$^3$/s on the side watershed (BV2) as the table indicates:

<table>
<thead>
<tr>
<th>Return floods</th>
<th>Main watershed (BV1)</th>
<th>Lateral watershed (BV2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Q_{\text{max}}$</td>
<td>$Q_{\text{max}}$ SCS</td>
</tr>
<tr>
<td>(Years)</td>
<td>Ortsom</td>
<td>Ortsom</td>
</tr>
<tr>
<td>10</td>
<td>47.2</td>
<td>33.8</td>
</tr>
<tr>
<td>25</td>
<td>55.0</td>
<td>68.5</td>
</tr>
<tr>
<td>50</td>
<td>60.8</td>
<td>109.8</td>
</tr>
<tr>
<td>100</td>
<td>66.5</td>
<td>150.2</td>
</tr>
</tbody>
</table>

### 4.1.3 Ecological flow analysis for Gacaca River

As no gauging data is available along the Gacaca River, rain-run off models were used to determine monthly in-flows coming from the catchments. The key catchment of Gacaca (BV1) was considered and the data generated is indicated in Table below (SHER, 2012).

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (mm)</td>
<td>14.7</td>
<td>27.7</td>
<td>35.7</td>
<td>45.4</td>
<td>40.5</td>
<td>30.5</td>
<td>2.4</td>
<td>7.4</td>
<td>18.7</td>
<td>28.6</td>
<td>32.0</td>
</tr>
<tr>
<td>Runoff coef</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Area (Km$^2$)</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
<td>97.4</td>
</tr>
<tr>
<td>Runoff (l/s)</td>
<td>116.3</td>
<td>249.9</td>
<td>322.1</td>
<td>409.2</td>
<td>274.7</td>
<td>18.9</td>
<td>5.4</td>
<td>16.8</td>
<td>126.3</td>
<td>258.1</td>
<td>288.7</td>
</tr>
<tr>
<td>Base flow (l/s)</td>
<td>121.8</td>
<td>121.8</td>
<td>194.8</td>
<td>194.8</td>
<td>194.8</td>
<td>97.4</td>
<td>4.9</td>
<td>4.9</td>
<td>24.4</td>
<td>48.7</td>
<td>73.1</td>
</tr>
<tr>
<td>Av. Flow, $Q_{\text{avg}}$ (l/s)</td>
<td>238.1</td>
<td>371.7</td>
<td>516.9</td>
<td>604.0</td>
<td>469.5</td>
<td>116.3</td>
<td>10.3</td>
<td>21.7</td>
<td>150.7</td>
<td>306.8</td>
<td>361.8</td>
</tr>
<tr>
<td>Av. Qty (m$^3$)</td>
<td>637,727</td>
<td>899,297</td>
<td>1,384,376</td>
<td>1,565,568</td>
<td>1,257,598</td>
<td>301,450</td>
<td>27,498</td>
<td>58,121</td>
<td>390,701</td>
<td>821,822</td>
<td>937,699</td>
</tr>
</tbody>
</table>

In determining the Ecological demand for the Gacaca River, the existing monthly flow, above, from the SHER 2012 technical report was used to generate a Flow Duration Curve (FDC) as indicated in figure 4.1.2. From the FDC, the flow value indicated at 95% of the time discharge is nearly 120,000 m$^3$. Using the 120,000 m$^3$ as the threshold for the definition of the ecological demand, a comparison of the monthly flow with the threshold ecological demand for the catchment of Gacaca gives a curve as represented in figure 4.1.3.
Deductions from these graphical representations indicate that other than July and August, all the other months have much higher flow than is required for the Ecological flow.

**Interuption of flow downstream**

When filling the reservoir, one of the options would be to create diversion to allow sharing of the dam in-flow with a minimum flow requirement of the river. The other option would be to have all the in-flow into the dam. For this case, based on the figure 4.1.4 below of a cumulative flow representation against monthly flow, it illustrates that at least 3 months will be required to obtain the 2.5Milion m$^3$ capacity of the dam. The recommended option would be to allow sharing of dam in-flow and maintain a minimum continuous flow of the river for the downstream to continue to
use the river water without interruption, especially since it is quite a short period in a year for the reservoir to fill to the required 2.5 Million m$^3$ capacity.

**Figure 4.1.4 Cumulative flow**

![Flow variation for Gacaca Marsh](image)

**4.1.4 Relief**

Gacaca marshland is an anchored marshland situated at about 1,350 m above sea level, at the center of which Misarara stream flows (Gacaca river). The watershed of this marshland has hills with elevation ranging from a minimum of 1350m- maximum of 1720, a slope average of 14-16%.

Its catchment comprises of undulating hilly slopes covered with thin slightly rocky soils on which xeric natural vegetation similar to that found in Akagera National Park. This is backed by the fact it was once part of the National park until it was settled by returning 1959 Rwandan refugees and migrants from other provinces of the country.

**Slope classification**- Based on slope classification map *(refer to appendix 7)* of the Gacaca marshland area, the marshland is classified under <2% slope appropriate for levelling the plots and gravitational irrigation. The hillside slopes by the marshland were classified within a 6-25% slope, suitable to act as a watershed to sustain the flow in Gacaca river and the marshland too.

**4.1.5 Soils**

The characteristics of the different soil series in Gacaca marshland and its surroundings are described in the soil map of Rwanda as:

- **Mubunza series (MZ)**: “The series MUBUNZA is a member of the family” of very-fine montmorillonitic, isohyperthermic Typic Chromusterts “Soil Taxonomy, USDA 1975. This series consists of soils developed in alluvial materials and are heavy-clay, well drained and
have a vertic development, these soils are no limited by any load gravel. They occur mainly in a regime of pedoclimatic ustiqueisohyperthermique”.

- **Nyamatebe series (NT):** “The series NYAMATEBE is a member of the family” of fine, mixed isohyperthermic Cumulic Haplaquolls “Soil Taxonomy, USDA 1975. This series consists of soils developed in alluvial material and are clayey, yellow, poorly drained and have a cambic development. These soils are not limited by any load gravel. They occur mainly in a regime of aquiqueisohyperthermique.”

- **Rwagitima series (RW):** “The series RWAGITIMA is a member of the family” of very fine, montmorillonitic, isohyperthermic Paleustollic Chromustert “Soil Taxonomy, USDA 1975. This series consists of soils developed in alluvial material and are heavy clayey, imperfectly drained and have a vertic development. These soils are not limited by any load gravel. They occur mainly in a regime of pedoclimatic ustiqueisohyperthermique.”

In reference to the Rwanda soil map, the most dominant soil series in this marshland is RW-Rwagitima series (Paleustollic Chromustert), which belongs to Vertic soil order according to the USDA 1975 Soil Taxonomy.

The analysis of the soil map indicates that ability of Gacaca marshland is uniformly favourable to the cultivation of rice; in fact the soils are derived from alluvial materials. The colluvial and soil minerals are mainly of cambic and vertic development.

Gacaca marshland has no limitation related to topography, with its slope seemingly less than 2% along the entire length, as per the slope classification map. Stoniness or gravel load is absent or below 10%. Soil depth is greater than 100cm as per the technical study by SHER. Drainage conditions are moderate to severe; the marsh generally poorly drained. *(SHER Report, 2012)*

On an overall outlook, the Gacaca marshland has soils that are suitable for growing rice and therefore worth the development proposed for it.
4.1.6 Geology

From field visits to the area and secondary data analysis, it was observed that the rocks around the intervention area are migmatites, gneisses and mica schists of the Paleoproterozoic Ruzizian basement overlain by the Mesoproterozoic Kibaran Belt. The Kibaran composed of folded and metamorphosed sediments mainly; the schists and quartzites intruded by granites, covers this region.
4.2. BIOLOGICAL ENVIRONMENT

Rwanda, having a tropical climate, boosts of different species of flora and fauna. Its climatic conditions are favourable for vegetation growth and animal habitat. The areas of intervention all in the eastern provinces may be classified under the savannah grasslands. It was therefore evident that the type of flora and fauna identified in the region was of similar grassland areas.

4.2.1 Flora and Fauna

4.2.1.1 Bio-physical aspect of the marshland

Gacaca marshland is a portion of the Buyanja-Gacaca wetland that was already inventoried and classified as a “wetland under conditional management” under the Integrated Marshland Critical Ecosystems (IMCE) Project. (REMA-IMCE, 2008). In particular, the marshland area to be developed for rice production can be best described under three zones:

- **The southern zone**, grazed by domestic cattle, is savannah vegetation degraded by bush fires and trampling where soles of ligneous pyrophile plants of the genus *Acacia* spp (locally called Umunyinya) and *Euphorbia candelabras* (locally called Umuduha) can be seen. The presence of *Sporobolus pyramidalis* indicates a state of advanced degradation of the indigenous species.

- **The central zone** is a zone under both cultivation and grazing. Indeed, uncultivated areas are fallows covered by ruderal plants such as; *Bidens pilosa* and *Cynodon dactylon* indicating current or previous existence of small farms.

- **The northern part** is surely flooded almost all year long. This zone indicates that, although most of the indigenous species were certainly altered, there is still part of original ecosystem dominated by riparian plants such as *Cyperus* spp which dominate and properly adapt to flooded areas of marshland.
The catchment areas surrounding the marshland (i.e. the main and lateral catchments) constitute of savannah grassland degraded by bush fires, trampling and erosion. It is an area quite dry and consequently, there is a likely possibility of conflict for water between Livestock farmers and the rice perimeter once the marsh has been developed.

The wild fauna identified for the Akagera wetlands complex under which this marshland is made of 16 species of amphibians, 13 reptile species, 54 bird species and 11 mammal species. With human occupation of the area, changes in land use to livestock farming and agricultural cultivation, the area is now left with a few birds species nesting on the *Acacia spp* trees demarcated for the reservoir (and other fauna such as reptiles (snakes, lizards) and amphibians(frogs). Birds (such as kingfisher (locally called Nyiramurobyi) that feed on reptiles) have been observed to migrate with the neighbouring rice paddies of Ntende marshland so as to feed on these reptiles and amphibians.

4.2.1.2 Socio-ecological aspect of the marshland

The dyke and the reservoir were proposed for location partly in the central zone and the rest entirely in southern zone. These areas are currently cultivated areas with perennial crops such as banana plantations and seasonal crops such as; maize, sorghum and cassava plantations. The southern zone, which will be inundated by the reservoir, is exploited currently under livestock farming with two kinds of farmers; (i) those with large modern farms in the range of 5-25ha fenced off, divided into paddocks, valley dams with water for their livestock, hectares of land cultivated with Napier grass as fodder, (ii) pastoralists with less than 10 cattle practicing open field grazing. This areas also hosts boreholes where water is collected for domestic use, women wash clothes and are used as cattle watering places.

Rehabilitation of the Gacaca marshland might have a number of impacts on the people of Ryamanyoni and Karambi cell, Murundi sector:

- Some habitats will be threatened, examples being open field pastoral grazing.
Some of the locals will lose of part their farms encroached on by the reservoir, dyke or other project activities.

Loss of farm land, cattle water points, drinking mounds “Ikibumbiro” and pastoral open field grazing may be argued to cause a reduction in milk production. However, it might also be argued that with cattle kept in kraals, water supplied to or near the farms under the Livestock Infrastructure Strategic Programmes (LISP) project and fodder delivered to the cattle, less energy would be lost by cattle in grazing and hence milk production will increase.

Locals living near the reservoir will be exposed to a number of diseases and dangers e.g. malaria, bilharzia, drowning, etc.

These issues shall need to be addressed in the course of planning this irrigation scheme in Gacaca marshland; more of the likely impacts are addressed in the chapters to come.

In conclusion regarding the ecosystem of the area, one could say that the establishment of the dam and other irrigation infrastructure is not likely to cause significant threat for the current biodiversity of this area. From the assessment of the project area and interviews with the locals, there is no protected plant species mentioned in the Rwandan Ministerial order No. 007/2008, article 4, appendix II identified at project site.

4.3. SOCIO ECONOMIC ENVIRONMENT

This section attempts to understand the current social status versus the likely effects of the proposed project. It involves collecting primary data from field investigations, group meetings, public consultations and expert field observations. It therefore describes the baseline of the socio-economic parameters of the area before project implementation. Some of the parameters that were discussed are; population and demography, land use, infrastructure (roads, water, electricity), health and sanitation, education, etc.

4.3.1 Administrative structure

Gacaca marshland is located in the Eastern province of Rwanda, Kayonza district, Murundi sector. Murundi sector comprises of 4 cells, 43 villages, about 31,000 people and 6231 households.

Of the 4 cells, the scope of the irrigation scheme directly affects 2 cells; Ryamanyoni and Karambi cells, hence our focus. Area is accessed by an earth feeder road about 15km off the paved road from Kayonza town center, at junction leading to Rukara sector. Three quarters (¾) of the sector was previously a portion of the Akagera National park but was later settled by returning 1959 Rwandan refugees. It is a sector that covers an area of 550km². 2 of 4 cells have offices and all 43 villages have offices.
In order for Gacaca marshland rehabilitation project to succeed, it is essential to understand how decisions are taken by local authorities surrounding it. A schematic representation of how decisions making evolves within Murundi sector is demonstrated hereafter.

Hierarchy of Administrative planning structure of the sector:

Communal settlement “Umudugudu”- Under the decentralization policy, Government indicates that all people are required to live in communal settlements “Umudugudu”. This has not been completely embraced in this area, for the following reasons; (i) the livestock farms that permit locals to live on their farms and not in these communal settlements; (ii) sparse population in the area, plus being an area that was once a national park and was recently settled, makes it difficult to have these settlements. By April 2012, 3776 households (60.6% of the sector) had been settled in communal settlements “Umudugudu”. 1334 grass thatched houses (locally called “Nyakatsi”) had been replaced by iron sheet roofed houses under the government campaign of eradicating grass thatched houses “Anti-Nyakatsi campaign”.

Sector priorities as per the annual achievement contracts (locally called “Imihigo”) for 2011-2012- Murundi sector priorities for this year are; (i) Completion of Rural communal settlement “Umudugudu”, (ii) Improved Infrastructure and land use management, (iii) Crop Intensification Programme, (iv) Forest planting, (v) improved water supply and sanitation, (vi) improved education for all through increased number of schools and teachers, (vii) improved access to health care and services, (viii) improve access to energy, (ix) improved road network, (x) promotion of cooperatives (currently, locals are attracted to forming cooperatives with a benefit of obtaining land, it has not been their initiative to form cooperatives based on an understanding of the benefit of coops.), (xi) environmental protection, (xii) tourism development with one of the shortest and quick access to Akagera.
national park, (xiii) improved access to quality justice, (xiv) mobilization for Government policies such as; eradication of grass thatched houses “Anti-Nyakatsi”, importance of land consolidation for increase in agricultural production, justice rendered by local councils at the grass roots “Abunzi”, and administrative infrastructure.

4.3.1 Population and demography

Based on information issued by Murundi sector, the sector has about 31,000 people with 6,231 households. Ryamanyoni cell, of the cells of the sector of our concern, was reported to have about 10,105 people and 2,131 households. The area neither has indigenous people nor marginalised tribes. This is because it was previously part of the Akagera National Park and recently settled by returning refugees of 1959 and immigrants from other provinces of Rwanda.

Based on the RIDHS, 2007-2008 report, for the 7,377 households successfully surveyed (99.5 % response rate), the total population indicated that there are more women than men in Rwanda: 53 %, compared with 47 %, or a sex ratio of 90 males per 100 females. This gap has narrowed somewhat since the 2005 survey when the ratio was 88 males per 100 females. The predominance of females is seen particularly in rural areas, where the sex ratio is 89 male per 100 female.

Between age 0 and 19 years there is an over-representation of males compared with females. Beginning with age group 20-24 the situation reverses, although the pattern is less clear. In urban areas, for age group 0-14, the proportion of males is higher than the proportion of females; this trend is reversed in age group 20-24. Between age 25 and 39, males are the largest group; then beginning with age 40, the proportion of women again becomes slightly greater than that of men. Overall, the results indicate that 86% of the Rwandan population resides in rural areas compared with 14 % in urban areas.

In terms of sex of the head of household, overall, 69% of households are headed by a man while women head 31%. Since the 2005 survey, the % of households headed by a man has increased from 66% to 69%. In rural areas the proportion of household headed by a woman has dropped slightly from 34 to 32 % (RIDHS, 2007-2008).

4.3.2 Infrastructure

4.3.2.1 Energy and transport

Electricity- The area is currently benefitting from connection to the national grid. By November, 982 Households in the sector had been connected to electricity and 4 households had biogas connection as an energy source. With reference to the map in appendix 10, indicating the features and infrastructure surrounding the area, it was observed that the Medium Voltage (MV) power lines and transformers are outside and quite a distance from the project area both the reservoir area and the command area. This is true except at Nyarunazi where the power line crosses about 50 m away from the edge of the command area demarcation and hence will not require relocation.
**Road classification**- The area is accessible through feeder roads constructed under the financing of an IFAD project called PDRCIU. The roads are earth roads, in some places finished with compacted laterite and in some areas just compacted earth. With poor drainage and lack of maintenance, it was observed that they currently degrading under the rain storm water during this wet season.

**Transport system**- The most common means of transport in the area are; pedestal (transport by foot) and bicycles (commonly used for transporting goods and people). Motorcycles are also used for longer distances but appear to be an expensive means and hence hardly used. Vehicle transport is rare, a few tipper trucks were observed in the area possibly attracted by the sand mining and brick making activities carried out in the Gacaca marshland.

**4.3.2.2 Water supply**
The area around Gacaca marshland depends mainly on the streams that flow through the marshland, for water. Areas in Ryamanyoni cell depend on Gacaca river (locally called Misararo) while those in Karambi cell depend on Karuruma river. Information from field visit indicate that Gacaca river dries up during the dry season (months of July- August) and locals close to the marshland in Ryamanyoni cell resort to fetching water from Karuruma river which never dries up.

A number of water points from boreholes built by PDRCIU, an IFAD funded project, were observed within the perimeter for rehabilitation of the Gacaca marshland, not far from the Gacaca or Karuruma rivers. These points are where locals fetch water for domestic use, women wash clothes and water is collected for livestock consumption. The quality of this water, however, does not meet acceptable standards of potable water and hence could be the result of water related diseases in the area.

There was evidence of steel pipes recently installed, likely to distribute potable water to the area. As
informed by Executive secretary of Murundi sector, Kayonza district has 2 water projects currently under construction; (i) Water supply to Ryamanyoni and Karambi cells, (ii) From Gahini to Nyabombe and to Buhabwa where the Murundi sector office is located. These projects have not yet been completed but are likely to serve those along and on top of hills and probably not those close to the marshlands as informed.

Based on the preliminary technical study for proposed rehabilitation of Gacaca marshland and after public consultation with coordination of Livestock Infrastructure Support Programme (LISP), the programme has commissioned a study for site N°.9, situated in Ryamanyoni cell, to supply livestock farms with water from 2 high yield boreholes. This may be considered an alternative source of water should the current water points be demolished.

The pitfall to the LISP initiative is that the 2 high yield boreholes might be located in the Gacaca marshland perimeter planned for rehabilitation, to be precise, in the reservoir area. This might spark conflict between LISP and RSSP III, drastically affecting the locals.
It is therefore essential that comparison is made of both studies to avoid any conflicts, especially since LISP and RSSP III are under MINAGRI.

4.3.2.3 Housing
Government policy of communal settlements of homes (in what is called imidugudu) is also practiced in this area except for a number of households that have not yet embraced it as may be realised on the large farms in the vicinity of the site. The likely reasons for not embracing communal settlement is the presence of large livestock farms that might allow for such settlement and the fact it is an area previously part of the Akagera National Park.
However for the rest of the population, communities have settled their homesteads in collective villages “Imidugudu” at the hillsides of the marshland or further uphill and have their plantations a distance away closer to the marshland.
The type of houses are made from mud with iron sheet roofing, probably resulting from government policy to eradicate grass thatched houses “Anti- Nyakatsi campaign”.

4.3.3. Land tenure
Preliminary registration of land was recently completed by the Rwanda National Resources Authority (RNRA), allowing locals to own land for the first time in Rwanda. The expectation
is that by May of this year (2012), preliminary lists of land ownership will be out for verification by the locals and July the final list of land ownership with Title deeds. This covers all land except the marshland/wetland which remains Government land. This has brought a sense of trust and ownership of land, overcoming the uncertainty of their investments on land once Government or bigger investors proposed projects in the area.

4.3.4. Land use

The area is entirely under livestock farming and subsistence farming, with the common crops in the valley and hillside proximity comprising; banana plantations, sorghum, maize and cassava. For cultivators, Banana, maize and sorghum are the main sources of income, while milk and its products are main sources of income for the livestock farmers.

It was apparent that there exist large livestock farms at the hillsides surrounding the marshland, with a possibility of covering an area of 15-25ha. Such farms have acquired a considerable level of modern livestock farming and comprise of Exotic Friesian cattle that have a capacity of providing 20-40 litres of milk a day. Consolidating land, capital and minds for production that meet economic size, market quality standard and continuity of supply is clearly not the tradition here and is slowly being embraced with a number of cooperatives forming especially for mass maize production under the Crop Intensification Programme (CIP), also a Government initiative. Information from the Sector offices reveals that land consolidated in the marshland last year was up to 2,000ha for only maize production.

4.3.5 Agricultural activities and cooperative organization

Livestock farming on the hillsides of the dam area: There are two kinds of farmers; (i) the richer livestock farmers that own farms in the range of 15-25ha, fenced off and divided into paddocks, with huge investments in modernised farming techniques and animal fodder. These farmers rear Exotic Friesian cows, local “Bovine” cattle and exotic “Boer” goats. (ii) The other kind are farmers with smaller incomes, owning up to 10 cattle. Murundi sector is organising small livestock farmers to own a common Kral “locally called Igikumba” of at least 8 cows to avoid open field over grazing, considering the scarcity of land and preventing conflict caused when cattle stray into plantations, destroying produce.

Also crucial for information is the “One cow per family” Government policy, as a poverty eradication move and means of improving balanced diet amongst the poorer in the Rural. The area has so far given 128 cows to the poorer families.

Agricultural cultivators: As earlier on stated crops commonly grown are; Banana, maize, cassava and sorghum. Under the Crop Intensification Programme (CIP), land consolidated in 2010 was 3,693ha and 5,002ha in 2011 entirely for crop production, maize covering the largest area up to 2000ha.

Cooperatives: Organising farmers to form cooperatives has already taken course, though with poor organisation and incompetently run. The type of cooperatives existing in Murundi sector, around Gacaca marshland, deal mainly in three domains; Agricultural crop production, Livestock farming and off-farm basket making “traditionally called Agaseke”.

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The number of Cooperatives with legal status is 5, including the SACCO and Milk collection centres “MUFCOS”.

Of these, in Ryamanyoni cell, only 2 have legal status; (i) “Duterimbere-Rwinyambo” for maize production, (ii) “Abateganye”- a female cooperative making baskets “traditionally called Agaseke”. Female representation in cooperatives and in local authorities is in range of 30% - 40%. It was brought to our knowledge that cooperatives headed by women are more stable than those lead by men.

Karambi cell also has about cooperatives that are in the process of obtaining legal status and these are; “Turwanye Ubukyene”, “Turengere Abana”, “Akabando Kabakuze”, “Ikitegerezo Murundi”, “Urumuri”, “Inkeragutabara”, “Abishize Hamwe”.

**Issues constraining the formation of Cooperatives by locals were,**

- Inadequate awareness by the locals of the benefits of doing agricultural or off-farm activities as cooperatives.
- Previous incidences of manipulation of locals under cooperatives by the educated, causing a negative impression of cooperatives.
- Poor managerial skills- Lack of qualified personnel to support cooperatives in their organization, management and accountability. E.g. no accountants for book keeping, no qualified administrator or manager, no agronomist or veterinary assistant paid by the cooperative to technically assist in their production.
- Inadequate financial capabilities to run the cooperative efficiently.
- Lack of capacity building trainings or study tours to improve local farmers’ awareness on farming.
- No markets to sell their produce, which discourages increased production lest the products rot hence encouraging subsistence farming. For example, the closest market is at Karubamba over 10km from the site area.

**Savings tendencies of the area**-The locals are encouraged to open savings accounts for produce obtained from their farms or plantations. It is for this reason; Murundi sector opened theUmurenge SACCO “Local bank” for the sector with 2 branches at Karambi cell and the main branch at Murundi Sector offices in Buhabwa cell.

The reason for opening a second branch at Karambi cell was that the sector branch was far for the locals from Karambi, with the cost of transport by motorbike at 2000Rwf, which eventually turned out costly hence the Karambi branch.

Constraints met in encouraging locals to open savings accounts were; Building Umurenge SACCO was difficult because of a low membership count due to lack of interest or inadequate awareness of its importance by the locals. It has since improved with most cooperatives obliging members to have accounts in the Umurenge SACCO, through which profits are conveyed.

**4.3.6 Economic environment and area resources**
**Income earning activities** The main economic activity is agriculture in the form of Livestock farming and agricultural cultivation. Large modern ranch farms exist, holding exotic “Friesian” cattle, exotic “Boer” goats and local “Bovine” cattle. Whereas for cultivation; the plantations were mainly of; Banana, maize, sorghum and cassava.

Other than agriculture, the area has a number of resources that are currently being exploited though on a minimal scale and these are; mining of minerals such as wolfram, extraction of clay for brick making, sand mining in the marshland, potential of tourism attraction the area being one of nearest access to the Akagera national park, marshlands for agricultural purposes and a young population.

**Commercial activities** The closest market for agricultural produce is Karubamba Market in the range of 8-10km from Ryamanyoni cell. Commercial centres observed with in Murundi sector and in the proximity of Gacaca marshland are; at Buhabwa, Karambi and Nyabugandu. These commercial centres are characterized by small shops with basic house commodities bought from Kayonza town and bars selling local brew made from banana.

**Human capital** The area is settled by mostly a young population migrating from other parts of the country. This is apparently an energetic work force capable of participating in the construction and implementation of this irrigation project. There is also evidence of skilled masonry workers in this area hence availability of the workforce required for during construction and at the time of maintenance works for the irrigation infrastructure.

**Poverty reduction programs in the area** One Cow per family “Girinka” and Communal financial support for the poorest “Ubudehe” projects is currently practiced, however, no Vision Umurenge programme (VUP) or any other poverty eradication projects exists.

Government through the Murundi sector has made contributions to poverty alleviation, some of which are;
- 87 homes with iron sheet roofing were built for the poorest “locally called Abatishoboye” and goats given to them as start-up capital towards poverty eradication,
- There are plans to build 7 homes for genocide survivors with materials already delivered at the cell offices, such as doors.

### 4.3.7 Health and Sanitation

One of the main killer diseases in the Rwanda represented by 40% is malaria, followed by diarrhoea or dysentery. Both malaria and diarrhoea are water related diseases whose prevalence is eminent in areas around water bodies. Malaria is also the leading cause of infant and child mortality (29%). In most regions of Rwanda, high cases of malaria occur during the wet season. This is mainly due to the existence of stagnant waters that are breeding ground for mosquito larvae.
Another health issue that is relevant to this study due to its demographic characteristic of prevalence is HIV/AIDS. It is now estimated that AIDS affects 3% nationally, compared to a rate of 1.3% in rural areas in 1986.

According to the 2004 UNAIDS Report on the Global AIDS epidemic, the adult HIV prevalence rate at the end of 2003 in Rwanda was 5.1% (between a low estimate of 3.4% and high estimate of 7.6%). The utilisation of health services that was once low, has since grown with the fairly affordable local medical insurance “called Mituelle de santé” and increased sensitization through AIDS campaigns. When health services are consulted, the public hospitals are the most frequently used provider (33.6%), followed by pharmacies (29.1%), health centres (12%), and traditional healers (11.4%), the last being mainly in rural areas.

The area surrounding Gacaca marshland has only one Health center called Ryamanyoni health center in Karambi cell and 1 dispensary/ “poste de santé” at Buhabwa cell next to the Murundi sector office. The closest hospital is in Gahini about 30km away.

Based on information from area local authorities, the health center and the dispensary, over 90% of the people in this area have medical insurance “Mituelle de santé”. Low cases of Malaria were reported in the area, simply because nearly every family received a mosquito net free under Government campaign to fight malaria. It is, however, required that locals are continuously reminded and sensitized on the importance of sleeping under a mosquito net hence the few cases of malaria reported.

The common disease is tape worms in children and few cases of other water borne diseases such as; diarrhea, possibly due to poor hygiene and poor water quality from the sources it’s fetched. No Malnutrition in the area was observed probably because there are a wide variety of foods grown in the area.

4.3.8 Education

The area has six (6) Primary schools, two (2) NineYear Basic Education (9YBEs) that were completed in 2009. No secondary school existed before that.

Reports from the sector office show that the area experiences a number of School drop outs due to the long distances travelled to the only schools in the area. One may wonder how far a child joining secondary school has to travel, the nearest probably more than 15km in Rukara sector.

4.3.9 Cultural heritage

During field survey, the consultant was particularly interested in the possibility of finding existing tangible or intangible cultural heritage, such as; archaeological, religious, cultural sites, spiritual sacred features, battle grounds, cemeteries, among others. (World Bank O P 4.11 physical cultural resources).

Information from the authorities indicate that locals still bury the dead in their home compound, however, the areas of project intervention were not observed to have any
cemeteries. Communal cemeteries do not exist in this area but this is one of the issues in the pipeline by the Sector management.

The project intervention areas have no archaeological sites, especially since it’s mainly marshland and previously a portion of the national park. Also based on records from the National Museum of Rwanda and field visits, the study was not able to identify any significant cultural heritage in this area. (National Museum of Rwanda, list of historical, cultural and archaeological sites in Rwanda, 2008)
CHAPTER 5: STAKEHOLDERS CONSULTATION AND PUBLIC PARTICIPATION

Issues raised during the stake holder engagement process were compiled and summarised below and have been elaborated in more detail and considered in proceeding chapters for impact assessment and incorporation in the Environmental impact and management plan.

Table: 5.1. Summary of issues raised during Public consultation

<table>
<thead>
<tr>
<th>Issues at hand</th>
<th>Stake holders</th>
<th>Response to issues at hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of project awareness by locals</td>
<td>Local farmers</td>
<td>Urgent and intensive sensitization of local farmers on Project activities by RSSP III.</td>
</tr>
<tr>
<td>Expropriation without compensation</td>
<td>local farmers/ Livestock farmers</td>
<td>Compensation will be for those affected and will be guided by a Resettlement Action Plan (RAP), before project commencement.</td>
</tr>
<tr>
<td>Destruction of water points/boreholes</td>
<td>Local farmers/ Livestock farmers</td>
<td>Alternative water sources for the destroyed ones shall be investigated for construction. The LISP and District will also be looked at as likely alternative options for water sources.</td>
</tr>
<tr>
<td>Destruction of Crops without earlier warning</td>
<td>Local farmers/ Livestock farmers</td>
<td>Clear planning schedule will be drawn, which will be referred to inform farmers not cultivate before construction commences.</td>
</tr>
<tr>
<td>Redundancy of farmers during construction</td>
<td>Local farmers</td>
<td>Alternative source of income by employing them in the construction of the irrigation infrastructure</td>
</tr>
<tr>
<td>Possibility of low wages to local workers for construction works.</td>
<td>Local residents of the area</td>
<td>RSSP III project coordination to ensure minimum wages by Rwanda labour law are followed by the contractor.</td>
</tr>
<tr>
<td>Oil spillage</td>
<td>RSSPIII/ contractor/ Local residents/ Local authorities/ MINIRENA/ REMA/MINAGRI</td>
<td>Restricted area proposed for re-fuelling or fuel storage that is cemented. Use of automobiles in good condition hence reducing on chances of oil leaking.</td>
</tr>
<tr>
<td>Dangerous borrow pits</td>
<td>RSSP III/Contractor/Local</td>
<td>Refilling pits to avoid injuries and planting</td>
</tr>
<tr>
<td>Issue</td>
<td>Responsible Parties</td>
<td>Solutions</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Occupational health hazards</td>
<td>REMA/District Labour and Environmental officer/ RSSP III</td>
<td>Safety wear is proposed on site. Spraying water to reduce dust is also proposed.</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>Local residents/ Contractor/ RSSPIII/ REMA</td>
<td>Works such as; excavations, compaction that emit irritating noise will only be done during working hours (7h00-17h00). Use of automobiles in good condition (with certification from the “National Automobile Inspection centre”) to minimise on noise emitted, Use of silencers for generators.</td>
</tr>
<tr>
<td>Air/dust pollution</td>
<td>Local residents/ Contractor/ RSSPIII/ REMA</td>
<td>Use of automobiles in good condition (with certification from the “National Automobile Inspection centre”) to minimise on noise emitted, Use of silencers for generators.</td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>Local authorities/Local farmers/REMA/RSSP III/Contractor</td>
<td>Soil erosion prevention techniques are required, such as; terracing, contour bunds, afforestation. Excavation at stages to prevent huge soil hips liable to erosion. Soil compaction for completed zones</td>
</tr>
<tr>
<td>Fire outbreaks</td>
<td>Local authorities/Local farmers/REMA/RSSP III/Contractor</td>
<td>Fuel storage restricted to only those authorized. Regular checks of electrical installations. Fire extinguisher equipment present and fire drills for workers as a form of protection from fire.</td>
</tr>
<tr>
<td>Fear of complete shift to Monoculture cultivation</td>
<td>Local farmers</td>
<td>Sensitization of farmers on the profitability of rice over their common crops. Study tours for farmers to areas with Rice scheme success stories.</td>
</tr>
<tr>
<td>Resistance to change of livelihood</td>
<td>Local farmers/ brick makers/ sand miners/ livestock farmers</td>
<td>Sensitization of locals on profitability of rice over their current sources of income. Integration of these stakeholders into the rice scheme by apportioning them plots of land to cultivate rice</td>
</tr>
<tr>
<td>Issue</td>
<td>Responsible Parties</td>
<td>Proposed Solutions</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Loss of soil fertility from monoculture and use of inorganic fertilizers</td>
<td>Local farmers/ MINIRENA/REMA</td>
<td>Periodic soil tests required to assess the trend of soil composition in regard to fertility. Combination of inorganic and organic fertilizers proposed with a tendency towards use of organic fertilizers only eventually.</td>
</tr>
<tr>
<td>Poor pesticide and fertilizer management</td>
<td>Local farmers/ local authorities/ REMA/ RSSPIII</td>
<td>Proposal to prepare an IPM. Technical support by Agronomists to farmers. Training of farmers in application of pesticides and fertilizers.</td>
</tr>
<tr>
<td>Water pollution</td>
<td>REMA/ MINIRENA/ Riparian countries sharing the receiving water bodies</td>
<td>Efficient use of fertilizers to avoid excess amounts washed away to the receiving waters. Baseline tests and progressive tests of water quality of surrounding receiving bodies (Gacaca river) to understand project effects on water quality and propose mitigation measures.</td>
</tr>
<tr>
<td>Water conflicts from Irrigation/ land consolidation</td>
<td>Local farmers/ Local authorities/ RSSPIII</td>
<td>Farmers organised under WUAs to manage the irrigation process.</td>
</tr>
<tr>
<td>Vandalism of irrigation infrastructure</td>
<td>Local farmers/ Local authorities/ RSSPIII</td>
<td>Regulations on penalties for perpetrators proposed. Punitive measures for perpetrators proposed. Community policing by cooperative members to avoid vandalism.</td>
</tr>
<tr>
<td>Increased spread of water related diseases (e.g. malaria, bilharzia)</td>
<td>Local farmers/ local authorities/RSSP III</td>
<td>Provision of Mosquito nets to locals for those who do not have. Growing the <em>Phytolaca decocandra</em> plant which prevents bilharzia snails from existing at the shores of water.</td>
</tr>
<tr>
<td>Canal siltation</td>
<td>Local farmers/Local authorities/RSSP III</td>
<td>Soil erosion control techniques on the hillside of the marshland. Regular inspection and maintenance of the canals.</td>
</tr>
<tr>
<td>Water logging and salinization</td>
<td>Local farmers/ local authorities/ RSSP III/ MINIRENA/REMA</td>
<td>Controlled release and use of water to the rice paddies to avoid water logging or salinization</td>
</tr>
<tr>
<td>High sedimentation levels of the reservoir</td>
<td>Local farmers/local authorities/RSSP III</td>
<td>Intensive Land husbandry on hillsides along the reservoir.</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Encroachment of the reservoir and primary emissary</td>
<td>Local farmers/local authorities/RSSP III</td>
<td>Establishment of a thick green belt along the reservoir and 2m green belt between the river and the closest rice paddies.</td>
</tr>
</tbody>
</table>
CHAPTER 6: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS

This section entails assessment of impacts of the RSSP III Irrigation project. By nature, the proposed project has potential to cause negative as well as positive impacts on the biophysical environment and socio-economic setups. The magnitude of which will vary between the phases of project implementation. The assessment of the project impact given below is for the proposed intervention area surrounding Gacaca marshland, Kayonza district, Rwanda, the Region and Internationally.

The approach taken in this chapter is to identify, describe and analyse all anticipated impacts or issues that are expected throughout the project cycle—planning/formulation, design, implementation (mobilization, construction and operational activities), monitoring and possible decommissioning. The nature and location of the impacts that may be caused by the proposed project are specified. These depend, to a large extent, on the natural value of the area affected by the activities and on the importance of the area for socio-economic uses. Detail of the more important activities and impact descriptions is presented below. The impacts described below are both positive and negative, with mitigation measures proposed for the negative impacts and in some cases suggestions on how to enhance positive impacts.

6.1. POSITIVE IMPACTS

Development of Gacaca marshland to embrace the possibility of furrow Irrigation scheme for large scale rice production identifies with many of the positive impacts of the proposed activities discussed in the proceeding sub-chapters.

6.1.1 Physical Environmental impacts

6.1.1.1 Soil Conservation through land husbandry

Traditional cultivation methods, deforestation on sloppy hills and high population density leading to fragmented land cultivation has largely contributed to the loss of soils to the erosive run-off.

RSSP III project activities involve comprehensive land husbandry techniques such as; terraces, contour bunds and agro-forestry tree planting on hillsides as a means of reducing soil erosion, avoiding sedimentation of the reservoir, destruction of earth delivery canals and improving the soil moisture.

6.1.1.2 Increased land productivity

With government support of fertilizers, availability of agronomists to follow up on farmers’ practices, improved agricultural practices and land husbandry, the soil fertility is expected to improve, thereby increasing farm yield.

6.1.1.3 Flood control

From the field survey, it was observed that the marshland is flooded and mostly the northern part of the marshland that is flooded all year round as was observed during the bio-physical analysis of the marshland. This would imply that some parts of the marshland are actual not...
able to function while others may only function when not flooded. By constructing the dam, levelling the marshland, preparing a well-designed drainage system for the marshland, the flow of Gacaca marshland will be controlled to avoid any floods but instead store water in the reservoir for use during the dry season when water is scarce. Land husbandry on the hillsides will protect the soils from erosion; improve the soil ability to retain water hence preventing any likely sources of flooding in the marshland.

### 6.1.2 Biological environmental Impact

#### 6.1.2.1 Habitat for fish and birds nesting

By developing a water reservoir, different fish species will be introduced in the massive water body hence inducing a habitat for fish. This would also mean fish would now be introduced to the household diet hence contributing to a balanced diet. Also as was observed during the field visit and mentioned in the bio-physical analysis of the area, birds nested around drinking mounds. With introduction of the reservoir birds would find sanctuary on trees along or within the reservoir as their nests thereby creating a habitat for different bird species and improving the ecosystem in the area.

### 6.1.3 Socio-economic environmental Impact

#### 6.1.3.1 Farming all year round

With the construction of the dam, rehabilitation of Gacaca marshland and introduction of monoculture rice growing, local cultivators in these areas of intervention will be able to grow crops all through the year as opposed to previously cultivating only during the two wet seasons (September-January, February-June) and facing drought in the dry season. This will eliminate the redundancy that occurred in the dry season.

#### 6.1.3.2 Effective use of Gacaca marshland

Development works on the Gacaca marshland involving construction of a dam, establishment of canals, aligning of the main emissary river and delivery canals, topographical levelling and demarcation of the land in the marshland; ensure efficient use of the marshland for agriculture even during wet seasons when it is flooded. An example of the part of the marshland that will benefit enormously from this development is the Northern zone close to Ntende marshland that is always flooded during the wet season making it impossible to cultivate it and only used by livestock during the dry season.

#### 6.1.3.3 Market access for agricultural products

Based on data from public consultation during the field visits, it appeared locals have to an extent established cooperatives and under the Crop Intensification Programme consolidated land for collective maize production. Even though only 5 of the many cooperatives
have been legally registered, this is a step in the right direction upon which this project can bank on.

RSSP III will support local farmers by organizing them into Water Users Associations and cooperatives, initiate land consolidation and collective harvesting by marshland levelling and plot demarcation of the marsh. By forming legally registered cooperatives, this will allow farmers to bargain fairly the farm gate prices with profits without the influence of middlemen as is the case currently where farmers possess individual low bargaining power. These cooperatives will hence empower farmers economically.

Under such organisation, Government and also with their own initiative as cooperatives at a more mature stage, they will be able to find market for their products after establishing large quantities, good quality and continuity of market supply of agricultural products.

As a matter of fact, farmers already cultivating rice in Northern zone of Gacaca marshland close to Ntende rice cultivators have secured market for their rice at a profitable cost 275Rwf/kg for unprocessed rice from authorised buyers. It is also important to know that a new rice processing factory was recently opened in Gatsibo District, a short distance away.

6.1.3.4 Collective harvest for large quantities and market continuity

Development of the marshland will involve; levelling of the marsh, demarcation into plots of 20 acres each, supply of water through canals, all of which is a program meant to encourage land consolidation, irrigation of plantations under supervision of Water Users’ Associations and collective harvesting. Such a program has proven (in areas close by such as Kanyonyomba marshland, Ntende-Rwagitima marshland) to promote large volumes of Rice harvest and enhance continuity of demanding markets for Rice, regionally and internationally.

6.1.3.5 Increased Rice yield

With the farmers cultivating all year season and having the added support by government under RSSP III of improved seeds and fertilizers, rice yield will indeed escalate much to the benefit of the local farmer and hence establishing food security in these areas in and around the project sites.

6.1.3.6 Profitability of rice

In reference to local farmers in Ngumeri II village in Karambi cell, close to Ntende rice marshland, who have initiated rice production for a while. It was observed that they already had market for their rice sales at 275Rwf/Kg of unprocessed rice as opposed to neighbouring farmers who sale their maize at 160kg/Rwf.

Based on the rice cooperative of Ntende marshland, COPORIZ, the cost of rice production is 153.8Rwf/kg. This would give the rice farmer a profitability of over 120Rwf/kg. This would mean the option of growing rice is more profitable than the maize or banana plantations currently produced.

Farmers will therefore experience increased income from production of the rice crop, availability of market for their products (an example of Ngumeri II village rice growers), the high yields able to sustain existence of cooperatives, collective investments, banking of savings, sales for house income and eventual ability for farmers to sustain themselves.
with improved quality of agricultural products. This will prompt them to improve their livelihood, invest in off-farm businesses and cover basic family needs like; medical insurance, education for the children among others.

6.1.3.7 Affordability of education and medical Insurance

Increased crop yields, ability to bargain for profitable farm-gate price and employment from the construction works of the irrigation infrastructure and land husbandry works, all this will hand the locals of the area the ability to pay school fees for their children and medical insurance “Mituelle de santé” for their families. This will improve literacy levels, give children the opportunity of education and improve health status in the area.

6.1.3.8 Employment creation

With confirmation by local authorities of the presence of skilled labour in masonry work in the area, construction works for the establishment of irrigation infrastructure and implementation of land husbandry technologies in water catchment and command area catchment will create employment for locals in and around the project areas. It will not only benefit farmers within the irrigable areas but will also create employment opportunities for other community members who will participate in labour provision in the farms (casual labouring) as well as advance the current commercial centres to levels where they can contribute to employment.

6.1.3.9 Transfer of skills during the construction phase

As the construction phase and the implementation of land husbandry technologies proceeds, locals will be able to acquire skills in masonry works which will be needed at the operation stage for maintenance works of the small irrigation infrastructure such as; maintenance of sluice gates, stone masonry channels, water intakes, etc. Local residents will also acquire skills in land husbandry works.

6.1.3.10 Increased Livestock fodder

The implementation of the project will increase livestock fodder; from grasses (such as; bracharia, chloris, etc.) and fodder shrubs grown along terraces and soil bunds to hold soil, forage and trees, rice straws for fodder, hence indirectly leading to integration of livestock farming with cultivation and in due course improving the productivity of livestock on farms in this area.

Availability of fodder for livestock will be an incentive for farmers to diversify, expand their livestock enterprises and enhance adoption of improved breeds, which are early maturing and high yielders. Livestock development is envisaged to have a potential to contribute to poverty reduction through increased farm incomes. Livestock development projects often act as catalysts that enable farm households to join the market economy and thus to achieve a decent standard of living. In addition to contributing to household level welfare, a balanced diet and the increased milk production will have a positive effect on the national dairy sector.
6.1.3.11 Food Security
Increased rice production will imply that the farmers have enough food to sustain household requirement and much more to sell for cash. Improved quantity of rice and income from it would result in affordability of variety of foods thus promoting a balanced diet and thereby improving public nutrition.

6.1.3.12 Poverty Alleviation
The irrigation scheme will promote increased agricultural productivity and commercialization of agriculture from subsistence farming. Improvement in crop productivity will raise the income for the rural poor above the poverty line of less than a dollar a day. This is an indirect impact that is progressive and might be felt after many years.

6.1.3.13 Improved nutrition
Profitability of growing rice as opposed to currently grown crops would imply increase in household income. This might imply that there is money available to purchase other foods hence improving nutrition and avoiding disabilities arising from unbalanced diets. With a healthy community, a number of unforeseen benefits may be achieved, such as; effectiveness of labour, reduced losses of time and money on treating diseases.

6.1.3.14. Land Appreciation
With the coming of this project, land that was once less productivewill now be cultivatable at any time of the year and very productive. This will lead to appreciate of the land, all to the benefit of the locals of these areas.

6.1.3.15. Empowerment of farmers
By organizing local farmers into Cooperatives, Water Users Associations (WUA), they are empowered to dictate collectively terms during price negotiations, sensitized and trained on the efficient use of water as a valuable resource, use of modern irrigation techniques, use of improved seed and fertilizer to improve their produce, maintenance of irrigation infrastructure, thus imparting skills for improved production as well as to access markets, which they will utilize even after the project’s exit.

6.2 ADVERSE (NEGATIVE) IMPACTS
Adverse impacts are negative impacts from activities that will affect the physical, biological and socio-economic environment of the area of operation. These impacts have been elaborated under three phases; design and planning, construction and decommission phases. For each adverse impact, mitigation measures are proposed. An Impact analysis table was used to determine the significant impacts that required mitigation measures. (Appendix 4)
6.2.1 Design and Planning Phase

The design phase of this RSSP III project involved identification of suitable sites for the infrastructure and undertaking of a detailed technical study. There are no adverse impacts expected during this stage, however, best practices were incorporated at this stage to ensure that the design takes into account the environmental issues to consider. The preliminary technical study report was used in developing and identifying potential adverse impacts.

6.2.1.1 Physical Environment

6.2.1.1.1 Destruction of water points/boreholes

Water points have been identified within the perimeter of the marshland development. An example was a water point in the area demarcated for the reservoir, where locals fetch water for domestic use; women wash clothes and water for livestock is collected from. It would be catastrophic for the locals should these water points be destroyed without alternatives, with a possibility of the locals resorting to fetching water from the reservoir of poor quality.

Even with the alternative of the LISP project for livestock farmers, there is also a possibility that boreholes of high water yield identified during the preliminary study of LISP site No.9 in Ryamanyoni cell might coincide with in the boundaries of the RSSP III Gacaca marshland development, hence affecting the alternative source of water to livestock farmers that depended on the Gacaca river.

Mitigation Measure(s)

It is important for the RSSP III Gacaca technical study to interact with the LISP study on site No. 9, to ensure that the high yield water supply boreholes identified in Ryamanyoni cell are not within the boundaries of the Gacaca marshland development.

Alternative sources of water (i.e. boreholes, springs,) on the hillsides need to be investigated for development. These sources may be used by the locals during construction and operation phases of the project as opposed to resorting to the reservoir or other demeaning measures.

Consultation with Kayonza district is crucial, on its water supply project to identify the coverage and whether it can be used as an alternative for the water sources inundated or demolished during the project execution.
6.2.2. Construction Phase

The construction phase involves several activities including; site clearing, site installation, trench excavations, earth stripping, road network clearing and levelling, construction of a dyke, reservoir, canals, levelling and partitioning of land into rice paddy plots for cultivation. Anticipated adverse impacts are discussed hereafter.

6.2.2.1Physical environment

6.2.2.1.1 Oil spillage resulting in soil and water contamination

Heavy machinery, such as; excavators, graders, wheel loaders, etc., will be used for earth moving construction works, especially during the construction of the dyke and the reservoir. All this will require re-fuelling of construction equipment, maintenance works, repair works, which in effect result in oil spillage. Contamination of soils and run-off ending in the receiving bodies (Gacaca marshland) shall cause water quality degradation, if no mitigation measures are implemented.

Mitigation Measure(s)

- It is proposed that the Developer or Project Manager inspects the contractor’s equipment, to confirm having machines and automobiles in good condition, certified by the “National Automobile Inspection centre”, in order to reduce on the likelihood of oil spillage.

- Re-fuelling, oil change, maintenance works, repair works will need to allocated a restricted area, far from the water stream and marshland and preferably positioned in an area that have no adverse effects if degraded. E.g. site position for building or house construction. The area allocated for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil.

- As for the river water quality contamination by oil spillage from generators, an oil interceptor should be installed at the stand-by generator. This will collect oil that would have been spilled hence avoiding water quality contamination.

6.2.2.1.2 Dangerous borrow pit Impacts

Construction of irrigation infrastructure involves borrow pits for soil tests, geological test and any kind of excavations. From the field survey, such pits have been identified about 50m from Rwinyambo communal settlement “Akagari” as a result of the technical study of the area.

Borrow pits if not refilled may result in health hazards; i.e. workers or livestock may fall in get fatal injured. These pits collect stagnant water becoming breeding grounds for mosquitoes (malaria spreading vectors). The pits may also become habitats for rodents that
act as pests to crops or even venomous reptiles such as; snakes, that might attack the locals.

**Mitigation Measure(s)**
Borrow pits need to be identified during the design and construction stage, marked out, refilled and the area rejuvenated so as to avoid any of the likely health hazards occurring or being habitat for rodents or venomous reptiles.

6.2.2.1. 3 Air and noise pollution
During construction, there will be movement of construction equipment at the project site. Dust and exhaust fumes that may cause air pollution as well as noise, is expected from earth moving activities by excavators, graders, trucks and bulldozers plus other machinery such as concrete mixers, dumpers, etc.

**Mitigation Measure(s)**
To reduce the effects of such activities, it is proposed that the following measures are implemented:
- Activities that create lots of noise or irritations, such as; vibrations, heavy equipment moving earth, excavations, shall be restricted to normal working hours (7h00-17h00) to prevent noise for neighbours at night;
- The contractor is required to use equipment and automobiles that have certification of good working conditions from “National Automobile inspection centre” to avoid noise or exhaust fumes since automobiles in good condition will pollute less.
- RSSP III project coordination on site will ensure that contractors will be doing routine maintenance, repair of trucks and machines. This would reduce on the exhaust fumes and noise from the machines.
- The project will spray water regularly when clearing land to reduce the dust.
- Generators for use at the site shall have silencers to reduce on the noise emitted.

6.2.2.1.4 Soil Erosion
Activities including: site clearing, excavations for the dyke and reservoir, road clearing, excavation of trenches for irrigation delivery and distribution canals, will all involve clearing of vegetation, excavation of hill slopes especially on right side of proposed dam, excavation where the soil will be exposed to the agents of erosion, mostly run-off and wind. This impact, though occurring on during construction period, can have a direct effect to the hillside embankments and possibly a continuous effect of hillsides collapsing during the operation phase. If not combated, it can develop into a cumulative impact of loss of valuable productive soils to the receiving waters, sedimentation of receiving waters, silting and blockage of delivering canals, and loss of agricultural productivity of the marshland.

**Mitigation Measure(s)**
Soil erosion effect can be avoided or reduced by implementing a number of measures. These are;
• Plan to excavate the plot sections demarcated for construction, in stages to avoid opening up of big sizes of the area and increasing the level of risk to erosion at any one time.
• The project can possibly be fast tracked so that the time the land is left bare and exposed to potential erosion agents is minimized.
• Debris in the compaction and construction of the foundation for the structures should be resurfaced and levelled;
• After any excavation or trenching is completed on site, immediate backfilling and resurfacing should be done to avoid facilitation of erosion agents. Compaction will be necessary to stabilise the soil. Planting of grass on bare land, slopes of the dyke embankments to minimise erosion tendencies should be given priority.
• Avoiding vegetation clearance that will expose soil to agents of erosion during construction phase.
• Re-vegetating the cleared sites with local species of vegetation.

6.2.2.1.5 Fire outbreak
Construction works will require a fuel store for re-fuelling the heavy equipment used for earth works and also for the generator. Mistakes with handling fuels or electrical short circuits can easily result in fire out breaks that could cause serious damage.E.g. loss of equipment, property, bush fires and in some cases loss of lives to fires.

Mitigation Measure(s)
• Regular checks on electrical installations and proper insulation of cables, to prevent short circuits that could trigger fires.
• Specific area restricted to only authorized personnel, should be allocated for fuel storage.
• Such an area should have sufficient fire extinguishing equipment to stop fires escalating.
• Water tank automobiles with hose pipes need to be part of the equipment required at the sites, for purposes of extinguishing fires.
• Fire management drills for the workers should regularly be done.

6.2.2.2 Socio-economic Environment

6.2.2.2.1 Occupational health hazards
During construction, workers will be subjected to situations that could be detrimental to their health and safety. A few examples include: Injuries caused by handling of construction equipment, spills and leakage of hazardous materials, injuries from stepping on or using sharp objects, fires, Communicable disease hazards due to interactions among the workers or with service providers such as food vendors, Emissions of dust from clearing and excavation works and fumes from vehicles and other machinery that might cause respiratory dysfunctions, Noise and vibrations from construction equipment causing temporary or permanent deafness. Not forgetting transmission of HIV from workers that have migrated to this region in such of work plus locals willing to spend more due to increased income from construction wages.
Mitigation Measure(s)
To avoid or reduce the effects of some of these occupational health hazards, it is proposed that the following measures are implemented:

- Spraying water regularly to suppress excessive dust during construction is strongly recommended;
- Workers on the site should be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls.
- The contractor should enforce and impress on their workers to use the protective gear. To this effect, the contractor shall have a staff department specifically following up on the safety compliance on site.
- The contractor together with local authorities is required to enforce acquiring medical insurance “mituelle de sante” for all workers as a means of affordability of treatment.
- Regular sensitization on ways of HIV prevention, importance of proper hygiene is important during execution of this project.

6.2.2.2.2 Impact on local infrastructure
Construction works will involve transportation and use of heavy equipment, for example; bulldozers, excavators, graders, trucks, among others. With such equipment, the current earth roads will be destroyed, some of the homes or boutiques will be demolished to create access to the construction sites, power lines, water points and pipelines might also be demolished in the process of site installation and clearing, an example of the access bridge to the Murundi sector and Buhabwa cell will be destroyed.

Mitigation Measure(s)
- A map out of local infrastructure identifying existing infrastructure such as; water points, pipelines, power lines, homes, town centres, roads and bridges is required to guide on the most optimal site installation and site access. This could reduce on the impact of the project on existing infrastructure and cut on cost spent through compensation of this infrastructure.
- Once the affected area has been identified then a compensation plan for losses of infrastructure is necessary. This can be guided by the Resettlement Action Plan and qualified valuation of likely infrastructure lost.
- It is also proposed that some of this infrastructure (such as; water points, pipelines, power lines, roads and bridges) could be shifted to other areas and continue to serve the purpose it has always had.
- As per technical design of the project, access roads to the marshlands shall be widened and improved to handle increased traffic and heavy equipment. The bridge will be raised 2m higher to prevent inundation by the reservoir.

6.2.2.2.3 Population migration
Population migration might be looked at two ways; (i) people migrating into this region in search of employment opportunities from construction works and eventually in rice...
paddies. (ii) people migrating out of the region, disgruntled with the new rice scheme and opting for other areas that can accommodate kind of agriculture. Either way, it is very likely that most migrations will be into the region and very minimal out of the area.

**Mitigation Measure(s)**

- Murundi sector along with the District is required to project likely increase in population in the region and plan for infrastructure capable of sustaining the increment in population. Infrastructure such as; housing facilities, water supply, electricity, health and education facilities need to be improved.
- It is proposed that within site installation, the contractor may be required to construct houses for migrating workers and a dispensary to cater for any injuries or contracted diseases hence reducing on the numbers frequenting the only health centre.
- Locals should be encouraged to actively participate in construction of the project thereby reducing on need for migrating population for work that can otherwise be done by the locals in the area. This would reduce on the migrating population.

**6.2.2.3.4 Resource use conflict**

During the construction phase, resources are required such as; water, electricity, construction material (gravel, sand, aggregate, clay, cement, etc.). Considering the level of water scarcity in this area, recently established electricity connections, sand mining and clay used for brick making, there is a possibility that project activities will affect the current domestic consumption of the mentioned resources. This could spark conflict of resources between the locals and the project.

**Mitigation Measure(s)**

- In the technical design, it is proposed that alternative water sources are investigated. For example, high yield boreholes are developed to supply the construction works without affecting the existing water sources used by the locals. These alternative new boreholes could later be transferred to local authorities once the construction is complete.
- Negotiations with EWSA to increase on amount of electricity channelled to this area to accommodate domestic use and sustain construction activities.
- The technical study has identified possible areas from which construction material shall be obtained. Material from these areas will be tested for suitability of the technical designs. These are from new resource points hence not conflicting with the already existing mining areas.
6.2.3 Operation Phase

The operation phase entails holding water from Gacaca river (main emissary) in the reservoir by a construction of dyke and distributing water through canals to plots of land downstream partitioned for rice growing. Only one main dam was proposed.

The main dam comprises of; a dyke of 9.1m height, with a reservoir of capacity of 2.5 Million m$^3$ covering an area of 89ha (at normal water level), 108ha (at maximum water level) and with a watershed of about 97.4km$^2$.

A lateral water shed of 24.1km$^2$ will also contribute to the water required for irrigation of the command area downstream. The type of irrigation proposed for this rice scheme is open field farrow irrigation system. Likely adverse impacts in this phase include;

6.2.3.1 Physical Environment

6.2.3.1.1 Modification of flows for downstream usage

Construction works for this irrigation scheme entail impounding water flowing in the Gacaca river from a watershed of 97.4km$^2$ by a single dam. Construction at the dam might require some temporary level of river diversion to construct the dam, control of the quantity of water flowing through the inlet and outlet valves of the dam, all of which might affect the receiving population downstream and temporarily destabilize the ecosystem dependent on the current river flow.

Further to the operation phase, when water will be drawn from the river thereby reducing the flow quantities, changing flood plains and affecting biodiversity downstream.

Mitigation Measure(s)

In regard to imbalance in the quantity of water from the rivers, the preliminary technical study by SHER presented a number of ideas ensuring minimal modification in the flows received by downstream users:

- From analysis of generated flows, it has been established that other than the months of July and August all other months exceed the ecological flow demand of the river, in some cases 13 times more (for example in April), hence sufficient water in the river for use downstream. Furthermore with an irrigation design for the scheme of 3 l/s/ha, measures to avoid excessive drainage of the main emissary (rivers) have been taken. The main drains tapping off the emissary have been limited to a maximum depth of 1.25 m, hence allowing continuous flow of water downstream.

- The design of 7 water intakes along the main emissary (river) has a purpose of optimum recycling of irrigation water drained from upstream usage into the main emissary. A combination of the intakes together with other regulating and distribution structures. e.g. drops, farm turn-outs, aqueducts, valves, sluice gates, canals, the flow of water is recycled back to the main emissary in the centre of the irrigation making water available to those downstream. The technical study indicates that at least 10% of the water discharge upstream is available as an input downstream of the emissary, which would imply a minimum downstream release of 108.6 l/s back into the river adequate enough when compared to the ecological demand of 46.3 l/s.

- Furthermore considering the fact that in the technical study, the water balance does not only take into account an irrigable area of Gacaca upstream (362 ha) but also
includes downstream irrigable areas of Ntende marshland (65ha) and Gacaca downstream (302ha), this is an indication that flow downstream has been catered for.

To this effect, with an irrigation efficiency of over 60% even during dry years and the water balance including adequate flow of water downstream for irrigation of Ntende and Gacaca downstream in addition to Gacaca upstream, gives the project an upper hand of not depleting resources and thus not affecting flows.

- However, it is recommended that daily flow monitoring of the water bodies (river Gacaca, Kamumzi and Kayongo and the new reservoir) to maintain the flow pattern shall be done by WUA after thorough training by RAB or ISAE water experts and periodic inspections by the RAB and ISAE shall to ensure records are taken preciously and data is interpreted and monitored. (At least every 6 months). Weirs need to be constructed and water level recorders at the rivers need to be installed for consistent checks on the effect of project activities on the flow. The lowest measuring station shall be at a level below the 7th intake. An MOU with the other agricultural institutions such as; RAB or ISAE, may be established to manage these records. This information may be used to defend any suspicions of project impact, assist in predicting future impacts and directing proposals of mitigation measures. It shall also prevent a cumulative effect of similar projects using water from the same water sources.

### 6.2.3.1.2 Loss of soil fertility from monoculture and use of inorganic fertilizers

With all year cultivation of the single crop of rice, no period left for soil to regain its fertility, soil fertility will continue to deplete. With reference to the preliminary technical study of the development of Gacaca marshland (SHER 2012 report), it is stated that for rice, DAP will be applied at the seedling stage and Urea during the weeding stage. These two inorganic fertilizers (mineral fertilizers) are acidifying, when combined to the already identified slightly acidic soils of the marshland; there is a likelihood that the soil acidity might exceed a threshold upon which it suffers what is termed as “field fatigue” from intensive monoculture. This could cumulatively low crop yield. If this is not tackled under the project program then the purpose of the irrigation scheme will fall short of its achievable goals

**Mitigation Measure(s)**

As Government policy and under RSSP III program, the agricultural sector has embarked on providing improved seed and fertilizers at subsidized costs to encourage their use in improving agricultural production. Farmers from Gacaca marshland will benefit from these initiatives. However, as mitigation measures towards avoiding loss of soil fertility from monoculture and use of organic fertilizers, the following suggestions were made;

- Techniques such as intercropping rice with alternate crops adaptive to the soil conditions left by the rice from the previous season, to avoid the proposed monoculture. By breaking the continuity of rice growth, then the alternate crop may facilitate restoration of soil to its original fertility.

- There is also a possibility of resting the land after a period of rice growing, to allow the soil to regain its fertility, hence reducing on the fertilizer required or promote use of rice variety with a 4 month growing cycle instead of 6months hence reducing on strain imparted on the soil.
The propositions above are only feasible for small scale agriculture but for a project as large and intensive as this, such measures might not feasible, instead more robust measures are proposed:

- Periodic soils tests are recommended to measure its nutrient levels, acidity levels and other soil characteristics that might determine the trend of soil fertility. This monitoring will guide decisions on what amounts and types of fertilizer are required for these soils and any techniques required to improve soil fertility in case it’s depreciating.
- It is also proposed that a combination of inorganic fertilizers is applied with organic fertilizers to reduce on the acidity caused by inorganic fertilizer. As such a combination is applied, less inorganic fertilizer will be applied and instead more organic fertilizer will be used until only organic fertilizer is used. Organic fertilizers could not be proposed for application on their own as an alternative in the first place, for reasons that though they are the most suitable they are slower to effect soils positively plus they also take longer to be formed.
- Source of organic fertilizer is humus from cow dung, which would integrate the rice project with livestock farmers on the hillside of the marshland, hence eliminating any conflicts that have existed between livestock farmers and cultivators.

6.2.3.1.3 Water pollution

Use of fertilizers and pesticides is a non-point source potential for introduction of nutrients into the likely receiving waters downstream of the rice paddies as a result of run-off. Agrochemical fertilizers such as; NPK and Urea \((\text{CO} \ (\text{NH}_2)_2)\) containing compounds of Nitrogen, Phosphorus and Potassium and, proposed for boosting soil fertility and pesticides will very likely drain into the river and lakes. Nutrients will cause de-oxygenation of the water bodies, in this case Gacaca river and downstream recipients of its waters, leading to death of oxygen depend aquatic ecosystem. e.g. fish. Such nutrients will also enhance evasive aquatic flora, the likes of water hyacinth, algae making it less oxygenated and restraining navigation and fishing activities in these waters. However, Water pollution from irrigation activities in this project is not going to be significant due to low quantity of agrichemicals used.

Mitigation Measure(s)

To avoid this impact, the farmers should adopt Integrated Pest Management practices instead of applying pesticides. For fertilizer, the farmers should be trained on the right application of fertilizer and safe use of pesticides.

Under the RSSP III component 2 of capacity building for marshland, hillside and commodity chain development, local farmers shall be trained on the safe application of pesticides and fertilizers. This is a practice that can immensely contribute to the reduction of possible chemical pollution of the receiving waters. Training on pesticide application may be specifically directed to the quantities to apply, timing (when), and protective gears to wear among others and should be incorporated in the Pest Management Plan.

Alternatively, a baseline test of the water quality and progressive tests are necessary to understand the effect of the project on the quality of water bodies and curb any likely impacts there may be before water quality deteriorates. This too can be entered in the MOU
with the national University laboratory to monitor the quality of these waters for precaution purposes.

6.2.3.1.4 Canal Siltation

Siltation of canals might occur from; mud slides of the hillsides adjacent to the perimeter canals, collapsing of embankments or canal slopes, soil erosion from heavy rains, cattle encroaching on the marshland and trampling over earth made canals. With silt in the canals, they will be blocked resulting in low water flows to the rice paddies causing dryness of soils and eventually low yields. This low flow might also cause conflicts amongst rice farmers over irrigation water.

Mitigation Measure(s)

- To avoid siltation, appropriate land husbandry technologies should be practiced such as; progressive and bench terracing and agroforestry along the hillsides adjacent to the marshland need to be established. This will hold the soils together, improve the soil composition, and hold slopes hence preventing slopes from collapsing into the canals.
- To avoid siltation, regular communal work for maintenance of canals should be mandatory for all rice growers.
- A 2m buffer zone along the primary emissary and canals has been proposed in the technical design to prevent farmers encroaching and hence prevent canal siltation. This buffer zone shall be regularly maintained by farmers for it to continue serving its purpose of holding soils and preventing collapse of canals.
- Regular inspection of canals and adjacent slopes is necessary to repair areas likely to collapse into the canals thereby reducing siltation.

6.2.3.1.5 Water logging and salinization

There are four main ways through which salinization can occur in irrigation practice. These ways are:

- Addition of lime in most of the soils during the cultivation to boost the soil fertility.
- Residues of solutes applied to the soil in the form of artificial and natural fertilizers as well as some pesticides that have not been taken up by crops;
- Salts which occur naturally in soil may move into solution or may already be in solution in the form of saline groundwater. This problem often occurs in deserts or arid areas where natural flushing of salts (leaching) does not occur and where the groundwater level is both high and saline, water will rise by capillary action and then evaporate, leaving salts on the surface and in the upper layers of the soil; and
- Salts carried in irrigation water are liable to build up in the soil profile, as water is removed by plants and the atmosphere at a much faster rate than salts. The salt concentration of incoming flows may increase in time with development activities upstream and if rising demand leads to drain water reuse; irrigated regime is intensified, even though the saline layers might be far below the soil surface and the irrigation water applied is of high quality.
Based on the above means of salinization, there is high probability of salt build up to occur in the intervention areas especially through the residue salts and salt build up in the soil profile.

**Mitigation**
With a properly determined crop water requirement, micro-management of irrigation water to specifically satisfy this need and regular monitoring of CropWat requirement to regulate the water quantity released to the catchments, the likelihood of water logging and salinization will be minimized. A minimum flow of 3l/s/ha Crop water demand during the agricultural Season A (September-January) after the driest period of the year, as per the technical study of the marshland development (SHER report, 2012).

Training of farmers to regulate quantities of water used will be a long term investment in sustaining the chemical properties of the soil for continuous fertility.

**6.2.3.1.6 High sedimentation levels for the reservoir**
The hillsides surrounding the area proposed for the reservoir were found to have a slope range of 6-25% as per the slope map in chapter 4. Combined with the savannah vegetation land cover, hardly any forests on the slopes and no erosion prevention methods applied on any of these slopes, there is a high possibility of soil erosion occurring. This is likely to cause huge levels of sedimentation for the reservoir and a higher dead load, drastically affecting the designed capacity of water collected in the reservoir hence lesser volumes of water and eventually low flows for the rice paddies in the downstream command area.

**Mitigation Measure(s)**
- Land husbandry techniques are proposed for the slopes surrounding the entire marshland, with emphasis on the slopes surrounding the reservoir. Some of these techniques are; Introduction of bench terraces on the steep slopes and progressive slopes on the less steep slopes. A buffer zone of at least 50m at the shores of the reservoir comprising of about 3 rows of vegetation to filter off sediment before it gets to the reservoir. Each of these rows with a thickness of about 10m may comprise of; emergent plants at the immediate of the shores, followed by agroforestry trees and then furthest uphill could Napier grass which may regularly be harvested and used as livestock fodder.

**6.2.3.2 Biological Environment**

**6.2.3.2.1 Invasive aquatic weeds**
Eutrophication of the reservoir from contaminated run-off by fertilizers applied on hillsides could possibly encourage resurgence of water hyacinth and any other aquatic weeds in the reservoir. In addition native aquatic weeds are likely to become more invasive to the
reservoir. This could eventually affect the efficiency of the reservoir to hold water resulting in insufficient irrigation in the command area.

Mitigation Measure(s)
- Periodic manual removal of weeds from the reservoir is proposed, to avoid the possibility of an uncontrollable invasion of the reservoir by weeds.
- Introduction of fish species that feed on invasive aquatic weeds into the reservoir hence reducing on the possibility of large quantities of weeds in the reservoir.
- Controlled use of fertilizers and pesticides on hillside cultivation to reduce on eutrophication from contaminated run-off.

6.2.3.2.2 Emergence of pests and crop diseases
The rice irrigation scheme could introduce new kinds of pests and crop diseases in an area that mainly grows banana, maize, sorghum and cassava. Examples of pests are birds that feed on grain and would increase in number once rice is introduced to the area. Such pests could affect production of other crops cultivated on the hillsides.

Mitigation Measure(s)
- Based on experiences of similar rice irrigation schemes in Kanyonyomba and Ntende- Rwagitima marshlands, rice cooperatives have been able to apply pesticides such as; Cypermethrine and Beam, to fight pests. It is proposed these pesticides are also applied to this project but in controlled quantities guided by the IPM and trained agronomists in the area.
- An Integrated Pest Management (IPM) study should be initiated to assess likely pests and crop diseases that emerge with rice schemes based on existing schemes such as Kanyonyomba, Ntende-Rwagitima marshlands, etc. This study will give recommendations on how to control likely pests and crop disease invasions.
- Scare crows are an old traditional means of preventing birds from encroaching on plantations. These along with rotating shifts of adults watching rice fields and the other plantations could one way to solve this issue. Children should not be allowed to skip school to chase away birds from the plantation fields.

6.2.3.3 Socio-economic Environment

6.2.3.3.1 Fear of complete shift to Monoculture cultivation
Livestock farmers and cultivators expressed worries of the Government policy to shift activities in the marshland to only cultivation of one crop, Rice. The marshland that is now cultivated with Banana plantations, maize, sorghum, Napier grass for livestock would no longer have such diverse variety of crops but instead only rice. Rice is a new crop and like all changes, there is a resistance towards the profitability and sustainability of the new crop under the climate of this area.
Farmers were sceptical of their livelihood depending on only one crop and whether homes would have a balanced diet with only rice grown. As for the livestock farmers, this was a
concern because cattle have always been a source of income, household food and milk provider and is a strong cultural symbol.

**Mitigation Measure(s)**

- There is a need for RSSP III together with local authorities to sensitize the locals of the profitability of the rice against any of the other crops that were grown in the marshland. For example, the cost of rice at 275Rwf/kg as opposed to 160Rwf/kg for maize. Plus a profit margin of over 120Rwf/kg on rice could be one way to change their mind-set.

- There is need for frequent study tours to areas that have had success stories from marshlands developed for rice production. This would enlighten the local farmers on the benefits of the choice of rice against the other means of living.

- It is important that sensitization of the local farmers is also done based on Crop Regionalisation map to inform farmers of the suitability of Rice to this marshland and its soils; against any of the crops they are growing. Other crops such as; banana, maize, sorghum and cassava could be grown on the hillsides of the marshland since from observation of the subsistence farming, they seem suitable. The Crop Regionalisation map is a part of Agricultural production map of Rwanda. It is a representation of crop regionalisation map according to agro-climatic zones in different district of Rwanda. (*CICA-MINAGRI, 2012*)

- Use of rice straws as fodder for livestock could also create a bond between cultivation and livestock farming thereby eliminating the worries of monoculture cultivation and instead encouraging appreciation of the rice project benefits to this area.

6.2.3.3.2 Resistance to change of livelihood

A number of activities are done in the marshland, as examples; (i) there is cultivation of crops such as; banana, maize, sorghum and on a small scale rice, (ii) Napier grass grown for livestock fodder, (iii) brick making since there are clay soils in the marsh, (iv) sand mining from the rivers.

There is already resistance against developing the marshland for only rice production. Some of those that depended on the marshland for a living through the different activities mentioned above are worried about the change in livelihood and source on income once rice is made monoculture.

**Mitigation Measure(s)**

It is known that sand mining; brick making in marshlands are degrading and hence not acceptable under the environmental protection policy of REMA. This would make brick laying and sand mining illegal in the marshland. Furthermore, since the marshland is Government property is allowed to develop it especially for a public benefit such as this agricultural intensification for food security in the country.

However, it is proposed that the brick makers, sand miners, cultivators are all integrated into the rice scheme by allocating them plots of land for rice production. This can be done along
with intense sensitization on the profitability of rice production as opposed to their current income earners. It is with such combination that resistance to change of livelihood is likely to be eliminated.

6.2.3.3 Poor pesticide and agrochemical fertilizer management

Part of Government policy is that farmers will be given improved seed and fertilizer, the project leaps further by providing pesticides for pest control. Use of fertilizer is crucial in improving soil fertility while pesticides will kill likely pests that might destroy crops. Based on the SHER report 2012, cooperatives from Ntende-Rwagitima rice growing marshland (COPRORIZ) and Kanyonyomba rice growing marshland (CORIMAK), about 200kg NPK/ha and 100kg Urea/ha is applied to their rice paddies. Pesticides applied are Cypermethrine and Beam.

However, if applied by farmers out of ignorance, it might result in health hazards such as; respiratory tract diseases, skin irritation, eventual cancers, soil infertility, pest resistance and water quality contamination. Furthermore, might affect soil composition and texture eventually drastically affecting its functionality to produce crop.

Mitigation Measure(s)

An Integrated Pest Management (IPM) guide adapted from those already done for RSSP I & II in previous projects, needs to be done. This shall be done in compliance with the “pest management- OP/BP-4.09”.

In the meantime, the following criteria may apply to the selection and use of pesticides in such projects: (a) They must have negligible adverse human health effects. (b) They must be shown to be effective against the target species. (c) They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them. (d) Their use must take into account the need to prevent the development of resistance in pests. (e) It is required that any pesticides be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable Internationally.

There is an agronomist at the sector level of Murundi, who may offer technical assistance to the rice growers once the project has taken off. It is however proposed that another Agronomist specific for this project is recruited and trained on the most appropriate pesticide and fertilizers application techniques. Like in other marshlands such as Kanyonyomba and Ntende-Rwagitima, the Agronomist has the responsibility of determining which type of fertilizer and pesticides are required, amounts required for application, recommend the areas of application and will be charged with the responsibility of training and following up on how farmers adopt to these techniques hence reducing on the misuse of these products.

Biological pest control may be introduced as a pilot test for this area, as a means of avoiding use of agro-chemicals. However, such an option is not feasible for this project area for reasons that biological control might be difficult to manage. Not knowing what other
beneficial organisms to the soils might be consumed by the applied pest controllers, makes it difficult to manage.

6.2.3.3.4 Water conflicts from the creation of irrigation scheme
With the coming of the rice irrigation schemes that involves; demarcating of the marshland into plots, land consolidation program for collective growing and harvesting, distribution of water through canals for irrigation, if the locals are not organized into institutional frameworks, this might be cause of conflict over who gets water for irrigation and what amount is meant for each of the plots, quarters or sectors. This can escalate in conflicts, enmity or vandalism.

Mitigation Measure(s)
It is proposed that RSSPIII along with local authorities are to organise locals into a cooperative and a Water Users’ Association (WUA) before commissioning the developed marshland.

The Cooperative will comprise of the members growing rice in the Gacaca marshland. Farmers will be sensitized on the importance of working under a cooperative, trained on modern techniques of rice growing, have the benefit of irrigation for cultivation throughout the year, encouraged to open savings accounts in the local bank “Umurenge SACCO” through which sales from an agreed percentage of their produce will be banked, trained on maintenance of their rice paddies and the irrigation infrastructure.

The Water Users’ Association (WUA) will manage the amount of water used for each section of the rice paddies and amount of water realised drained from Gacaca river (it should not go below a depth of 1.25m as per SHER Report 2012). WUA will collect revenues for water bills used by the locals; this could be done preferably as deductions off the farmers’ harvest. These revenues will be used for maintenance of irrigation infrastructure, which cannot be done by the farmers during communal work “Umuganda”. WUAs will also resolve arising conflicts over water distribution with in the marshland.

6.2.3.3.5 Vandalism of Irrigation infrastructure
With the coming of the project, a number of infrastructure will be made from metal or steel or concrete, for example; sluice gates, valves, HDPE Pipes. It also should be noted that not all locals will be pleased with the project initiatives, later on the existence of petty thieves in the area. From experience of previous irrigation projects, if farmers are not organised in such as to have community policing to guard the infrastructure and crops of the marshland, they will be vandalized and sold elsewhere.

An example from Mwogo marshland was, steel from the sluice gates and valves were vandalised and used as spare parts for bicycles. This would definitely cripple advances made by the project towards crop intensification and commercial agriculture.

Mitigation Measure(s)
Early establishment of cooperatives as the management structure at the project site, sensitization of farmers to ensure project ownership and effecting community policing as a means of ascertaining security, will collectively avoid vandalism.
Regulations on penalties against perpetrators convicted of vandalism are necessary. Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism.

6.2.3.3.6 Floods from reservoir over flow or dam collapse

Circumstances when the reservoir overflows or when the dam collapses and bursts should be envisioned. A reservoir of 2.5 Million m$^3$ is a huge amount of water that could flood the immediate area downstream of the dam and the command area below may occur; causing soil erosion, crop destruction, destruction of property and in very severe cases killing people in the marshland and livestock at the hillsides closest to the marshland.

Mitigation Measure(s)

The project has already championed precaution measures at the stage of project design of the dam.

- A Spillway at the height of 8.55m above low ground level, with a weir 25m long for the main dam has been designed for a 100 year return flood with an estimated flow of 66m$^3$/s, capable of a threshold flow of 1.3m water depth to act as a flood control structure. This means that should the water level exceed 8.55m height above ground, water will be evacuated via the spillway thereby avoiding the dam from being damaged or destroyed by water flowing on, over or against it. Also a Free board of 2.4m has also been designed for, to avoid erosion of the dam's material by an overtopping surface runoff which could remove masses of material whose weight holds the dam in place against the hydraulic forces acting to move the dam. With the dam protected, then it can hold water in the reservoir preventing it from flooding downstream or avoid the dyke from collapsing.

- A Cut-off trench was included in the design of the dam to reduce seepage and improve stability of the dam, preventing it from tipping to allow water from the reservoir to flood downstream.

- The design of the dam included a rock toe which will help relieve seepage problems in the downstream area of the dam on impervious foundation hence preventing it from collapsing as a result of seepage.

- Regular inspection of likely areas of weakness along the dam (such as; cracks, fissures) by qualified and experienced expert personnel is crucial to avoiding such calamities. In case of fissures, it can be cleaned off and concreted. For larger indentations or cracks, slush grouting should be used, which is a thick slurry mix of cement and water poured and bloomed into the larger cracks and fissures before any concrete is laid to fill the remaining indentations.

- It is recommended that a dam collapse preparedness plan is developed amongst the stakeholders. i.e. RSSP, EWSA, District authorities, local authorities, Police and local farmers. This plan shall include; understanding the flow patterns of the rivers, regular rainfall runoff patterns, modeling of the flood flow in case of dam failure for prediction of the trend of areas that will be affected, planning of resources required to evacuate during floods and after, proposal of evacuation routes, specific Institutional responsibilities at the time of the dam failure, etc.
Regular monitoring is essential to detect seepage and prevent failure. Downstream from the dam, seepage may be measured by increased flow from ground water springs in existence prior to the reservoir as might be caused by the pool of water behind the dyke.

Also regular reservoir water level measures might indicate seepage. Continuous and sudden drop in the normal reservoir level could be sign that there is actual seepage that requires treatment to avoid collapse of the dam.

Furthermore certain observations from routine inspections of the downstream face of the dam or contact of the embankments with the spillway or dam could indicate seepage. E.g. Growth of emergent plants in lush and dark green around the downstream face of the dam, slides in the embankment of the spillway or dam are possible signs of saturation of water in soils due to seepage, eroded soils in the shape of cone around the outlet of the downstream face of the dam, all these are signs of the possibility of seepage.

6.2.3.3.7 Increased spread of Water related diseases

In reference to public consultation and expert knowledge, the presence of a reservoir is to increase incidences of contracting water related diseases such as; malaria, bilharzia, because the water reservoir would serve as a breeding ground for mosquitoes and bilharzia snails. Water borne diseases such as; dysentery, diarrhoea, stomach-related disorders specifically infestation by worms, all resulting from using the irrigation water for domestic purposes (drinking and cooking).

Mitigation Measure(s)

As commitment to the health of the project beneficiaries, RSSP III is recommended to include in its plans planting of *Phytolaca decocandra* which will destroy the Bilharzia snails that serve as hosts of *shistosomiasis* along the shores of the lakes and river.

In addition to this, the project may work along with MINISANTE in issuing mosquito nets for those who don’t have, to reduce on the spread of malaria resulting from the created water mass in these areas. This shall go along with sensitization of sleeping under a mosquito net and its importance to the locals.

The formed cooperatives shall need to work with local authorities in restricting locals from using water from the reservoir for domestic consumption. As a matter of fact, RSSPIII should ensure the existence of alternative water points close enough to the locals in order to prevent locals from resorting to fetching unhealthy water from the reservoir.

The project may also venture into semester surveys of health records at the community health centres, with the collaboration of MINISANTE, to ascertain the spread or increase of malaria, bilharzia, dysentery or other water borne diseases that may be related to the project and come up with possible preventions.

The project may introduce fish in the reservoir that feed on mosquito larvae, hence reducing on mosquitoes that would have otherwise spread malaria.
6.2.3.3.8 Encroachment of the reservoir and primary emissary

With the irrigation project in place, there is a likelihood of local farmers encroaching the boundaries of the reservoir or the primary emissary (Gacaca river) in cases of water points being further than the reservoir, pumps at the water points breaking down or insufficient water supplied to the rice paddies.

Mitigation Measure(s)

- A clear and strict buffer zone is recommended at least 50m from the reservoir and 10 m from the river to the nearest rice paddies has already been planned for. This buffer zone may be a green belt comprising of; emergent plants such as cattails, bulrush, reed, trees that will clearly define off limit boundaries, preventing local farmers from encroaching the water sources. The buffer zone may also be used to filter off any likely nutrients, chemicals, sediments from applied fertilizers and pesticides used in the paddies for the emissary or on hillside cultivation for the reservoir, before reaching the receiving waters.

6.2.3.3.9 Wastage of water

Ignorance of farmers on the irrigation especially since this rice irrigation scheme is new in the area, could result in poor management of water distribution to the rice paddies. In experienced people managing the water realised from the reservoir into the canals, excessive amounts of water channelled to the quartiers, sections and rice paddies and cultivation close to the tertiary and secondary canals creating water leakages, could all result in wastage of water meant for efficient irrigation.

Mitigation Measure(s)

- Establishment of Water Users Association (WUAs) to manage quantities of apportioned for each rice paddy hence reducing on likely water misuse. WUAs are required to have trained technicians in water management, infrastructure control and repair. These will be of technical assistance to WUAs in managing water losses.
- Frequent inspection and repairs of leaking infrastructure is necessary to reduce on losses of water through leakages.
- Sensitization of farmers on proper management of water allocated for their paddies, preventing them from digging close to the canals to prevent embankment collapse and water leaks. Farmers could also be trained on identification infrastructure failures and possibly repair, such that they can warn WUAs of any leakages hence reducing wastage of water.
- Water allocation infrastructure such as; sluice gates and water intakes should only be managed by trained technicians. This will avoid excessive distribution of water thereby preventing wastage of water from the reservoir.

6.2.3.3.10 Drowning of children and livestock

Existence of large mass of water reservoir could encourage locals to fetch water from it, children to venture into swimming in the reservoir and livestock to drink from it. These activities expose mainly children and livestock to drowning in such a massive water body, if no precautions are taken to avoid encroaching the reservoir.
Mitigation Measure(s)

- A strictly maintained buffer zone is recommended at least 50m from the reservoir. This buffer zone may be a green belt comprising of; emergent plants such as cattails, bulrush, reed, trees that will clearly define off limit boundaries, preventing local farmers from encroaching the water sources. The green belt shall be thick enough to prevent children and livestock from penetrating it hence avoiding drowning.
- Locals should be sensitized on the dangers of swimming in the reservoir. This could urge adults to prevent children or their livestock from accessing the reservoir.
- Among the established cooperative and part of the local authorities (for example, local defence), a team of people should be assigned the task of patrolling the reservoir to prevent children and livestock from drowning in the reservoir.

6.2.4 DECOMMISSIONING PHASE

- The Irrigation infrastructure might remain in operation for many years provided maintenance of the facility is given due attention. However, the facilities may be abandoned because of fresh development projects or even more profitable resource exploitation identified for this area. If this happens, environmental as well as social adverse impacts might occur.

6.2.4.1. Physical Environment

6.2.4.1.2. Dust and noise Pollution from demolition activities

Dust and noise pollution might occur when demolishing the dyke, draining the reservoirs, filling canals and demolishing other infrastructure.

Mitigation Measure(s)

- Controlled draining of the reservoir is crucial; considering recipients downstream or even the plots in the command area from flooding plus avoiding the river embankments from eroding.
- To mitigate the health hazard, workers participating in the demolition shall require protective gear, such as; eye goggles, nose masks, overalls, wellington boots, gloves and working ear phones.
- Spray of water to reduce dust.
- Compaction of soils in areas where demolition is complete.
- For works that could cause noise, these will be done at hours when locals are out of the marshland, preferably in the afternoon.

6.2.4.1.2. Contamination and impaired Environment

In the event of future rehabilitations and upgrading of this marshland, portions of the project infrastructure and associated facilities might need to be demolished and the necessity
of disposal of demolished waste. Haphazard disposal might cause contamination/impaired quality of the receiving water bodies (Gacaca river), especially land and water resources.

**Mitigation Measure(s)**
- Monitoring of the waste disposal to authorized dumping areas by MINAGRI, district and local authorities will be necessary to avoid contamination of receiving waters or causing human health hazards.

### 6.2.4.2. Socio-economic Environment

#### 6.2.4.2.1. Abandoned Infrastructures

The Gacaca marshland Irrigation project is established to run for a long time, as such decommissioning is not envisaged unless it occurs in unforeseeable eventualities which may force abandonment of Irrigation Infrastructure and other project facilities that may permanently render the project land useless.

**Mitigation Measure(s)**
- Establishment of cooperatives, income and profits earned from the rice scheme will ensure locals have savings and businesses to turn to as alternative sources of income.
- RSSP III project policy to finance off-farm activities in areas of intervention will ensure locals have alternative means of income to resort to other than this particular project.

#### 6.2.4.2.2. Possibility of downstream flooding

During the demolition of the dyke and its spillway, it is likely that areas downstream might be flooded, for example; the command area, the main emissary (Gacaca river) banks eroded and downstream receiver of Ntende marshland and Gacaca downstream marshland. With volume of water of about 3 Million m$^3$ from the reservoir, this could result in loss of property, land, plantations and in some cases lives for those caught in the field at the time of the flood.

**Mitigation Measure(s)**
- Controlled draining of the reservoir is crucial to avoid recipients downstream or even the plots in the command area from flooding plus avoiding the river embankments from eroding.

#### 6.2.4.2.3. Loss of livelihood

It is envisaged that farmers and their families will be depending directly or indirectly on the irrigation scheme for income and food for their households. Decommissioning of the project means loss of livelihood.

**Mitigation Measure(s)**
It is anticipated that farmers would have gained a lot from project trainings and development, to enable them sustain themselves even without the project support. Communities would have organized themselves into Cooperatives dealing in commercial agriculture. They would have been introduced to saving at an early stage hence reaching out to their savings accounts to invest in other income earning businesses.

Off-farm income earning activities would have been adopted by project beneficiaries such that loss of irrigation scheme would not have a huge impact on their livelihood, for example; Making of Rwandan traditional basket “Agaseke” on a large scale by women as an off-farm activity done after returning from the rice paddies, could be turned to as an alternative income earner.

6.3. CONSIDERATION OF ALTERNATIVES

6.3.1. Choice of location

Choice of dam axis location
The choice of position of the dam axis was solely dependent on the water reservoir capacity to irrigate the perimeters of; Gacaca upstream (~ 360 ha) but also areas of existing development of Ntende-Rwagitima (~ 65 ha) and those provided under the future development of Gacaca downstream (~ 300 ha).
For the main dam axis of the 97.4km² watershed, 5 axis profiles were identified during the topographical survey from which dam axis No. 1 gave the best results, with a reservoir capacity of 2,468,000m³ and a dam height of 9.1m.

Choice of irrigable area
There were a number of issues that contributed to the choice of location for irrigation and some of these are (but not limited to these):

- The slope classification of the marshland indicated that it was <2%, which is suitable for gravitational irrigation without an extra effort of pumping water in any direction.
- The soil classification, RW-Rwagitima series (Paleustolic Chromustert), identified in the area as suitable for rice growth, based on the soil map and the preliminary technical study, also contributes to the choice of the location of this development.
- Furthermore, from the preliminary technical study, it was observed that there was a possibility of a quarry 500m from the site with suitable material for dam construction. This would cut cost on expenses incurred during construction by reducing hugely on material transportation cost, while giving the locals a double job opportunity to participate in construction and also in working at a quarry within their vicinity.
6.3.2 Choice of Technology investment

In reference to the Economic Financial Analysis (EFA) done under the technical study (SHER Report, 2012), with calculations based on additional benefits for at least the next 20 years the project will bring to the locals compared to their current standards of living, a number of potential technology investment choices were assessed. Two options were looked at, which involved;

(i) development of the marshland for irrigation of rice paddies without including a dam;

(ii) development of the marshland with only the main dam supplied by the first watershed of 97.4km² coverage, with a reservoir capable of holding up to 2.5 Million m³ of water;

(iii) With a target of irrigating an area close to (±500ha) of the Gacaca marshland, the table below indicates the possible irrigable areas for each of the options.

<table>
<thead>
<tr>
<th>Marshlands</th>
<th>Option 1</th>
<th></th>
<th>Option 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Season A</td>
<td>Season B</td>
<td>Season A</td>
<td>Season B</td>
</tr>
<tr>
<td></td>
<td>(Area in ha)</td>
<td>(Area in ha)</td>
<td>(Area in ha)</td>
<td>(Area in ha)</td>
</tr>
<tr>
<td>Gacaca upstream</td>
<td>72</td>
<td>290</td>
<td>362</td>
<td>362</td>
</tr>
<tr>
<td>Ntende-Rwagitima upstream</td>
<td>16</td>
<td>39</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Gacaca downstream</td>
<td>0</td>
<td>76</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td><strong>404</strong></td>
<td><strong>729</strong></td>
<td><strong>729</strong></td>
</tr>
</tbody>
</table>

From the EFA, it was no surprise that Option 2 of 2.5 Million m³ was financially and economically more profitable, hence Option 2 was considered the most appropriate option.

6.3.3 No-Project Alternative

This alternative of no-project alternative is considered not feasible from the following facets:

a) The areas already had agriculture practiced; however, the kind of subsistence farming has not benefited the local farmers in these areas compared to the potential outstanding from the use of water resources available. Use of water for irrigation would mean crop cultivation throughout the year without the interference of the dry season hence increased crop yield resulting in increased income.

b) All year cultivation would mean no drought or hunger during the dry season that has at times led to migration to other districts or hunting of animals in Akagera National Park in such for food in some cases causing security threats instead this would establish food security for the farmers.
c) Commercialised farming, organisation of farmers in Cooperatives, delivers an opportunity of profitable farm-gate crop price bargaining, access to markets (regional and international) which would eventually bring in high revenues and the chance of application of advanced agricultural techniques for high yields.

d) The coming of this project brings along high crop yield, which motivates the locals to adopt the habit of saving in bank accounts hence preparing for an economical independent future for their households.

e) Government’s achievement of food security, which means adequate sustainability of household food needs plus surplus crop yield to sell and earn a favourable income by a farmer in rural areas of the country.

Based on the above it is considered that No-Project alternative is not a plausible alternative.
CHAPTER 7: ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) described in Table 7.1 provides a way forward for implementation of the identified mitigation measures. RSSP III project coordination shall be responsible for overall implementation of the EMP. The project Environmental officer shall be designated to make day to day follow ups (e.g. supervision and liaising with stakeholders). The estimated costs for implementation of the mitigation measures are just indicative. Appropriate bills of quantities should clearly give actual figures. In any case the consultant used informed judgement to come up with these figures.

Table: 7.1. Environmental and Social Management Plan

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
| Design and mobilisation phase| Design of the dam without consideration of existing water points or alternative water points for the locals | Destruction of water points/boreholes                                                             | • Interaction between RSSP III Gacaca technical study and LISP study on site No. 9 is important, to ensure that the high yield water supply boreholes identified in Ryamanyoni cell are not within the boundaries of the Gacaca marshland development.  
• Alternative sources of water (i.e. boreholes, springs,) on the hillsides need to be investigated for development. These sources may be used by the locals as opposed to resorting to the reservoir or other demeaning measures.  
• Consultation with Kayonza district is crucial, on its water supply project to identify the coverage and whether it can be used as an alternative for the water sources inundated or demolished during the project execution. | RSSP III Project  
Kayonza District  
Murundi sector  
MINIRENA  
REMA | 42,000US$/water point based on preliminary study of LISP development of water points in Ryamanyoni cell. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
| Construction  | Refuelling of construction equipment, vehicles and generator. Mechanical repairs of equipment. | Oil spillage resulting in soil and water contamination                                                      | • Only equipment and automobiles in good condition and certified by the “National Automobile Inspection centre” will be allowed on site, in order to reduce on the likelihood of oil spillage.  
• Re-fuelling, oil change, maintenance works, repair works will be allocated a restricted area, far from the water stream, marshland and preferably positioned in an area that has no adverse effects if degraded. A cemented floor and a sand stock for use in the absorption of spilled oil is appropriate.  
• As for the river water quality contamination by oil spillage from generators, an oil interceptor should be installed at the stand-by generator to avoid water quality contamination. | Contractors.  
• RSSP III.  
• Kayonza district.  
• Murundi sector.  
• REMA | Inclusive in the contractor's sum |
| Construction  | In the process of doing soil, geological tests and possibly during excavation works. | Dangerous borrow pits                                                                                     | • Borrow pits need to be identified, marked out, refilled and the area rejuvenated so as to avoid any of the likely; injuries, health hazards occurring or habitat for rodents and venomous reptiles. | Contractor  
• RSSP III.  
• Murundi Sector.  
• Kayonza district | Inclusive in the contractor's sum |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Interactions amongst construction workers on site and with the local community once off site. | Occupational health hazards during construction | • Spraying of water regularly to suppress excessive dust during construction is strongly recommended;  
• Workers on site will be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls.  
• To this effect, the contractor shall have a staff department specifically following up on the safety compliance on site.  
• An Insurance policy covering injuries or death at the site should be presented at contract signature. This will act as security over any occurring occupational health hazards for the workers on site.  
• Enforcement of medical insurance “mituelle de santé” acquisition for all workers as a means of affordability of health treatment.  
• Regular sensitization on ways of HIV prevention, importance of proper hygiene is important during execution of this project. | Contractor  
• RSSP III.  
• Kayonza district.  
• Murundi Sector  
• MINISANTE  
• REMA | Inclusive in the contractor’s sum |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>During site clearance, excavation works, disposal of debris, supply of</td>
<td></td>
<td>• Activities that create lots of noise or irritations, such as; vibrations, heavy equipment moving earth, excavations, shall be restricted to normal working hours (7h00-17h00) to prevent noise for neighbours at night;</td>
<td>Contractor</td>
<td>Measurement of noise</td>
</tr>
<tr>
<td></td>
<td>construction material, compression and vibrations. All these activities</td>
<td>Air and noise pollution</td>
<td>• Use of equipment and automobiles that have certification of good working conditions from “National Automobile inspection centre” to reduce noise or exhaust fumes emissions.</td>
<td>RSSP III.</td>
<td>levels covered in contractor’s sum.</td>
</tr>
<tr>
<td></td>
<td>will involve movement of construction equipment, trucks which raise dust,</td>
<td></td>
<td>• Ensure routine maintenance, repair of trucks and machines to reduce on the exhaust fumes and noise from the machines.</td>
<td>Murundi sector.</td>
<td>A stand by generator</td>
</tr>
<tr>
<td></td>
<td>emit noise and greenhouse gases.</td>
<td></td>
<td>• The project will spray water regularly when clearing land to reduce the dust.</td>
<td>Kayonza District.</td>
<td>may cost up to 25000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Generators for use at the site shall have silencers to reduce on the noise emitted.</td>
<td>REMA.</td>
<td>US$ but this is at the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MINISANTE.</td>
<td>contractor’s expense.</td>
</tr>
<tr>
<td>Phase</td>
<td>Activity</td>
<td>Impacts</td>
<td>Mitigation/Enhancement measures</td>
<td>Responsible Institution</td>
<td>Estimated costs (US$)</td>
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<tr>
<td></td>
<td>Site clearing, excavation exposing the ground to potential erosion agents such as; wind and storm water</td>
<td>Soil erosion</td>
<td>• Plan to excavate the plot sections demarcated for construction, in stages to avoid opening up of big sizes of the area and increasing the level of risk to erosion at any one time. &lt;br&gt;• The project can possibly be fast tracked so that the time the land is left bear and exposed to potential erosion agents is minimized. &lt;br&gt;• Debris in the compaction and construction of the foundation for the structures shall be resurfaced and levelled; &lt;br&gt;• Immediate backfilling and resurfacing after excavation to avoid facilitation of erosion agents. &lt;br&gt;• Light compaction will be necessary to stabilise the soil. &lt;br&gt;• Planting of grass on bare land to minimise erosion tendencies should be given priority. &lt;br&gt;• Avoidance of vegetation clearance that will expose soil to agents of erosion during construction phase. &lt;br&gt;• Re-vegetating the cleared sites with local plant species.</td>
<td>Contractor&lt;br&gt;RSSP III&lt;br&gt;MNAGRI&lt;br&gt;Kayonza District&lt;br&gt;Murundi sector</td>
<td>Inclusive in the contractor's sum</td>
</tr>
<tr>
<td>Phase</td>
<td>Activity</td>
<td>Impacts</td>
<td>Mitigation/Enhancement measures</td>
<td>Responsible Institution</td>
<td>Estimated costs (US$)</td>
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</tbody>
</table>
|       | Welding, electrical installations to or from the generator or power lines, refuelling of equipment, smoking on site could cause fire outbreaks. | Fire outbreaks | • Regular checks on electrical installations and proper insulation of cables, to prevent short circuits that could trigger fires.  
• Specific area restricted to only authorized personnel, should be allocated for fuel storage.  
• Such an area should have sufficient fire extinguishing equipment to stop fires escalating.  
• Water tank automobiles with hose pipes need to be part of the equipment required at the sites, for purposes of extinguishing fires.  
• Fire management drills for the workers should regularly be done.                                      | Contractor  
• RSSP III.  
• Murundi sector.  
• Kayonza district. | Part of the contractor’s cost |


<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | During site installation, site clearing and excavation, transportation and use of heavy construction equipment will occur that could destroy existing infrastructure | Impact on local infrastructure | • Mapping out of existing infrastructure such as; water points, pipelines, power lines, homes, town centres, roads and bridges is required to guide on the most optimal site installation and site access. This could reduce on the impact of the project on existing infrastructure and cut on cost spent through compensation of this infrastructure.  
• A Resettlement Action Plan and qualified property valuation can guide compensation of those affected.  
• It is also proposed that some of this infrastructure (such as; water points, pipelines, power lines, roads and bridges) could be shifted to other areas and continue to serve the purpose it has always had.  
• As per technical design of the project, access roads to the marshlands shall be widened and improved to handle increased traffic and heavy equipment. The bridge will be raised 2m higher to prevent inundation by the reservoir. | Contractor  
• RSSP III.  
• Kayonza district  
• Murundi sector | Part of the contractor's cost |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Huge construction project involving dam construction and developing a marshland, which shall attract workers from beyond the intervention area. | Population migration | • District projections of likely increase in population in the region and plans for improving infrastructure capable of sustaining the increment are necessary. E.g. housing facilities, water supply, electricity, health and education facilities need to be improved.  
• At site installation, the contractor may construct houses for migrating workers and a dispensary to cater for any injuries or contracted diseases hence reducing on the numbers frequenting the single health centre in the area.  
• Locals should be encouraged to actively participate in construction of the project thereby reducing on need for migrating population for work. | Kayonza district.  
Murundi sector.  
NISR  
Contractor | Part of the contractor's sum for site installation might cater for workers accommodation. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | During the entire construction phase, the project shall consume water,  | Resource use conflict            | • In the technical design, it is proposed that alternative water sources are investigated. For example, high yield boreholes are developed to supply the construction works without affecting the existing water sources used by the locals. These alternative new boreholes could later be transferred to local authorities once the construction is complete.  
• Negotiations with EWSA to increase quantity of electricity channelled to this area to accommodate domestic use and sustain construction activities.  
• The technical study has identified possible areas, in the radius of 500m- 3km, from which construction material shall be obtained. These are from new resource points hence not conflicting with the already existing mining areas. | Contractor                | Part of contractor's cost       |
<p>|       | electricity, exploitation of existing construction material sites.       |                                  |                                                                                                                                                                                                                                                                                         | RSSP III                 |                       |
|       |                                                                          |                                  |                                                                                                                                                                                                                                                                                         | Kayonza District         |                       |
|       |                                                                          |                                  |                                                                                                                                                                                                                                                                                         | Murundi sector           |                       |</p>
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|        | **Operation stage**                                                                                                                                                                                   | **Impounding of water flowing in River Gacaca by constructing a dam and diverting some of the water through canals for downstream irrigation of the command area**                                                                                                                                                                                                                     | • With generated flows indicating that for all months, except July and August, the ecological flow demand is exceeded in some cases 13 times and with an irrigation design of 3 l/s/ha to avoid excessive drainage of the main emissary, flow downstream will remain sufficient and not be affected by the irrigation scheme.  
  • The design of 7 water intakes along the main emissary (river) ensures optimum recycling of irrigation water drained from upstream usage into the main emissary. A combination of the intakes together with other regulating and distribution structures, e.g. drops, farm turn-outs, aqueducts, valves, sluice gates, canals, ensure that the flow of water is recycled back to the main emissary hence adequate water downstream. From the study at least 10% of the water discharge upstream is available as an input downstream of the emissary, which would imply a minimum downstream release of 108.6 l/s back into the river adequate enough when compared to the ecological demand of 46.3 l/s.  
  • Furthermore, with an irrigation efficiency of over 60% even during dry years and the water balance accounting for irrigable area of Gacaca marshland upstream (362 ha), Ntende (65 ha) and Gacaca downstream (302 ha), gives the project an upper hand of not depleting resources and thus not affecting flows.  
  • It is recommended that daily flow monitoring of the water bodies (river Gacaca, Kamunzi and Kayongo and the new reservoir) to maintain the flow pattern shall be done by WUA after thorough training by RAB or ISAE water experts.  
  • Periodic inspections by the RAB and ISAE shall to ensure records are taken precisely and data is interpreted and monitored. (At least every 6 months).  
  • Weirs and water level recorders at the rivers need to be installed, the lowest station below the 7th Intake level, for consistent checks on the effect of project activities on the flow. An MOU with RAB and ISAE may be established to manage these records. This information may be used to defend project impact, predict future impacts and direct proposals of mitigation measures. It shall also prevent a cumulative effect of similar projects using water from the same water sources. | MINAGRI/ RSSP III  
MINIRENA  
REMA  
ISAE or RAB                                                                                                                                                                                                                                                                  | Regular monitoring of flow patterns is part of the irrigation infrastructure technician's job requirements.  
250 US$ flow analysis and interpretation. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Growing of only rice in the Gacaca marshland as opposed to the diverse type of crops presently grown.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
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</table>
| Fear of complete shift to monoculture cultivation | • Need for sensitization of the locals on the profitability of the rice against any of the other crops that were grown in the marshland. For example, the cost of rice at 275Rwf/kg as opposed to 160Rwf/kg for maize. Plus a profit margin of over 120Rwf/kg on rice could be one way to change their mind-set.  
• Need for frequent study tours to areas that have had success stories from marshlands developed for rice production. This would enlighten the local farmers on the benefits of the choice of rice against the other means of living.  
• Sensitization of the local farmers may also base on the Crop Regionalisation map to inform farmers of the suitability of Rice to this marshland and its soils; against any of the crops they are growing. The Crop Regionalisation map is a part of Agricultural production map of Rwanda, regionalising crops according to agro-climatic zones in different district of Rwanda. (CICA-MIN-AGRI, 2012).  
• Use of rice straws as fodder for livestock could also create a bond between cultivation and livestock farming thereby eliminating the worries of monoculture cultivation and instead encouraging appreciation of the rice project benefits to this area. | RSSP III  
Kayonza District  
Murundi sector |

<p>| Estimated costs (US$) | No cost application since sensitization is within the tasks of RSSP III and sector staff. |</p>
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Replacement of present livelihood such as; diverse crop cultivation, brick making and sand mining in the marshland, with only rice cultivation | Resistance to change of livelihood | • To avoid resistance to change, it is proposed that the brick makers, sand miners, cultivators are all integrated into the rice scheme by allocating them plots of land for rice production and sensitizing them on rice profitability.  
• It should be remembered that brick making and sand mining in marshlands degrade the environment and are not acceptable by REMA. | RSSP III. · MINAGRI · Kayonza District · Murundi sector | No cost applicable. |
|       | All year cultivation of a single crop, i.e. rice, on the same piece of land in the marshland | Loss of soil fertility from monoculture and use of inorganic fertilizers | • Periodic soils tests are recommended to measure its nutrient levels, acidity levels and other soil characteristics that might determine the trend of soil fertility. Amounts of fertilizer applied and any techniques to improve soil fertility shall depend on these tests.  
• It is also proposed that a combination of inorganic fertilizers is applied with organic fertilizers to reduce on the acidity caused by inorganic fertilizer. As trends go by, less inorganic fertilizer will be applied and instead more organic fertilizer will be used until only organic fertilizer is used. | RSSP III · MINAGRI. · MINIRENA · REMA · Kayonza District. Murundi sector. | Cost of soil tests for each period of examination could in the range of 600 to 800 US$. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Application of pesticides and fertilizers on the rice paddies. | Poor pesticide and agrochemical fertilizer management | • An Integrated Pest Management (IPM) guide adapted from those already done for RSSP I & II in previous projects, needs to be done. This shall be done in compliance with the “pest management- OP/BP-4.09”.  
• Technical assistance from Murundi sector agronomist and a recruited agronomist specific for this project is proposed. They have the responsibility of determining which type of fertilizer and pesticides are required, amounts required for application, recommend the areas of application and will be charged with the responsibility of training and following up on how farmers adopt to these techniques hence reducing on the misuse of these products. | RSSP III  
MINAGRI  
MINIRENA  
REMA  
Kayonza District  
Murundi sector | About 10,000US$ for IPM report based on previous study costs.  
Pest control estimates may be obtained from the RSSPIII budget allocation |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Application of excess fertilizers which are eventually washed by run-off into receiving water bodies. | Water pollution                                                        | • The Project site Agronomist and the sector agronomist should conduct training to the local farmers on the safe application of pesticides and fertilizers. This is a practice that can immensely contribute to the reduction of possible chemical pollution of the receiving waters. Training on pesticide application may be specifically directed to the quantities to apply, timing (when), and protective gears to wear among others and should be incorporated in the Pest Management Plan.  
• Alternatively, a baseline test of the water quality and progressive tests are necessary to understand the effect of the project on the quality of water bodies and curb any likely impacts there may be before water quality deteriorates. This too can be entered in a MOU with the national University laboratory to monitor the quality of these waters for precaution purposes. | RSSP III MINAGRI MINIRENA REMA Kayonza District Murundi sector | Cost of water quality tests shall be determined at the time of the MOU with the ISAE or RAB but might not exceed 150US$ for a complete quality test. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Water distribution through the primary, secondary and tertiary canals for  | - It is proposed that RSSP III along with local authorities are to organise local farmers into a cooperative and a Water Users’ Association (WUA) before commissioning the developed marshland.  
- Farmers under the cooperatives will be sensitized on the importance of cooperatives, trained on modern techniques of rice growing, have the benefit of irrigation for cultivation throughout the year, encouraged to open savings accounts in the local bank “Umurenge SACCO” through which sales from an agreed percentage of their produce will be banked, trained on maintenance of their rice paddies and the irrigation infrastructure.  
- The Water Users’ Association (WUA) will manage the amount of water used for each section of the rice paddies and amount of water realised drained from Gacaca river (it should not go below a depth of 1.25m as per SHER Report 2012).  
- WUA will collect revenues for water bills used by the locals; this could be done preferably as deductions off the farmers’ harvest. These revenues will be used for maintenance of irrigation infrastructure, which cannot be done by the farmers during communal work “Umuganda”.  
- WUAs will also resolve arising conflicts over water distribution with in the marshland. | RSSP III  
Kayonza District.  
Murundi sector office | No cost application                                                       |
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<th>Phase</th>
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<th>Impacts</th>
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<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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</table>
|       | Existence of steel sluice gates, valves, HDPE pipes which material can be used by locals for domestic repair works such as bicycle repairs. | Vandalism of Irrigation infrastructure | ● Early establishment of cooperatives as the management structure at the project site, sensitization of farmers to ensure project ownership and effecting community policing as a means of ascertaining security, will collectively avoid vandalism.  
● Regulations on penalties against perpetrators convicted of vandalism are necessary. Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism. | RSSP III  
Formed Gacaca marshland Cooperative and WUAs  
Murundi sector | No cost application for establishing management except for registration fees that will not exceed 60US$.  
Community policing estimated to cost 200US$/ month but to cut on costs coops. Members can take turns doing this. |
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<th>Phase</th>
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<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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</table>
|       | Poor workmanship in construction of the dam resulting in its collapse during operation phase. | Floods from reservoir overflow or dam collapse | The project has already championed precaution measures at the stage of project design of the dam.  
- A Spillway at the height of 8.55m above low ground level, with a weir 25m long for the main dam has been designed for a 100 year return flood with an estimated flow of 66m³/s, capable of a threshold flow of 1.3m water depth to act as a flood control structure. Water level exceeding 8.55m height above ground will be evacuated via the spillway thereby avoiding the dam from being damaged or destroyed by water flowing on, over or against it.  
- Also a Free board of 2.4m has also been designed for, to avoid erosion of the dam's material by an overtopping surface runoff which could remove masses of material whose weight holds the dam in place against the hydraulic forces acting to move the dam. With the dam protected, then it can hold water in the reservoir preventing it from flooding downstream or avoid the dyke from collapsing.  
- A Cut-off trench was included in the design of the dam to reduce seepage and improve stability of the dam, preventing it from tipping to allow water from the reservoir to flood downstream.  
- The design of the dam included a rock toe which will help relieve seepage problems in the downstream area of the dam on impervious foundation hence preventing it from collapsing as a result of seepage.  
- A dam collapse preparedness plan should be developed amongst the stakeholders, i.e. RSSP, EWSA, District authorities, local authorities, Police and local farmers. This plan shall include; understanding the flow patterns of the rivers, regular rainfall runoff patterns, modeling of the flood flow in case of dam failure for prediction of the trend of areas that will be affected, planning of resources required to evacuate during floods and after, proposal of evacuation routes, specific Institutional responsibilities at the time of the dam failure, etc.  
- Regular inspection of likely areas of weakness along the dam (such as; cracks, fissures) is crucial to avoid such calamities. In case of fissures, it can be cleaned off and concreted. For larger indentations or cracks, slush grouting should be used. | RSSP III  
Conductor  
Works Supervising firm.  
MINAGRI  
MININFRA  
Kayonza Infrastructure department. | Part of designs with Bills of Quantities considered for the contractor’s sum. |
<table>
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<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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</table>
|       | Use of water from the reservoir by locals for bathing, washing clothes,  | Increased spread of water related diseases (such as; Bilharzia, malaria, | • As commitment to the health of the project beneficiaries, RSSP III is recommended to include in its plans planting of *Phytolaca decandra* which will destroy the Bilharzia snails that serve as hosts of *Schistosomiasis* along the shores of the lakes and river.  

• In addition to this, the project may work along with MINISANTE in issuing mosquito nets for those who don’t have, to reduce on the spread of malaria resulting from the created water mass in these areas. This shall go along with sensitization of sleeping under a mosquito net and its importance to the locals.  

• The formed cooperatives shall need to work with local authorities in restricting locals from using water from the reservoir for domestic consumption. As a matter of fact, RSSPIII should ensure the existence of alternative water points close enough to the locals in order to prevent locals from resorting to fetching unhealthy water from the reservoir.  

• The project may also venture into semester surveys of health records at the community health centres, with the collaboration of MINISANTE, to ascertain the spread or increase of malaria, bilharzia, dysentery or other water borne diseases that may be related to the project and come up with possible preventions.  

• RSSP III project  
• MINISANTE  
• Ryamanyoni health centre.  
• Kayonza District.  
• Murundi sector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                         |                      |
<p>|       | drinking and cooking food.                                                |                           | Cost can only be determined after a commitment between MINAGRI and MINISANTE on control against water related disease has been established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                         |                      |</p>
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<th>Phase</th>
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<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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<tbody>
<tr>
<td></td>
<td>Soil erosion, mudslides collapsing of embankments or canal slopes from</td>
<td>To avoid siltation, terraces and agroforestry along the hillsides adjacent to the marshland</td>
<td>To avoid siltation, terraces and agroforestry along the hillsides adjacent to the marshland need to be established.</td>
<td>RSSP III</td>
<td>Cost designated under the RSSPIII Sub-component 1.2 budget.</td>
</tr>
<tr>
<td></td>
<td>hillside run-off.</td>
<td>need to be established. This will hold the soils together, improve the soil composition,</td>
<td>hold slopes hence preventing slopes from collapsing into the canals.</td>
<td>Formed Cooperative and WUA.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>hold slopes hence preventing slopes from collapsing into the canals.</td>
<td>To avoid siltation, regular communal work for maintenance of canals should be mandatory for all rice growers.</td>
<td>Murundi sector.</td>
<td></td>
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<td></td>
<td></td>
<td>Regular inspection of canals and adjacent slopes is necessary to repair areas likely to</td>
<td>Regular inspection of canals and adjacent slopes is necessary to repair areas likely to collapse into the canals</td>
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<tr>
<td></td>
<td></td>
<td>collapse into the canals thereby reducing siltation.</td>
<td>thereby reducing siltation.</td>
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<tr>
<td>Phase</td>
<td>Activity</td>
<td>Impacts</td>
<td>Mitigation/Enhancement measures</td>
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<td></td>
<td>• Addition of lime to the soil during cultivation.</td>
<td>Water logging and salinization</td>
<td>• With a properly determined crop water requirement, micro-management of irrigation water to specifically satisfy this need and regular monitoring of CropWat requirement to regulate the water quantity released to the catchments, the likelihood of water logging and salinization will be minimized. A minimum flow of 3l/s/ha was proposed compared to the 2.5l/s/ha Crop water demand during the agricultural Season A (September-January) after the driest period of the year, as per the technical study of the marshland development (SHER report, 2012). • Training of farmers to regulate quantities of water used will be a long term investment in sustaining the chemical properties of the soil for continuous fertility.</td>
<td>• RSSP III • MINAGRI • Kayonza District. • Murundi Sector • Cooperative. • Formed WUA.</td>
<td>Cost under Sub-component 2.1.</td>
</tr>
<tr>
<td>Phase</td>
<td>Activity</td>
<td>Impacts</td>
<td>Mitigation/Enhancement measures</td>
<td>Responsible Institution</td>
<td>Estimated costs (US$)</td>
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</table>
|       | Savannah grasslands, lack of forests and poor land husbandry on the hillside surrounding the reservoir. | High sedimentation levels in the Reservoir |  • Land husbandry techniques are proposed for the slopes surrounding the entire marshland, with emphasis on the slopes surrounding the reservoir. Some of these techniques are;  
  • Introduction of bench terraces on the steep slopes and progressive slopes on the less steep slopes.  
  • A Green belt buffer zone of at least 50m at the shores of the reservoir comprising of about 3 rows of vegetation to hold soils and filter off sediment before it gets to the reservoir. Each of these rows with a thickness of about 10m may comprise of; emergent plants at the immediate of the shores (such as reeds, bulrush or cattails), followed by agroforestry trees and then furthest uphill could be Napier grass which may regularly be harvested and used as livestock fodder. | RSSP III.  
  • Murundi sector. | Cost under RSSPIII sub-component 1.2 budget |
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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</thead>
</table>
|       | Farmers cultivating closer to the reservoir and primary emissary, with the likelihood of digging up the embankments and exceeding restricted boundaries | Encroachment of water sources | • A clear and strict buffer zone is recommended at least 50m from the reservoir and 2m from the river (primary emissary) to the nearest rice paddies has already been planned for. This buffer zone may be a green belt comprising of; emergent plants such as cattails, bulrush, reed and trees that will clearly define off limit boundaries, preventing local farmers from encroaching the water sources.  
• The buffer zone may also be used to filter off any likely nutrients, chemicals, sediments from applied fertilizers and pesticides used in the paddies for the emissary or on hillside cultivation for the reservoir, before reaching the receiving waters. | RSSP III  
• Murundi sector.  
• Formed Cooperative. | Cost under RSSPIII sub-component 1.2 budget. |
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
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<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
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</thead>
</table>
|       | Regulating of water from the reservoir through canals to rice paddies for irrigation. | Wastage of water | • Establishment of Water Users Association (WUAs) to manage quantities of apportioned for each rice paddy hence reducing on likely water misuse. WUAs are required to have trained technicians in water management, infrastructure control and repair. These will be of technical assistance to WUAs in managing water losses.  
• Frequent inspection and repairs of leaking infrastructure is necessary to reduce on losses of water through leakages.  
• Sensitization of farmers on proper management of water allocated for their paddies, preventing them from digging close to the canals to prevent embankment collapse and water leaks. Farmers could also be trained on identification infrastructure failures and possibly repair, such that they can warn WUAs of any leakages hence reducing wastage of water.  
• Water allocation infrastructure such as; sluice gates and water intakes should only be managed by trained technicians. This will avoid excessive distribution of water thereby preventing wastage of water from the reservoir. | WUAs  
Rice Cooperative.  
RSSP III | Cost under Sub-component 2.1. |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Use of reservoir water by children as a source of fetching water, washing clothes, swimming. Use of the reservoir as a drinking mound for livestock. | Drowning of children and livestock           | • A strictly maintained buffer zone is recommended at least 50m from the reservoir. This buffer zone may be a green belt comprising of; emergent plants such as cattails, bulrush, reed, trees that will clearly define off limit boundaries, preventing local farmers from encroaching the water sources. The green belt shall be thick enough to prevent children and livestock from penetrating it hence avoiding drowning.  
• Locals should be sensitized on the dangers of swimming in the reservoir. This could urge adults to prevent children or their livestock from accessing the reservoir.  
• Among the established cooperative and part of the local authorities (for example, local defence), a team of people should be assigned the task of patrolling the reservoir to prevent children and livestock from drowning in the reservoir. | Murundi sector.  
Established Rice cooperative.  
RSSP III. | Cost under Sub-component 2.1. |
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
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<th>Responsible Institution</th>
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</table>
|       | Eutrophication of the reservoir | Invasive aquatic weeds | • Periodic manual removal of weeds from the reservoir is proposed, to avoid the possibility of an uncontrollable invasion of the reservoir by weeds.  
• Introduction of fish species that feed on invasive aquatic weeds into the reservoir hence reducing on the possibility of large quantities of weeds in the reservoir.  
• Controlled use of fertilizers and pesticides on hillside cultivation to reduce on eutrophication from contaminated run-off. | • Established Rice cooperative.  
• RSSP III.  
• Murundi sector | Cost under Sub-component 2.1. |
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
</tr>
</thead>
</table>
|       | Introduction of rice scheme to the Gacaca marshland | Emergence of pests and crop diseases | • Based on experiences of similar rice irrigation schemes in Kanyonyomba and Ntende-Rwagitima marshlands, rice cooperatives have been able to apply pesticides such as; Cypermethrine and Beam, to fight pests. It is proposed these pesticides are also applied to this project but in controlled quantities guided by the IPM and trained agronomists in the area.  
• An Integrated Pest Management (IPM) study should be initiated to assess likely pests and crop diseases that emerge with rice schemes based on existing schemes such as Kanyonyomba, Ntende-Rwagitima marshlands, etc. This study will give recommendations on how to control likely pests and crop disease invasions.  
• Scare crows are an old traditional means of preventing birds from encroaching on plantations. These along with rotating shifts of adults watching rice fields and the other plantations could one way to solve this issue. Children should not be allowed to skip school to chase away birds from the plantation fields. | Established Rice cooperative.  
• RSSP III.  
• Murundi sector | Cost under Sub-component 2.1.
<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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</thead>
</table>
| Decommissioning Phase | Decommissioning of the project             | Abandoned Infrastructures                         | • Establishment of cooperatives, income and profits earned from the rice scheme will ensure locals have savings and businesses to turn to as alternative sources of income.  
• RSSP III project policy to finance off-farm activities in areas of intervention will ensure locals have alternative means of income to resort to other than this particular project. | MINAGRI  
• Existing cooperative. | Cost can only be determined at the time of demolition. |
|                     | Demolition of the dam and irrigation infrastructure | Dust and noise pollution from demolition activities | • To mitigate the health hazard, workers participating in the demolition shall require protective gear, such as; eye goggles, nose masks, overalls, wellington boots, gloves and working ear phones.  
• Spray of water to reduce dust.  
• Compaction of soils in areas where demolition is complete.  
• For works that could cause noise, these will be done at hours when locals are out of the marshland, preferably in the afternoon. | MINAGRI  
• Existing Cooperative. | Cost can only be determined at the time of demolition. |
|                     | Collapse of the dam during demolition       | Possibility of downstream flooding               | • Controlled draining of the reservoir is crucial to avoid recipients downstream or even the plots in the command area from flooding plus avoiding the river embankments from eroding. | MINAGRI  
• Existing Cooperative.  
• Existing District and sector authorities | Cost can only be determined at the time of decommissioning |

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<table>
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<tr>
<th>Phase</th>
<th>Activity</th>
<th>Impacts</th>
<th>Mitigation/Enhancement measures</th>
<th>Responsible Institution</th>
<th>Estimated costs (US$)</th>
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<tbody>
<tr>
<td></td>
<td>Disposal of debris during demolition</td>
<td>Contamination and impaired environment</td>
<td>• Monitoring of the waste disposal in authorized damping areas by MINAGRI and district authorities will be necessary to avoid contamination of receiving waters or causing human health hazards.</td>
<td>MINAGRI, Existing Cooperative, District health officer</td>
<td>Cost of water quality test is 100US$ per sample. For any other tests cost determined at demolition.</td>
</tr>
<tr>
<td>Decommissioning of the irrigation project</td>
<td>Loss of livelihood</td>
<td>• It is anticipated that farmers would have gained a lot from project trainings and development, to enable them sustain themselves even without the project support. • Farmers would have organized themselves into Cooperatives dealing in commercial agriculture. • They would have been introduced to saving at an early stage hence reaching out to their savings accounts to invest in other income earning businesses. • Off-farm income earning activities would have been adopted by project beneficiaries such that loss of irrigation scheme would not have a huge impact on their livelihood, for example; Making of Rwandan traditional basket “Agaseke” on a large scale by women as an off-farm activity done after returning from the rice paddies, could be turned to as an alternative income earner.</td>
<td>MINAGRI, Existing Cooperatives.</td>
<td>Cost can only be determined at the time of demolition.</td>
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CHAPTER 8: ENVIRONMENTAL MONITORING PLAN

Monitoring refers to the systematic collection of data through a series of repetitive measurements over a long period of time to provide information on characteristics and functioning of environmental and social variables in specific areas over time. In this chapter a monitoring plan is proposed and is provided in Table 8.1 below.

Table 8.1: Environmental and Social Monitoring Plan

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Parameter(s)</th>
<th>Indicator</th>
<th>Method</th>
<th>Frequency of measurement</th>
<th>Responsibility</th>
<th>Cost estimates (US$)</th>
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</thead>
<tbody>
<tr>
<td>Destruction of water points/boreholes</td>
<td>Water scarcity</td>
<td>High yield water extraction points/boreholes</td>
<td>Review of technical Design reports indicating identified high yield water extraction points for development for inclusion in contractor’s bid</td>
<td>Before approval of the final technical report and at the time of tender document advertisement</td>
<td>RSSP III Project, Kayonza District, Murundi sector, MINIRENA, REMA</td>
<td>42000 US$/ water point based on preliminary study of LISP development of water points in Ryamanyoni cell</td>
</tr>
<tr>
<td>Oil spillage resulting in soil and water contamination</td>
<td>Soil and water quality</td>
<td>Lead (Pb) levels, oil content</td>
<td>Soil and water quality tests at river shores and fuel refuelling positions</td>
<td>Every six months</td>
<td>Contractors, RSSP III, Kayonza district, Murundi sector, REMA</td>
<td>Inclusive in the contractor's sum</td>
</tr>
<tr>
<td>Impacts</td>
<td>Parameter(s)</td>
<td>Indicator</td>
<td>Method</td>
<td>Frequency of measurement</td>
<td>Responsibility</td>
<td>Cost estimates (US$)</td>
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<tr>
<td>Dangerous borrow pits</td>
<td>• Safety</td>
<td>• Accidents</td>
<td>• Review of accidents reports on site</td>
<td>• Every fortnight (2 weeks) of the construction contract period.</td>
<td>• Contractor</td>
<td>Inclusive in the contractor’s sum</td>
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<td>RSSP III.</td>
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<td>MINISANTE.</td>
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<td>REMA</td>
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<tr>
<td>Occupational health hazards during construction</td>
<td>• Safety and human health</td>
<td>• Accidents, increment in related diseases. (i.e. communal diseases, HIV/AIDS) and deaths</td>
<td>• Review of accident records, health records on site and nearby health centres.</td>
<td>• Continuously during construction period</td>
<td>• Contractor</td>
<td>Inclusive in the contractor’s sum</td>
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<td>RSSP III.</td>
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<td>Murundi Sector</td>
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<td>MINISANTE.</td>
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<td>REMA</td>
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</tr>
<tr>
<td>Air and noise pollution</td>
<td>• Sound levels</td>
<td>• Sound/Noise levels in decibels.</td>
<td>• Application of noise monitoring systems.</td>
<td>• At the time of works that emit a lot of noise or vibrations, for example; like; earth works or concrete vibrations.</td>
<td>• Contractor</td>
<td>Measurement of Noise levels covered in the contractor’s sum.</td>
</tr>
<tr>
<td></td>
<td>• Air quality</td>
<td>• Greenhouse gas content (CO₂, CO, CH₄) and dust particles in the air.</td>
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<td>RSSP III.</td>
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<td>Murundi sector</td>
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<td>Kayonza District</td>
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<td></td>
<td>REMA</td>
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<td></td>
<td></td>
<td>MINISANTE.</td>
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</tr>
<tr>
<td>Impacts</td>
<td>Parameters</td>
<td>Indicator</td>
<td>Method</td>
<td>Frequency of measurement</td>
<td>Responsibility</td>
<td>Cost estimates (US$)</td>
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</tbody>
</table>
| Soil erosion                    | • soil cover loss | • Qualitative observation of rills and gullies | • Use of erosion pins or pipes to determine eroded soil depth.  
• Sediment levels in runoff  
• Quantity of soil loss/ha | Every 6months. | • Contractor  
• RSSP III  
• MINAGRI  
• Kayonza District  
• Murundi sector. | Inclusive in the contractor's sum |
| Fire outbreaks                  | • Fires    | • Incidences                              | • Review of incidences report that involved fires         | Continuously.            | • Contractor  
• RSSP III.  
• Murundi sector.  
• Kayonza district.  
• National Police. | Part of the contractor's cost |
| Impact on local infrastructure  | • Infrastructure destruction | • Incidences                              | • Review of records of incidences involving destruction of local infrastructure | Continuously through the construction phase. | • Contractor  
• RSSP III.  
• Kayonza district.  
• Murundi sector. | Part of the contractor's cost |
| Population migration            | • Sector/Local population | • Local Population counts (males, females, youth, children, elderly) | • Baseline and periodic Household census | Once every 4 years. | • Kayonza district.  
• Murundi sector.  
• NISR | Part of the contractor's sum for site installation might cater for workers accommodation. |
<table>
<thead>
<tr>
<th>Impacts</th>
<th>Parameter(s)</th>
<th>Indicator</th>
<th>Method</th>
<th>Frequency of measurement</th>
<th>Responsibility</th>
<th>Cost estimates (US$)</th>
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</thead>
<tbody>
<tr>
<td>Resource use conflict</td>
<td>• Security</td>
<td>• Cases of conflict</td>
<td>• Review of conflict case reports</td>
<td>• Continuously through the construction phase</td>
<td>• Contractor</td>
<td>Part of contractor’s cost</td>
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<td>• Murundi sector</td>
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<td>Modification of flows for downstream usage</td>
<td>• Water quantity</td>
<td>• Flow rate, Q (m³/s)</td>
<td>• Establishment of weirs for flow measurement at specific points of the river.</td>
<td>• By the seasons</td>
<td>• MINAGRI</td>
<td>Regular monitoring of flow patterns is part of the irrigation infrastructure technician’s job requirements.</td>
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<td>• RSSP III</td>
<td>250US$/ flow analysis and interpretation.</td>
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<td>• MINIRENA</td>
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<td>• REMA</td>
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<td></td>
<td>• ISAE or RAB</td>
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<td>Resistance to change of livelihood</td>
<td>• Security</td>
<td>• Cases of Incidences of resistance</td>
<td>• Review of Incidence reports</td>
<td>• Continuously through the construction phase</td>
<td>• RSSP III</td>
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<td>No cost applicable.</td>
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<td>Impacts</td>
<td>Parameter(s)</td>
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<td>Loss of soil fertility from monoculture and use of inorganic fertilizers</td>
<td>Soil fertility</td>
<td>Tests for soil pH and for plant nutrients in 3 categories:</td>
<td>Soil samples for qualitative tests</td>
<td>Twice a year</td>
<td>RSSP III, MINAGRI, MINIRENA, REMA, Kayonza District, Murundi sector.</td>
<td>Cost of soil tests for each period of examination could be in the range of 600 to 800US$.</td>
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<td></td>
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<td>• Major nutrients: nitrogen (N), phosphorus (P), and potassium (K)</td>
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<td>• Secondary nutrients: sulphur, calcium, magnesium</td>
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<td></td>
<td></td>
<td>• Minor nutrients: iron, manganese, copper, zinc, boron, molybdenum, aluminium</td>
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<td>Impacts</td>
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| Poor pesticide and agrochemical fertilizer management | • Water quality.  
  • Soil quality.  
  • Nutrient load in water recipients from non-point sources (NO₃⁻, PO₄³⁻, K).  
  • NPK levels in the soils | • Nutrient load in water recipients from non-point sources (NO₃⁻, PO₄³⁻, K).  
  • NPK levels in the soils | • Samples of water and soil quality tests. | • Twice a year. | • RSSP III  
  • MINAGRI  
  • MINIRENA  
  • REMA  
  • Kayonza District  
  • Murundi sector | Pest control estimates may be obtained from the RSSP III budget allocation. Tests could cost up to 150US$ per sample. |
| Water pollution               | • Water quality  
  • Nutrient load in water recipients from non-point sources (NO₃⁻, PO₄³⁻, K). | • Nutrient load in water recipients from non-point sources (NO₃⁻, PO₄³⁻, K). | • Samples of water and soil quality tests. | • Twice a year. | • RSSP III  
  • MINAGRI  
  • MINIRENA  
  • REMA  
  • Kayonza District  
  • Murundi sector | Cost of water quality tests shall be determined at the time of the MOU with the ISAE or RAB but might not exceed 150US$ for a complete quality test. |
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<tr>
<th>Impacts</th>
<th>Parameters</th>
<th>Indicator</th>
<th>Method</th>
<th>Frequency of measurement</th>
<th>Responsibility</th>
<th>Cost estimates (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water conflicts from the creation of the Irrigation scheme</td>
<td>• Security</td>
<td>• Incidences of conflicts</td>
<td>• Review of Incidences/conflict reports</td>
<td>• Continuously through project life.</td>
<td>• RSSP III</td>
<td>No cost application</td>
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<td>• Kayonza District</td>
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<td>• Murundi sector</td>
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<tr>
<td>Vandalism of Irrigation infrastructure</td>
<td>• Security</td>
<td>• Incidences of vandalism</td>
<td>• Review of vandalism reports</td>
<td>• Continuously through project life.</td>
<td>• RSSP III</td>
<td>No cost application</td>
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<td>• Formed Gacaca marshland Cooperative and WUAs</td>
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<td></td>
<td>• Murundi sector</td>
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<tr>
<td>Floods from reservoir overflow or dam collapse</td>
<td>• Flooded area</td>
<td>• Cracks or fissures on the dyke. • Incidences of floods</td>
<td>• Inspection of dyke for fissures/cracks. • Review of flood incidence reports.</td>
<td>• Continuously through project life.</td>
<td>• RSSP III</td>
<td>Part of designs with Bills of Quantities considered for the contractor's sum.</td>
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<td>• Contractor</td>
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<td>• Works Supervising firm.</td>
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<td>• MINAGRI</td>
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<td>• MININFRA</td>
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<td>• Kayonza District.</td>
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<td>• Murundi sector</td>
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<td>Impacts</td>
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<td>Frequency of measurement</td>
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<td>Cost estimates (US$)</td>
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</table>
| Increased spread of water related diseases (such as; Bilharzia, malaria, dysentery, diarrhoea, etc.) | • Prevalence of diseases | • Increased patient numbers with water related diseases relative to the baseline records done at start of project. | • Review of health records | • Baseline done at project commencement.  
• Every 6 months during project implementation/operation stage | • RSSP III  
• MINISANTE  
• Ryamanyoni health centre.  
• Kayonza District.  
• Murundi sector | Cost depends on the magnitude of the impact. |
| Canal Siltation | • Canal blockage  
Canal embankment collapse | • Incidences of canal embankment collapse incidence records | • Continuously | • RSSP III  
• Formed Cooperative and WUA.  
• Murundi sector. | Cost under RSSPIII Sub-component 1.2 budget. |
<table>
<thead>
<tr>
<th>Impacts</th>
<th>Parameters</th>
<th>Indicator</th>
<th>Method</th>
<th>Frequency of measurement</th>
<th>Responsibility</th>
<th>Cost estimates (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water logging and salinization</td>
<td>Soil quality</td>
<td>• waterlogged soil</td>
<td>• Visual soil salinity symptoms identification.</td>
<td>Every six months</td>
<td>RSSP III, MINAGRI, Kayonza district, Murundi sector, Cooperative, Formed WUA.</td>
<td>Cost for soil salinity test is not more than 150US$ per sample. Cost for training farmers from RSSP III sub-component 2.1 budget.</td>
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<td></td>
<td></td>
<td>• black greasy patches on the soil surface</td>
<td>• Soil salinity tests.</td>
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<td></td>
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<td>• salt crystals</td>
<td>• Soil conductivity in dS/m</td>
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<td>• Bare patches of soil</td>
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<td>• Alkalinity of the soil</td>
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<td>• Na(^+), Cl(^-) content of soil</td>
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<td>Visual soil salinity symptoms identification.</td>
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<td>Soil salinity tests</td>
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<td>Soil conductivity in dS/m</td>
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<tr>
<td>High sedimentation levels in the Reservoir</td>
<td>Reservoir dead load</td>
<td>Water turbidity</td>
<td>Water turbidity tests</td>
<td>Every 6 months</td>
<td>RSSP III, MINAGRI, REMA</td>
<td>Cost under RSSP III sub-component 1.2 budget.</td>
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<td></td>
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<td>Sediment levels in runoff</td>
<td>Sieve analysis for collected runoff.</td>
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<td>Reservoir bed depth measurements (m)</td>
<td>Periodic measurement of reservoir bed depth</td>
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<td>Cost estimates (US$)</td>
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<tr>
<td>Encroachment of water sources</td>
<td>Safety</td>
<td>Incidences of locals or livestock encroaching water sources.</td>
<td>Review of water source encroachment incidences reports.</td>
<td>Continuously through project life.</td>
<td>RSSP III, Murundi sector, Formed Cooperative.</td>
<td>Cost under RSSPIII sub-component 1.2 budget.</td>
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<tr>
<td>Wastage of water</td>
<td></td>
<td>Flow rate, Q (m³/s)</td>
<td>Small weirs along secondary canals for stream gauging/ flow rate measurement</td>
<td>Seasonally</td>
<td>WUAs, Rice Cooperative, RSSP III, MINIRENA, MINAGRI, REMA, Kayonza District</td>
<td>Cost under Sub-component 2.1.</td>
</tr>
<tr>
<td>Drowning of children and livestock</td>
<td></td>
<td>Cases of Incidences, accidents or deaths at the reservoir</td>
<td>Review of incidences, accidents or deaths reports</td>
<td>Continuously through project life</td>
<td>Kayonza district, Murundi sector, Established Rice cooperative, RSSP III, MINISANTE</td>
<td>Cost under Sub-component 2.1.</td>
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<td>Impacts</td>
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<tr>
<td>Invasive aquatic weeds</td>
<td>• Aquatic weed coverage</td>
<td>• Area of reservoir covered in weeds.</td>
<td>• Use of boats to determine area coverage and to manually uproot the weeds.</td>
<td>Quarterly in a year</td>
<td>• MINAGRI</td>
<td>Cost under Sub-component 2.1.</td>
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<td>• Volumes (m³) or quantities of aquatic weeds collected.</td>
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<td>• MINIRENA</td>
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<td>• REMA</td>
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<td>• Established Rice cooperative.</td>
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<td>• RSSP III.</td>
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<td>• Established Rice cooperative.</td>
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<td></td>
<td>• MINAGRI</td>
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<tr>
<td>Emergence of pests and crop diseases</td>
<td>• Prevalence of pests and crop diseases</td>
<td>• Increased cases of pests attack and crop diseases</td>
<td>• Review of reports on pests attack and crop diseases</td>
<td>Continuously through project life</td>
<td>• Established Rice cooperative.</td>
<td>Cost under Sub-component 2.1.</td>
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<td>• RSSP III.</td>
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<td>• MINAGRI</td>
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<td>Responsibility</td>
<td>Cost estimates (US$)</td>
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<tr>
<td>Loss of livelihood</td>
<td>• Income increment</td>
<td>• Household income per annum</td>
<td>• Baseline, mid-term review and project completion studies of its impact on the locals</td>
<td>• Project commencement, mid-term of the project and at the end of the project</td>
<td>• RSSP</td>
<td>Cost can only be determined at the time of demolition.</td>
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</tbody>
</table>

- Loss of livelihood
  - • Income increment
  - • Household income per annum
  - • Baseline, mid-term review and project completion studies of its impact on the locals
  - • Project commencement, mid-term of the project and at the end of the project
  - • RSSP
  - • MINAGRI
  - • Existing Cooperatives.
  - • Kayonza district.

Cost can only be determined at the time of demolition.
CHAPTER 9: PRELIMINARY DECOMMISSIONING PLAN

Decommissioning of the proposed RSSP III irrigation project will become necessary when the project completes its life cycle or when there is change of use. In a situation where the Dam (Dyke and reservoir), delivery canals, spillways, sluice gates and small civil engineering infrastructure complete their lifecycle, decommissioning process will typically involve dismantling of the equipment, demolition of dyke and reservoir, clearing of the site and reclaiming or restoring the affected land into a natural condition. It is assumed that the Community WUA or cooperatives at the time shall be able to fund and implement all aspects of the project decommissioning, including but not limited to all engineering, environmental assessment, permitting construction and mitigation activities associated with the removal of the infrastructure in accordance with this plan and mitigation of the project removal impacts on site. The community WUA or Cooperative, along with District authorities at the time shall monitor environmental impacts during and after project removal to respond to defined events during the monitoring phase.

9.1. CHANGE OF USE SITUATION

In situations where there is a change of use, the decommissioning process may entail demolition of existing facilities (i.e. the dam and irrigation infrastructure). Upon completion of the demolition, the affected land will need to be reclaimed or restored into a natural condition through landscaping and planting of vegetation.

9.2. END OF LIFE SITUATION

In a situation where the project infrastructure have completed their useful life, decommissioning process will entail demolition of the erected and dismantling of the structures including; the dyke, reservoir, intakes, delivery canals and any other small irrigation infrastructure installed. Site clearing and reclaiming or restoring the affected land into a natural condition will then follow.

Restoration of the affected land may involve; the filling in of any open pits and grading the land to its natural contours, then planting appropriate tree species and cover vegetation to hold the soil in place and to prevent flooding. Planting of trees however, may not be necessary if the site is immediately taken over for another development.

The debris resulting from the demolition will either be transported by licensed waste transporters for dumping at an approved dump site or used as base material for new construction work. The demolition process will entail removal of materials using crowbars and hammers, breaking of walling and reinforced slabs using sledge hammers and/or jack hammers, which utilize compressed air and lowering of materials from high to low levels.

The exercise will therefore entail working at high levels and all the necessary health and safety measures will need to be implemented including provision of personal protective
equipment such as; safety harnesses, helmets, gloves, nose masks, safety shoes, overall, goggles and ear protectors.

Project decommissioning has five phases: (1) pre-removal monitoring; (2) permitting; (3) interim protective measures; (4) project removal and associated protective actions; and (5) post-removal activities, including monitoring of environmental and social economic activities.

The first phase will occur prior to removal of the project (i.e. within the first six months). The fourth phase – project removal and associated protective actions – will take place twelve months after closing business. The fifth phase will begin after total removal and due to nature of the project (medium scale, with relatively moderate impacts) removal and continue for at least one year. The description that follows outlines the activities that will occur in each phase:

- **Pre-removal Monitoring:** Pre-removal monitoring includes environmental and socio economic status of the project and the surrounding. This monitoring is essential to identify if there is any environmental or social liability which need to be settled before the permit for closure is given. This period will also be used to keep inventories of all assets and facilities that need to be disposed of and to prepare a final decommissioning plan for approval by REMA.

- **Permitting:** RSSP III project (if still in existence) or the Cooperative shall obtain all permits required to undertake removal of the project. This basically will include REMA, RRA, Kayonza District, MINIRENA, MININFRA, MINICOM, etc.

- **Interim protective Actions:** This will take care of any interim protective measure that needs to be implemented to protect human health and environment, if any.

- **Project Removal:** As noted above, the removal of the project will be completed within twelve months.

- **Post-Removal Activities:** Post-project removal monitoring will continue for one year.
CHAPTER 10: CONCLUSIONS AND RECOMMENDATIONS

10.1. CONCLUSIONS

The Scoping Exercise has identified a number of issues pertaining to the proposed Gacaca marshland irrigation project at Murundi sector, Kayonza district. The issues/impacts have been assessed and described in some detail to gain an adequate understanding of possible environmental effects of the proposed project – from design to decommissioning, in order to formulate mitigation measures in response to negative aspects which have emerged. The Environmental Management Plan (EMP) provides a way forward for implementation of the identified mitigation measures. The EMP should be implemented as a prerequisite for a positive Record of Decision (RoD) by the appropriate authorities.

The estimated costs of implementing the mitigation measures are just indicative. Appropriate bills of quantities should clearly give the actual figures. In any case the consultant has used informed judgement to come up with these figures.

The Environmental Monitoring Plan provides parameters to be monitored and responsibility. While the consultant is aware that each monitoring aspect need to have a separate budget line, for small projects which are remotely located this does not make economic sense. The consultant is recommending that the Project Proponent (RSSPIII) assigns the Environmental officer to undertake the monitoring of the mitigation measures for the project through its existence. This is the way the proponent will achieve sustainable project implementation at reduced cost for undertaking the monitoring. The figures given are considered to be absolute maximum such monitoring could cost. However, regular internal monitoring shall be carried out by the project proponent.

Given the nature and location of the development, the conclusion is that the potential impacts associated with the proposed development are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures.

10.2. RECOMMENDATIONS

It is recommended that, based on the findings of the scoping, EIA exercise and supplementary information that:

1. Water abstraction quantities require monitoring through periodic water level measures to avoid water resource depletion. This may be done under the supervision of the developer and the relevant authorities (MINIRENA/RNRA) in terms of delivery/demand and quality.

2. Integrated Pest Management (IPM) should be prepared for guidance in pesticide application; Resettlement Action Plan (RAP) should also be prepared for guidance in compensation of those voluntarily or involuntarily displaced.
3. Periodic soil tests to measure nutrient levels, acidity levels and relevant soil characteristics to determine the trend of soil fertility is necessary to guide on the effects of fertilizer application and monoculture cropping.

4. Baseline and progressive water quality tests of the reservoir and the receiving primary emissaries (rivers) are necessary to determine mitigation measures for likely non-point source water pollution.

5. Establishment of a rice cooperative and Water User’s Association (WUA) for the Gacaca marshland development. These will ensure well-defined management of plot distribution, irrigation water distribution, marshland infrastructure maintenance, organised collective harvest and economic development of rice farmers.

6. Capacity building framework for project beneficiaries is recommended in a number of sectors such as; rice growing, irrigation techniques, marshland infrastructure maintenance and management, water distribution, land husbandry, regulated fertilizer and pesticide application, importance of collect harvesting, importance of cooperatives and WUAs, importance of owning accounts, among others.

7. A baseline socio-economic survey is recommended to determine the current status of the area, which will eventually be the basis of evaluating the rice scheme project influence on the livelihood in this area.

8. A marshland development and catchment management plan is necessary to ensure sustainable management by locals of the resources in the marshland and its surrounding hillsides.

9. Agrochemical pollution control can be achieved through application of required amounts of fertilizers under the supervision of trained agronomists. Furthermore, organic fertilizers can be applied along with agrochemicals with the option of eventually phasing out agrochemicals and only using organic manure.

10. Water related diseases can be avoided by planting *Phytolaca decandra* which will destroy the Bilharzia snails that serve as hosts of *shistosomiasis* along the shores of the lakes and river. Introduction of fish, in the reservoir that feed on mosquito larvae thereby reducing on their breeding. Provision of mosquito nets, sensitization on the importance of sleeping under a mosquito net and encouraging locals on proper hygiene will reduce on the likelihood of contracting water related diseases.

11. Land husbandry techniques along the slopes surrounding the marshland are necessary. A green belt buffer zone of at least 50m along the reservoir and 2m buffer zone from the river is recommended to prevent encroachment of these water sources, act as filters to possible pollution and restrict children and livestock from drowning.

12. Periodic manual removal of aquatic weeds from the reservoir to avoid the possibility of an uncontrollable invasion of the reservoir by weeds rendering it non-navigable and incapable of providing sufficient quantities to effective irrigate the command area.

Based on the study, the Consultant is of the opinion that most of the potential environmental impacts identified can be mitigated. The proposed environmental management plan and environmental monitoring plan if implemented will safeguard the integrity of the environment.
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APPENDICES

APPENDIX 1: ISSUES REPORTS

COMPONENT: RSSP III Gacaca Marshland development
PROVINCE: EAST
DISTRICT: KAYONZA

Issues Report for Gacaca marshland, Murundi Sector (Kayonza district) site

<table>
<thead>
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<td>Project title: Gacaca marshland development project.</td>
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Venue: Kayonza district, Murundi sector (Ryamanyoni and Karambi sector)
Date: 19th-30th April 2012

Public consultation/ Field observations:

Murundi sector consultation

Administrative organization of the area:

Murundi sector- comprises of 4 cells, 43 villages, about 31,000 people, 6231 households.
Scope 2 cells- Ryamanyoni and Karambi. Area is accessed through earth work feeder road about 15km off the paved road from Kayonza town center at junction leading to Rukara sector.

Three quarters (¾) of the sector was previously a portion of the Akagera National park but was later settled by the returning 1959 Rwandan refugees. It is a sector that covers an area of 550km².
2 of 4 cells have offices, all 43 villages have offices.
**Hierarchy of Administrative planning structure of the sector:**

- **Sector “Called Umurenge”**
- **Cells “Called Akagari”**
- **Village “Called Umudugudu”**
  - Priorities synthesis
  - Problems identified
  - Micro-project elaboration
- **JADF Sector Council**
  - Kigali locals under Murundi Development Committee. *(This is the level where decisions are taken)*
- **Cell council**
- **Local population**

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**Rural communal settlement “Umudugudu”**

Government policy of all locals living in communal settlements “Umudugudu” has not been completely embraced in this area, for the following reasons; (i) the livestock farms that permit locals to live on their farms and not in these communal settlements; (ii) sparse population in the area, plus being an area that was once a national park and was recently settled, makes it difficult to have these settlements.

By April 2012, 3776 households (60.6% of the sector) are settled in communal settlements “Umudugudu”. 1334 grass thatched houses were replaced by iron sheet roofed houses under the government campaign of eradicating grass thatched houses “Nyakatsi”.

**Sector priorities as per the “Imihigo” for 2011-2012:**

The sector priorities for this year are; Rural communal settlement “Umudugudu”, Infrastructure and land use management, Crop Intensification Programme, Forest planting, Water supply and sanitation, improved education for all through increased number of schools and teachers, improved access to health care and services, improve access to energy, improved road network, promotion of cooperatives (up to now, locals are attracted to forming cooperatives by issuing them land, it has not been their initiative to form cooperatives based on an understanding of the benefit of coops.), environmental protection, tourism development with quick access to Akagera national park, improved access to quality justice, mobilization for Government policies such as; eradication of grass thatched houses “Nyakatsi”, importance of land consolidation for increase in agricultural production, justice rendered by local councils at the grass roots “Abunzi”, and administrative infrastructure.

**Resources of the sector:**

Mainly agriculture, other resources are; minerals such as wolfram, clay for brick making, nearest access to the Akagera national park, marshlands for agricultural purposes and a young population.

**Issues at hand:**

- No forest in the area since it was previously a savannah national park.

**Awareness of the project:**

Yes, they do but it’s the elite stakeholders that invested in livestock farms that know about the rice project.
Land ownership:
Land registration has been done, only preliminary registration is complete, with the expectation by May the preliminary list of land ownership will be out and July the final list will be out. This is only for any land except the marshland/wetland.

Issues at hand-
- With livestock farmers on the hillsides owning land titles, local farmers growing maize, banana and soya under the land consolidation under cooperatives and cooperatives formed for brick making in the marshes, it will be difficult convincing them to turn to rice production. In fact, such negativity was observed at the time of preliminary technical study carried out by SHER.
- Worry by locals of their land transformed without valuable compensation.
- Worry that works could start before harvest and warning, implying that their crops would be cleared in preparing the site and hence losses to the farmer.

Mitigation measures proposed-
- Need for intense sensitization of the locals on the profitability of rice production as opposed to their current crops.
- Need to establish a means of compensation and assure the locals affected that they will be compensated.
- Farmers currently cultivating the marshes may be compensated by the plots once the rehabilitation is completed.
- An MOU between RSSPIII and Murundi sector, on how the transition of the marshland will follow is essential. It may comprise of; the means of compensation, how plots will be issued once rehabilitation is complete, how the marshland will be managed, how to organize farmers into cooperatives and how the produce, marshland will be maintained, among others. One should remember that this is a Government of the people and before profitability is reached, first the locals’ interest need to be covered.
- A resettlement action plan, covering the value of land and plantations affected for compensation, is required.

Agricultural activities:
Staple food- maize floor.
Crops commonly grown- Banana, cassava, maize and the newly introduced apple banana.
Currently, land consolidated in marshland last year was up to 2,000ha for maize production.
Livestock farming is of exotic Friesian cattle in paddocks of 15-25ha and local cattle breed. All for milk supply.

Currently cost of crops is at; Maize- 150-160Rwf/ kg, beans at 300Rwf/Kg and sorghum- 160-170Rwf/kg.

Cooperatives
The type of cooperatives existing deal mainly in three domains; Agricultural crop production, Livestock farming and off-farm basket making “traditionally called Agaseke”

Number of Cooperatives with legal status are 5, including the SACCO and diary center of MUFCOS. Female representation in cooperatives and in local authorities is above 30% and close to 40%. It was brought to our knowledge that cooperatives headed by women are more stable than those lead by men.

Local preference:
Rice was not previously grown except downstream of the marshland, in Karambi cell, out of influence from the neighbouring Ntende- Rwagitima marshland.
For rice to pick up there is a crucial need for sensitization of the public on the profitability of rice versus the other crops like; maize, banana, cassava; and cattle keeping.

Possibility of existing technical support from the sector:
The sector has an agronomist and veterinary doctor who support local farmers in crop production, cattle keeping and land consolidation.

Issues at hand-
- Animals from the Akagera Park nearby still attack locals and destroy their plantations. e.g. buffaloes.
- From a look at the rice paddies at Ntende marsh at the limit downstream of the marshland, the rice paddies are attacked by birds hence low production.
- Unexpected dry spells possibly a result of the climate change.
- Poor mindset of the local farmers on storage of agricultural produce, where farmers cannot store produce for a time when it is required for the market and a time it fetches a profitable price. This is common in this area where, farmers are paid off per plantation before harvest by middlemen at very low prices as compared to the acceptable prices.
- No access to market- From experience of land consolidation for maize production, the locals have realized that MINAGRI and MINICOM have not delivered on their side by constructing markets for this produce or rehabilitating feeder roads for access to outer markets. The fear here is that this may occur for rice production.
- MINICOM has not enacted laws of penalty to the middlemen “locally known as abamami” that rob locals of their produce by paying them low prices or cheating them by under weighing their produce. This happens because the locals are not in organized in well-established and legal cooperatives to bargain and sell their produce in bulk as opposed to each individual manipulated by the middlemen.

Issues at hand for forming cooperatives by locals-
- Inadequate awareness by the locals of the benefits of doing agricultural or off-farm activities as cooperatives.
- Previous incidences of manipulation of locals under cooperatives by the educated, causing them a negative impression of cooperatives.
- Lack of qualified personnel to support cooperatives in their organization, management and accountability. e.g. no accountants for book keeping, no qualified administrator or manager, no agronomist or veterinary assistant paid by the cooperative to technically assist in their production.

Economic environment of the sector:

Agricultural production
- Under the Crop Intensification Programme (CIP), land consolidated in 2010 was 3693ha and 5002ha in 2011 entirely for crop production, maize covering the largest area.
- Small livestock farmers have been organized to have a kraal “locally called Gikumba” of atleast 8 cows to avoid overgrazing and encourage farm best zero grazing.
- One cow per family program has been implemented, with so far 128 cows given to families.
- For the richer livestock farmers, Friesian cows and exotic goats of Boer type are reared on farms a large as 15-25ha.
- Murundi sector farmers were able to mobilize 63Million Rwf to purchase tractors for modern farming.

Savings tendencies of the area
There is only one Umurenge SACCO “Local bank” for the sector with 2 mini-branches at Karambi cell and the main branch at Murundi Sector offices at Buhabwa cell. The reason for opening a branch at Karambi cell
was that the sector branch was far for the locals from Karambi, with the cost of transport by motorbike at 2000Rwf. This turned out costly hence the Karambi branch.

Issues at hand-
- Building Umurenge SACCO was difficult because of low membership count due to lack of interest or inadequate awareness of its importance by the locals.

Poverty reduction projects in the area
No Vision Umurenge Program (VUP) or Ubudehe programs for poverty eradication currently operating in the area.

Human capital
The area is settled by mostly a young population migrating from other parts of the country. This is apparently an energetic work force capable of participating in the construction and implementation of this irrigation project. Other unskilled labour, there is evidence of skilled masonry workers in this area hence availability of the workforce required for during construction and at the time of maintenance works for the irrigation infrastructure.

Education and health services in the area:
Health center- 1 called Ryamanyoni health center in Karambi cell and 1 dispensary/ “poste de santé” at Buhabwa cell next to the Murundi sector office.
The closest hospital is in Gahini about 30km away.

Education- 6 Primary schools, 2 9 Year Basic Education (9YBEs) completed in 2009. No secondary school existed before that.

Issues at hand-
- School drop outs due to the long distances travelled to the only schools in the area. One may wonder how far a child joining secondary school has to travel, the nearest probably more than 15km, Rukara sector.

Water supply in the sector:
Kayonza district has to 2 water projects under implementation currently; (i) Water supply to Ryamanyoni and Karambi, (ii) From Gahini to Nyabombe and to Buhabwa where the Murundi sector office is located. These projects have not yet been completed and very likely serve those along and on top of hills and probably not those close to the marshlands.

Issues at hand-
- Lack of piped potable water in the area.

Electricity:
The area has been recently connected to the national grid. By November, 982 Households were connected to electricity and 4 households had biogas connection as an energy source.

Infrastructure:
The area is accessible through feeder roads constructed under the financing of an IFAD project called PDRCIU. The roads are earth roads, in some cases finished with compacted laterite and in some areas just compacted earth. Now currently being affected by the rains.

Cultural heritage:
Locals still bury in their home compound, however, the areas of project intervention may not have any cemeteries. Communal cemeteries have not yet been adopted but this is one of the issues in the pipeline by the Sector management. The project intervention areas have no archaeological sites, especially since it’s mainly marshland, previously a portion of the national park.

**Natural resources conservation:**
By end of 2011, terraces were covering an area of 98ha, number of trees planted were 50,000.

**Problems faced by locals:**
- Attacks from National park animals on people and their crops; such as, most commonly are buffalo attacks.
- Poor infrastructure of the roads, the health centres, schools and the district offices.
- Only one health center and dispensary “Poste de santé” to serve the entire sector of 550km².

**Ryamanyoni cell consultation**

**Administrative organization of the area:**
Population in this cell is about 10,105 people with 2,131 households. We were informed that the area has no indigenous people since it was previously part of the Akagera National Park and was only recently occupied when the park was moved further to accommodate the returning refugees of 1959. This area was hence occupied by people from out of the country and those from different provinces of the country.

**Awareness of the project:**
Only one meeting with the local people was done by SHER, the technical study consultants, informing them of the likelihood of an irrigation rice production project. The local authorities, for example Ryamanyoni cell leader is not adequately informed of the project, later on the locals. It appears that RSSPIII has not given adequate sensitization of the project activities to the locals.

**Issues at hand-**
- Crop farmers fear for the outcome of their land, banana plantations and other crops, later on the livestock farmers, once the project encroaches on their land. There is negativity towards the project and rice production, probably due to lack of sensitization on its profitability, which much result in a lack of project ownership by the locals should it not be addressed.
- Rice is a new crop in Ryamanyoni cell and hence might meet a lot of resistance to switch from the commonly grown, banana, maize, cassava, to rice as means of poverty reduction, should a lot of sensitization not be done.
- Worries of compensation still arise from local farmers and whether those in marshland will be accorded portions of land for cultivation once the marshland rehabilitation works are completed.

**Mitigation measures proposed-**
- Intense and continuous sensitization is required of the composition of the project, importance of irrigation, profitability of the rice production against other crops.
- Sensitization on the project should start with the local authorities and then the locals. This hierarchy of passing on information is important since locals listen more to their authorities than foreign people and since most questions from the locals would be already addressed once local authorities are met.
Land ownership:
Preliminary land registration has been completed.

Agricultural activities:

Cooperatives
Only 2 have legal status; Duterimbere-Rwinyambo for maize production, Abateganye - a female cooperative making baskets “traditionally called Agaseke”.
The other cooperatives that have not yet obtained legal status involved in agriculture and livestock farming.

Issues at hand-
- Inadequate financial capabilities to run the cooperative efficiently.
- Poor managerial skills and qualification of the cooperatives.
- Lack of capacity building trainings or study tours to improve local farmers’ awareness on farming.
- No markets to sell their produce, which discourages increased production lest the products rot hence encouraging subsistence farming.
- No market with in the cell later on the sector where farmers can sell their products.

Local preference/Appreciation:
- It is apparent the regions that grow rice have benefitted economically from it; however sensitization of its profitability is essential for such a project to succeed.
- Any Jobs opportunities for the locals during the construction and implementation of the project?
- Questions were raised whether the project had consulted the locals on rice being the most appropriate for this area. It was the peoples’ opinion that maize was better than rice for reasons that; Rice required a lot of effort to cultivate; it takes a long time to reach harvest time. It appeared that locals were not consulted.
- There were worries of what homes would depend on, from when the construction works begun to the first rice harvest since the land for cultivation would not be ready and rice takes at least an extra 6 months for harvest.
- To what extent does the project stand to profit female, youth, local authorities, cooperatives and associations in the area. Can this be addressed in the technical study?

Possibility of existing technical support from the sector:
- Agronomist and veterinary from Murundi sector.

Economic environment of the sector:

Agricultural production
- Mainly Maize, Cassava and bananas. Staple food is cassava.

Savings tendencies of the area
- SACCO with 2 branches, capable of providing loans to farmers and with fast services.

Poverty reduction projects in the area
- Girinka and Ubudehe projects currently available, however, no VUP or any other poverty
eradication projects available.

- Currently contributions to poverty alleviation are; 87 homes with iron sheet roofing were built for the poorest “locally called Abatishoboye” and goats given to them as startup capital towards poverty eradication, plans to build 7 homes for genocide survivors with materials already delivered.

Issues at hand-

- The project is required to involve poverty eradication sub-projects with in its plans to support the poorest “Abatishoboye” and vulnerable. e.g. genocide survivors, child headed homes, disables and HIV affected families.

**Education and health services in the area:**

- About 9,000 people of the local population has health insurance “Mituelle”. The only health center is at Karambi cell and is called Ryamanyoni health center from the old administrative boundaries.
- Low cases of Malaria were reported in the area, simply because nearly every family received a mosquito net free under Government campaign to fight malaria. It is, however, required that locals are continuously reminded and sensitized on the importance of sleeping under a mosquito net.
- Common disease is tape worms in children and water borne diseases, possibly due to poor hygiene and poor water quality from the sources its fetched.
- No Malnutrition in the area probably because there is a wide variety of foods grown in the area.
- This cell has 3 primary schools and 1 9YBE.

**Water supply in the sector:**

- Evidence of a likelihood of potable water supply in the area. Also, boreholes and fetching water from river Misararo was observed.

Issues at hand-

- Some water sources like boreholes exist in the zone to be rehabilitated under the project. It is therefore a requirement that alternative water sources are prepared by the project for the locals. A study on the likely water points is necessary as part of the technical study for incorporation in the execution of the project.

**Electricity:**

National grid connection begun in November 2011 and is still going on.

**Karambi cell consultation**

**Awareness of the project:**

- One meeting has so far been held by SHER with locals. Locals are aware but not sufficiently.

**Locals appreciation/ preference:**

- Based on experience from the bordering neighbours at Ntende rice growing marshland, the locals prefer rice. They are aware of the market for rice production, with a rice processing factory recently opened in Gatsibo district close by.
- Locals appreciate this project because this is an area that has always been flooded making it difficult for them to grow any crop in such an area. Rehabilitation of the marshland would mean that it would now be cultivated.

Issues at hand-

- Fear of no compensation for the land and plantations lost to marshland rehabilitation.
• For the cattle keepers who depended on the Napier grass and wells and around the marshlands, what is the project’s plan for them.
## APPENDIX 2: LIST OF PUBLIC CONSULTED

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<tr>
<th>Name of participant</th>
<th>Position</th>
<th>Contacts/ Telephone</th>
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<tr>
<td>Mugabo John</td>
<td>Mayor of Kayonza District</td>
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<tr>
<td>Murekezi Claude</td>
<td>Executive Secretary of Murundi sector</td>
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<tr>
<td>Ingabire Christine</td>
<td>Executive Secretary of Ryamanyoni cell</td>
<td>0783836141</td>
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<tr>
<td>Bituyimana Emmanuel</td>
<td>Executive Secretary Karambi cell</td>
<td>0783729011</td>
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<tr>
<td>Gaspard Niragira</td>
<td>Technical Assistant/ Rural Engineer RSSP III</td>
<td>0788559622</td>
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<tr>
<td>Didace Habamenshi</td>
<td>Environmental officer of RSSP III</td>
<td>0788613065</td>
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<tr>
<td>Chantal Umuhire</td>
<td>Agribusiness officer of RSSP III</td>
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<tr>
<td>Phillipe Ndimirungwe</td>
<td>Community Development Officer for RSSP III in Kayonza District</td>
<td>0788838964</td>
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<td></td>
<td><strong>Ryamanyoni cell</strong></td>
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<td>Musabyimana Vincent</td>
<td>Local resident Rwinyambo village “Umudugudu”</td>
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<td>Kalisa Edouard</td>
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<td>Local resident Rwinyambo village “Umudugudu”</td>
<td>-</td>
</tr>
<tr>
<td>Gasasira Gaspard</td>
<td>Local resident Nyabugando village “Umudugudu”</td>
<td>-</td>
</tr>
<tr>
<td>Ndangurura</td>
<td>Local resident Nyabugando village “Umudugudu”</td>
<td>-</td>
</tr>
<tr>
<td>Name</td>
<td>Age</td>
<td>Residential Location</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Shingiro</td>
<td></td>
<td>Local resident Nyabugando village “Umudugudu”</td>
</tr>
<tr>
<td>Kayitesi</td>
<td></td>
<td>Local resident Nyabugando village “Umudugudu”</td>
</tr>
<tr>
<td>Bucyanayandi</td>
<td></td>
<td>Local resident Rwinyambo village “Umudugudu”</td>
</tr>
<tr>
<td>Uwumuremiy J.C</td>
<td></td>
<td>Local resident Rwinyambo village “Umudugudu”</td>
</tr>
<tr>
<td>Ruziga Damas</td>
<td></td>
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<tr>
<td>Nyiramana Disayana</td>
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<tr>
<td>Bazatoka</td>
<td></td>
<td>Local resident Ubwiza village “Umudugudu”</td>
</tr>
<tr>
<td>Uwiragiye Merebega</td>
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<tr>
<td>Mukankwiro</td>
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</tr>
<tr>
<td><strong>Karambi cell</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kamanzi Audace</td>
<td></td>
<td>Local resident Karambi-Nyamirama village “Umudugudu”</td>
</tr>
<tr>
<td>Bigilimana Jonas</td>
<td></td>
<td>Local resident Karambi village “Umudugudu”</td>
</tr>
<tr>
<td>Mpumuje Stephen</td>
<td></td>
<td>Local resident Akabuga village “Umudugudu”</td>
</tr>
<tr>
<td>Kayihura Michel</td>
<td></td>
<td>Local resident Nyamirama village “Umudugudu”</td>
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<tr>
<td>Gishahayo Damien</td>
<td></td>
<td>Local resident Karambi village “Umudugudu”</td>
</tr>
<tr>
<td>Mukarutabana Mega</td>
<td></td>
<td>Local resident Karambi-centrevillage “Umudugudu”</td>
</tr>
<tr>
<td>Ruhumuriza Innocent</td>
<td></td>
<td>Local resident Karambi- Centre village “Umudugudu”</td>
</tr>
<tr>
<td>Nsanztwali Venuste</td>
<td></td>
<td>Local resident Karambi-Centre village “Umudugudu”</td>
</tr>
<tr>
<td>Muligande Jackson</td>
<td></td>
<td>Local resident Karambi village “Umudugudu”</td>
</tr>
<tr>
<td>Micombero Emmanuel</td>
<td></td>
<td>Local resident Karambi village “Umudugudu”</td>
</tr>
<tr>
<td>Turikimana Flugence</td>
<td></td>
<td>Local resident Rwasama village “Umudugudu”</td>
</tr>
<tr>
<td>Nyamugiza Emmanuel</td>
<td></td>
<td>Local resident Kiyovu village “Umudugudu”</td>
</tr>
<tr>
<td>Nizeyimana Donatien</td>
<td></td>
<td>Local resident Akabuga village “Umudugudu”</td>
</tr>
<tr>
<td>Semakuba Simon</td>
<td></td>
<td>Local resident Nyagashanga village “Umudugudu”</td>
</tr>
<tr>
<td>Nizeyimana Jean</td>
<td></td>
<td>Local resident Ngumeri I village “Umudugudu”</td>
</tr>
<tr>
<td>Harerimana Emmanuel</td>
<td></td>
<td>Local resident Ngumeri II village “Umudugudu”</td>
</tr>
<tr>
<td>Nsengumukiza Damien</td>
<td></td>
<td>Local resident Karambi village “Umudugudu”</td>
</tr>
<tr>
<td>Habyarimana Arthimond</td>
<td></td>
<td>Local resident Rukoyoyo village “Umudugudu”</td>
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<tr>
<td>Gasengayire Epeserance</td>
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<td>Local resident Nyamirama village “Umudugudu”</td>
</tr>
<tr>
<td>Maniriha</td>
<td></td>
<td>Local resident -Nyagashanga village “Umudugudu”</td>
</tr>
<tr>
<td>Kanamugire Jean</td>
<td></td>
<td>Local resident Rumuri village “Umudugudu”</td>
</tr>
</tbody>
</table>
APPENDIX 3: CHECKLIST OF KEY GUIDING QUESTIONS

Checklist of Key questions upon which impacts of the project may be established are in the table below:

<table>
<thead>
<tr>
<th>A- Physical and Biological environment-will the RSSP Gacaca marshland project:</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Is the irrigation scheme dependent on water from the River Misararo or is there an alternative source?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) What kind of soils, vegetation, terrain is in the area? How suitable is it for the proposed irrigation scheme?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Any likely water sources around? Any likelihood of the project affecting or contaminating them?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Poor drainage that might eventually influence the risk of water-related diseases such as; malaria or bilharzia?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Operate within a fragile ecosystem areas (e.g. forests, wetlands) or threatened species?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Likelihood of soil salinity from Irrigation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Any risks leading to increased soil degradation or erosion?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Impact on the quantity or quality of surface waters (e.g. Lakes, rivers, wetlands), or groundwater (e.g. springs)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) During construction and implementation any chances of solid or liquid waste production? Proposed disposal or treatment means?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B- Socio-economic environment/ Impacts - RSSP Gacaca marshland project:</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Influence of the project on public health, proper sanitation and any other health facilities such as; medical insurance “Mituelle”?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Influence of the project on the education sector, through school construction, ability of farmer to afford school fees for their children?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Is the project going to facilitate off- farm agricultural activities?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Is its location around an area where there is an important historical, archaeological or cultural heritage site?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Is its location within or adjacent to any areas that are or may be protected by government (e.g. national park, national reserve, world heritage site) or local tradition, or that might be a natural habitat?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Depend on water supply from an existing dam, weir, or other water diversion structure?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Will the project displace homesteads, commercial centres, or individual plantations? - Voluntary and Involuntary resettlement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sociologist Interview Questionnaire

- Interview guide with Local Population

1. Have you ever been told that this marshland is for rice production? Mwigeze mubirwa ko iki gishanga kizatunganywa kigabingwano umuceri?

2. How do you appreciate this project? Uyu musbinga murawumva muce?

3. Do you think that some of the population will be displaced due to that project? If yes, are they already informed? Ese mubona hari abaturage bashobora kuzimurwa? Niba babari barabimeneshejwe?

4. Are there school infrastructures and health centers? Hano amashuri n’amavururo arabegereye?

5. Don’t you see any effects due to irrigation activities such malaria? Ubu buryo bagye kuzatega amazi bayagomera mubona nta ngaruka bizabirabo? Ese nta malaria bisibobora kubatera?

6. What are the main activities activities that enable you to earn money in this District? Ni iyibe mirimo musite yinjiza mafaranga?

7. Has you land been registered? Ese ubutaka bwa hano bwose bwarabarawe?

8. Do you think that this project will improve your living conditions? Mubona uyu musbinga wo gutunganya igishanga no gubinga igihingwa kimwe hari icyo uzabindura ku miberebo yanyu ya buri muns?

9. What are the consequences of the displacement of the population due to the project? Ni izihe ngaruka zaba hari abaturage bimwe kubera gabunda yo gutunganya iki gishanga?


11. Rice production is mainly where there is much water, don’t you see any consequences on your lives? Umuceri ko ukunze gubingwa abantu hari amazi menshi, mubona nta ngaruka byazagira ku buzima bwanyu?

12. There some insects that appreciate rice, don’t you see any effects due to these insects on your lives? Ko hari udako n’udusimba twimbi dukunda igihingwa cy’umuceri, ntidushobora kugira ingaruka ku buzima bw’abaturiye iki gishanga?

13. What can you suggest RSSP that this project may be useful for your families? Ni iki mwasaba RSSP kugira ngo uyu musbinga uzagirire rwose akamaro imiyango yanyu?
**Interview guide with RSSP staff**


2. Are they people who will be displaced due to the project? If yes are they informed? *Ese abagomba kwimurwa kubera iyi gabunda? Niba ari yego, Abagomba kwimurwa barabizi?*

3. The labor force who will be used in this project, are they from this area or elsewhere? *Ese abakozi bazakenerwa muri uyu mushinga bava muri aka gace cyangwa abandi?*

4. Does the project has a time limit? *Gabunda yo gubinga umuceri ni gabunda izaborabo? Cyangwa ifite igihe izamara.*

5. If there is any problem that affect the population due to this project, who will be responsible of that? *Ese bagize ikibazo kivuka kibangamiye abaturage ku mitunganyiwo y'igishanga, ubwo byabarwa kuri nde?*

6. Have you ever thought about the market for rice production? *Ese uyu mushinga utekereze hape, mwatekereje n'abo abaturage babona isoko ry'ugurishirizamo umuceri?*

7. How can you assure the population that the project will improve the living condition of the population? *Ni ikihe cyemezo mwaha abaturiye uyu mushinga ko wazazamira imiberebo yabo?*

**Interview guide with local authorities**

1. Have you ever been told that this marshland is for rice production? *Mwigeze mubwirwa ko iki gisanga kizatunganywa kigabingwamo umuceri?*

2. How do you appreciate this project? *Uyu mushinga murawumwa mutwe?*

3. Do you think that some of the population will be displaced due to that project? If yes, are they already informed? *Ese mubona hari abaturage basobora kazimurwa? Niba babari barabimenyeshejwe?*

4. What are the main activities that enable you to earn money in this District? *Ni iyihe mirimo mufrcte yinjiza masarakanga?*
5. Do you think that this project will improve the population living conditions?
Mubona uyu mushinga wo gutunganya igishanga no gubinga igihingwa kimwe hari icyo uzahindura ku mibereho y’abaturage banyu?

6. How many cooperatives or associations are they in this cell or sector? Hari amacooperatives angahe cyangwa ama associations angahe muri aka kagari cyangwa umurenge?

7. What are the main activities in those cooperatives or associations? Ayo makoperative eg amasosiations yibanda ku yibe mirimo?

8. How women or girls are represented? Ubwitabire bw’abadamu muri aya makoperative buhagaze bute?

9. What are the main problems that face those cooperatives? Ibibazo amakoperative akunze gubura nabyo ni ibibe?

10. What are the consequences of the displacement of the population due to the project? Ni izihe nga nkaruka zababa hari abaturage bimwwe kubera gabunda yo gutunganya iki gishanga?


12. If there is any problem that affect the population due to this project, who will be responsible of that? Ese bagihe ikibazo kivuka ki bangamiye abaturage ku mitunganyi riye y’igishanga, ulwwo byabarwa kuri nde?

13. Have you ever thought about the market for rice production? Ese uyu mushinga utekerezvabo, mwatekereje n’abo abaturage babona isoko ryo kugurishirizamo umuceri?

14. How can you assure the population that the project will improve the living condition of the population? Ni ikihe cyemezo mwaba abaturiye uyu mushinga ko wuzazamura imiberebo yabo?

15. How this project will help specifically vulnerable people of this Sector? Ese uyu mushinga wo gutunganya iki gishanga by’unwihariko uzamarira iki abatishoboye?

16. How are you going to face the problem of students drop out due to looking for job?
Muzabangana mute n’ikibazo cy’abana bata mu masburi bajya gushaka akazi mu mirima y’imiciri?
17. What can you suggest RSSP that this project may be useful for your families? *Ni iki mwasaba RSSP kugira ngo uyu mushinga uzagirire rwose akamaro imiryango yanyu?*

**Interview guide with Cooperative members**

1. How many cooperatives or associations are they in this cell or sector? *Hari amacooperatives angabe cyangwa ama associations angabe muri aka kagari cyangwa umurenge?*
2. What are the main activities in those cooperatives or associations? *Ayo makoperative og amasosiations yibanda ku yibe mirimo?*
3. How women or girls are represented? *Ubwitabire bw'abadamu muri aya makoperative buhagaze bute?*
4. What are the main problems that face those cooperatives? *Ibibazo amakoperative akunze gubura nabyo ni ibibe?*
5. Do you think that rice can be consummated every day as other crops? *Mubona umuceri ari ikiribwa umuntu yarya buri muni?*
6. Have you ever been told that this marshland is for rice production? *Mwigeze mubwirwa ko iki gishanga kizatunganywa kigahingwano umuceri?*
7. How do you appreciate this project? *Uyu mushinga murawumva mute?*
8. Do you think that some of the population will be displaced due to that project? If yes, are they already informed? *Ese mubona hari abaturage bashobora kuzimurwa? Niba babari barabimenyesbejwe?*
9. Don’t you see any effects due to irrigation activities such malaria? *Ubu bunnyo bagiye kuzatega amazi bayagomera mubona nta ngaruka bizabagiraho? Ese nta malaria bishobora kubatera?*
10. Has your land been registered? *Ese ubutaka bwa hano bwose bwarabararwe?*
11. Do you think that this project will improve your living conditions? *Mubona uyu mushinga wo gutunganya igisanga no guhinga igihingwa kimwe hari icyo uzahindura ku mibereho yanyu ya buri muni?*
13. What can you suggest RSSP that this project may be useful for your families? *Ni iki mwasaba RSSP kugira ngo uyu mushinga uzagirire rwose akamaro imiryango yanyu?*
### APPENDIX 4: MATRIX ANALYSIS

#### Impacts analysis

<table>
<thead>
<tr>
<th>Environmental Impact</th>
<th>Impact type</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gacaca marshland development site</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>J. Construction of the dam and development of the marshland for Irrigation</em></td>
<td>Significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Farming all year through (all season)</td>
<td>X</td>
<td></td>
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<tr>
<td>Effective use of Gacaca marshland</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Market access for agricultural products</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Collective harvest for large quantities and market continuity</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Increased Rice yield</td>
<td>X</td>
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<tr>
<td>Profitability of rice</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Affordability of education</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Affordability of medical insurance</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Employment creation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Transfer of skills during the construction phase</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Soil conservation through land husbandry</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Improved soil fertility</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Agricultural Intensification</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Improved Vegetation cover</td>
<td>X</td>
<td></td>
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<tr>
<td>Increased Livestock fodder</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Country 1</td>
<td>Country 2</td>
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<tr>
<td>Food security</td>
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<tr>
<td>Poverty Alleviation</td>
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<tr>
<td>Improved nutrition</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Land Appreciation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Empowerment of farmers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Lack of project awareness by locals</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Expropriation without compensation</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>International waterway management</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Destruction of water points/boreholes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Destruction of crops without earlier warning</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Redundancy during the construction phase</td>
<td>X</td>
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<tr>
<td>Possibility of low wages for skilled and unskilled labour for construction works</td>
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<td>X</td>
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<tr>
<td>Oil spillage resulting in soil and water contamination</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Dangerous borrow pits impacts</td>
<td>X</td>
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<tr>
<td>Occupational health hazards during construction</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Air and Noise pollution</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Soil Erosion</td>
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<tr>
<td>Fire Outbreak</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Modification of flows for downstream usage</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fear of complete shift to Monoculture cultivation</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Resistance to change of livelihood</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Loss of soil fertility from monoculture and use of</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>inorganic fertilizers</td>
<td>Poor pesticide and agrochemical fertilizer management</td>
<td>Eutrophication of receiving water bodies and water quality degradation</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

| Water conflicts from the creation of irrigation scheme | X | X | X | X |

| Vandalism of irrigation infrastructure | X | X | X | X |

| Floods from reservoir overflow or pipe cuts | X |

| Increased spread of Water related diseases | X | X | X | X |

| Canal siltation | X | X | X | X |

| Water logging and salinization | X | X | |

| High sedimentation levels for the reservoir | X | X | X |

| Encroachment of the reservoir and primary emissary | X | X | X | X |

| Abandoned Infrastructure | X | X | |

| Dust and noise pollution from demolition activities | X | X |

| Contamination and impaired environment | X | X | X | X |

| Loss of livelihood | X | X | X | X |
APPENDIX 5: MAPS OF GACACA MARSHLAND SITE LOCATION
APPENDIX 6: GACACA TOPOGRAPHICAL MAP
APPENDIX 7: GACACA SLOPE CLASSIFICATION MAP
APPENDIX 8: GACACA LAND USE MAP
APPENDIX 9: GACACA SOIL MAP
APPENDIX 10: AREA FEATURES AND INFRASTRUCTURE
APPENDIX 11: TERMS OF REFERENCES

1. CONTEXT

The Government of Rwanda (GoR) is pursuing a comprehensive Poverty Reduction Programme. In support of this Programme, the GoR is implementing the Third Rural Sector Support Project (RSSP3) under the Ministry of Agriculture and Animal Resources (MINAGRI). The RSSP3 aims at promoting diversification of economic activities in rural areas as a way of increasing and stabilizing rural incomes.

The RSSP3 has three components: two technical components and one implementation support component. Component 1: Marshlands and hillsides rehabilitation and development. The objective of this component is to expand irrigated area in cultivated marshlands and increase use of sustainable land management practices on associated hillsides to accelerate the pace of agricultural intensification.

Component 2: Strengthening commodity chains. The objective of this component is to support the commercialization of smallholder agriculture in targeted marshlands and hillside areas by intensifying production, promoting agricultural value addition, and expanding access to markets.

Component 3: Project coordination and support. The objective of this component is to ensure: (i) efficient execution of administrative, financial management, and procurement functions; (ii) coordination of Project activities among the various stakeholders; (iii) timely implementation and monitoring of environmental and land-use management frameworks mandated by World Bank safeguards policies; and (iv) establishment and operation of an effective monitoring and evaluation (M&E) system.

RSSP3 plans to carry out civil works related to the construction of dam and irrigation infrastructures to enhance irrigated rice production in Gacaca marshland of Kayonza District. This activity requires the preparation of an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP). For the purposes of this assignment, “environment” is defined as the biophysical environment, human uses of that environment (e.g. farming, fishing), and cultural property as defined in World Bank OP 4.11 Physical Cultural Resources. The EIA will be prepared in accordance with the requirements of (i) Article 67 of the Organic Law N° 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda; and (ii) applicable World Bank safeguard policies, especially OP 4.01 Environmental Assessment, OP 4.04 Natural Habitats, OP 4.09 Pest Management and OP 4.12 Involuntary Resettlement. The objectives of the EIA are to ensure environmental due diligence according to Rwandan Law and the Safeguard policies of the World Bank.

2. OBJECTIVES OF THE ASSIGNMENT

The objective of the assignment is to assist MINAGRI to develop an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) to ensure that the
RSSP3 is implemented in an environmentally and socially sustainable manner and in full compliance with Rwanda’s and the World Bank’s environmental and social policies and regulations. The specific objectives are: (i) to assess the potential environmental and social impacts of the RSSP3 Project’s proposed dam construction and development of irrigation infrastructure of Gacaca marshland (±500 ha) in Kayonza District of the Eastern Province of Rwanda, whether positive or negative, and propose mitigation measures which will effectively address the impacts; and (ii) to inform the project preparation process of the potential impacts of different alternatives, and relevant mitigation measures.

3. SPECIFIC TASKS

The present terms of reference were designed to guide the study for Environmental Impact Assessment of the works related to the dam construction and development of irrigation infrastructures in Gacaca marshland (±500 ha) in Kayonza District of the Eastern Province for the account of RSSP following the conditions and the requirements of these terms of reference.

The present study will consist of collecting and analyzing available data using appropriate techniques to achieve the goals of this consultancy. It will come up with realistic proposals and recommendations after consultations with Rwanda Environmental Management Authority (REMA), MINAGRI and RSSP. In order to gather the required data, field surveys in Gacaca marshland and its surrounding catchments will be required. This will be done in close collaboration with RSSP, MINAGRI, Rwanda Development Board (RDB) and REMA. In each site, the study will include mapping sensitive natural habitats and important ecological conservation zones and working with RSSP Environmental Officer and REMA to consider alternatives and what marshland conservation zones can be retained and/or enhanced around and within each subproject. All site locations must be described fully with clear maps to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts.

To carry out this study, the selected firm will be guided by environmental criteria including but not limited to the extent of potential adverse impacts likely to be caused by water reduction in the river; water pollution; and any other type of adverse impact on physical and/or human environment. In addition, the selected firm will analyze available project alternatives to ensure sustainable water provision to the irrigated marshland for two seasons of rice production per year.

The selected firm will conform to the regulations of Rwanda Environmental Management Authority (REMA) regarding EIA process in Rwanda.

Rice production activities in Gacaca marshland may have potential adverse impacts on the environment.

The present terms of reference were prepared not only to guide the evaluation of extent of negative impacts of the project on the environment, but also to identify realistic measures capable to reduce, compensate or mitigate the identified impacts during implementation of the project.
The Evaluation of potential impacts will therefore include the following:

3.1 Review of Baseline Data

- Assemble, evaluate and present baseline data on the relevant environmental characteristics of the Project area. Include information on any changes anticipated before the project commences. Include the following information:
  
  (a) Physical environment: geology; topography; soils; climate; ambient air quality; surface and ground-water hydrology; ecological flow analysis for existing streams, existing water pollution discharges; and receiving water quality.
  
  (b) Biological environment: flora; fauna; rare or endangered species; sensitive habitats, including parks or preserves, significant natural sites, etc.; species of commercial importance; and species with potential to become nuisances, vectors or dangerous.
  
  (c) Socio-cultural environment (include both present and projected where appropriate): population; present land use; planned development activities; community structure; employment; distribution of income, goods and services; recreation; public health; cultural properties.
  
  (d) Analysis of interactions likely to occur with all activities in the vicinity and cumulative impacts on the environment.

3.2 Public consultation:

The firm will propose, for RSSP approval, a thorough program of consulting the public during the detailed EIA study. The purpose of this consultation program will be to assist RSSP to both inform all interested parties about the subproject and to solicit their views about it. Specifically, the Consultant will propose an effective, comprehensive public consultation strategy which includes at least:

- A list of stakeholders or audiences to be consulted;
- Methods for reaching these stakeholders/audiences;
- The scheduling of consultation activities; and
- How the consultation efforts will be analyzed and used.

3.3 Description of the project:

Detailed project description covering the area of influence (spatial and temporal boundaries), location, layout, different activities related to the project etc:

- Project size and land requirement
- Description of all activities associated with all development stages from conception to closing, staffing and employment related to each phase of the project,
- Description of all equipments associated with all development stages of the project
- Description and estimation of water requirements, water availability, nature and quantities of wastes generated in different phases of the project and description of wastes disposal plans, etc.

3.4 Requirements of EIA
Identification of relevant legislations and guidelines (local as well as international) in line with environmental impact assessment for irrigation projects. This should include appropriate norms and standards for irrigation projects.

3.5 Impacts prediction and analysis

This will consist of identifying and describing adverse impacts as well as environmental risks associated with the execution of the proposed project. The study will be particularly focused but not limited to the following parameters:

3.5.1 Site selection

- Describe how project sites are selected and screened.
- Prepare site selection criteria for sites that have not yet been identified.
- Develop a methodology and tools for screening chosen sites for potential negative environmental and social impacts.
- Develop suitable screening procedures to assess the possibility of involuntary resettlement or displacement arising from construction of infrastructure or civil works.

Possible impacts to be screened for include:
- Social impacts related to the displacement of the people and livestock (flooded zones and the marshland to be developed);
- Impacts on the wildlife, particularly on endangered species if relevant;
- Impacts on cultural heritage, such as archeological sites if relevant;
- Impact of dam construction on infrastructure (roads, electric wires, channels);
- Waste materials: re-use or recycling of construction waste such as mixture of cement concrete, pieces of timber etc…;
- Erosion and disturbance of the vegetation, the soil water seepage and infiltration of water into the irrigation channels;

3.5.2 Water supply

Possible impacts to be screened for with regard to the quality and nature of the water source and water supply include:
- Impacts related to the nature of water source, its quality, conveyance techniques towards irrigated land;
- Impacts caused by underground water source possible leading to the subsidence of the soil;
- Changes in the natural hydrology of the rivers and watercourses;
- Changes in the temperature of water affecting the ecosystems associated with water resources;
- Impacts of increased salinity on the soil surface affecting sustainable agricultural production if not properly managed;
- Impact related to the establishment of irrigation systems likely to affect environmental characteristics of irrigated agriculture;
- Impacts related to water losses in the conveyance system which may increase the hydrostatic level;
- Impact related to the combination of poor quality of water supply system and increased hydrostatic level which may affect the sustainability of the irrigation system;
- Impacts related to water discharge and water extraction from the river which in the absence of a specific study, may lead to the trans-boundary impact affecting neighboring countries.

**Water management techniques:**
Possible impacts to be screened for with regard to water management techniques include:
- The salinity resulting from high hydrostatic level of water in the aquifer may lead to excessive irrigation requirement or poor drainage;
- The puddles of water likely to occur due to an excessive or poor irrigation water management;
- The commercialization of agricultural inputs and produce may lead to mobile sources of water pollution (agrochemicals including fertilizers and pesticides);
- High concentrations of nitrate in the drinking water, particularly in underground water source;
- The increased incidences of malaria and schistosomiasis, especially in the irrigation channels and water reservoir;
- Detailed soil survey will be conducted to determine whether the soil of the marshland is suitable for the rice production;

**3.6 Analysis of alternatives:**

- Describe alternatives that were examined in the course of developing the proposed Project and identify other alternatives which would achieve the same objectives. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts, capital and operating costs, suitability under local conditions, and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. Include the “no project” alternative, in order to demonstrate what would reasonably be expected to occur to environmental conditions in the foreseeable future (based on existing ongoing development, land use, and regulatory practices and other relevant forces).

**3.7 Mitigation Measures**

Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels and enhance positive impacts. Provide a detailed description for appropriate reduction and compensatory measures as well as the design and the description of equipment and operational procedures (considered relevant) to respond to those impacts or to avoid or reduce the risks with the cost associated.
Describe and precise roles and responsibilities of different actors to be involved in effective implementation of the proposed mitigation measures. Prepare an Environmental Management Plan (EMP) including proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures. Explain how the project would comply with the requirements (including consultation) of the Bank’s Environmental Assessment Policy (OP 4.01) and the environmental requirements of other applicable Safeguard policies (e.g., Natural Habitats (OP 4.01), Forests (OP 4.36), Involuntary Resettlement (OP 4.12), Cultural Property (OP 4.11), Pest Management (OP 4.09).

The mitigation measures will consider but not be limited to the following
1. Political interventions;
2. Role of expertise and technology
3. Role of system management
4. Role of irrigation/agricultural practices
5. Socio-economic impacts

3.8 Environmental Management Plan (EMP):

The Environmental Management Plan includes the following components:

**Mitigation**
The EMP will be presented in tabular form and covers all anticipated significant adverse impacts, mitigation measures, implementation schedule and highlights the responsibility of people and institution involved as well as the costs required.

**Monitoring**
The monitoring section of EMP, presented in tabular form, provides a specific description and technical details of monitoring measures including the parameters to be measured, methods to be used, frequency of measurements, responsibility of different actors involved in effective implementation of the proposed mitigation measures especially at lower level and an estimation of the cost of the implementation of the proposed mitigation measures.

4. REPORTING
4.1 Reporting requirements

The findings of the reviewed relevant literature and field visits will be compiled into a self-standing report. The report will be based on the above terms of reference and will be submitted to RSSP in three printed copies, along with an electronic copy on CD, for evaluation and approval. The report will be presented to the public during a consultative session involving relevant stakeholders for their views on the report.

The following format is suggested for the EIA:

4.1.1 Executive summary
This concisely discusses significant findings and recommended actions.

4.1.2 Introduction:
   a. Background to the project
   b. Objectives of the study
   c. Methodology

4.1.3 Policy, legal, and administrative framework
This part discusses the policy, legal, and administrative framework within which the EA is carried out. This should include both national and international legislations.

4.1.4 Baseline data
This section assesses the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. It also takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project location, design, operation, or mitigatory measures. The section indicates the accuracy, reliability, and sources of the data.

4.1.5 Project description.
This part concisely describes the proposed project activities and its geographic, ecological, social, and temporal context, including any offsite investments that may be required (e.g., dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). It indicates the need for any resettlement plan with a map showing the project site and the project's area of influence. It provides detailed information on the following:

1. Location of the study area and description of the current use of the location, project objectives and size;
2. Detailed description of the project, extent in time and space;
3. Description of activities related to all implementation stages from the inception, staffing and employment related to different stages of the project;
4. Description of all activities and farming techniques to be used during all farming seasons of the year;
5. Description of all activities which will follow from the execution of the project (construction of road, warehouse etc);
6. Description of prevention and security measures, water and energy supply, wastes treatment and evacuation.

4.1.6 Analysis of alternatives
This section systematically compares feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. It states the basis for selecting the particular project design proposed and justifies recommended emission levels and approaches to pollution prevention and abatement.

4.1.7 Environmental impacts
This part predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. It explores opportunities for environmental enhancement, identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention.

4.1.8 Environmental Management Plan (EMP):
This section includes two components: mitigation plan and monitoring plan. The EMP should be presented in the form of a table.

(i) Mitigation plan:
- Significant adverse impacts of the subproject;
- Detailed description of mitigation and compensation measures proposed,
- Implementation schedule;
- Responsibility of people and institution involved
- Estimate of the costs required

(ii) Monitoring plan:
- Monitoring activities
- Significant adverse impacts of the subproject;
- Parameters to be measured
- Method used to measure the parameter
- Frequency of measurements
- Responsibility of people and institution involved
- Estimate of the costs required

4.1.9 Conclusions and Recommendations
The report should also include all information necessary to the project review such as lists of data sources, project background reports and studies, and any other relevant information to which the developer/consultant's attention should be directed. It should provide also detailed designs/plans of construction, the water canalization and waste water treatment systems, etc.

4.1.10 References
These are written materials both published and unpublished used in the study preparation.

4.1.11 Appendices
- List of EIA report preparers –individuals and organizations
- Record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local non-governmental organizations (NGOs). The record specifies any means other than consultations (e.g. Surveys) that were used to obtain the views of the affected groups and local NGOs.
- Tables, maps presenting the relevant data referred to or summarized in the main text

4.2 Report presentation and Deadlines
The draft of the EIA report will be presented within 45 calendar days from the date of signing the contract by both parties. RSSP will have 10 days calendar to check the document and request some modifications on it. The modifications to be made on the document will be submitted to the consultant in writing and must be integrated during the editing of the final version. The final version of EIA report will be presented within 15 calendar days after submitting the comments to the consultant. RSSP will have 5 working days to check the documents. The Final version of the EIA report will be presented in 3 printed copies and on CD.

While conducting this assignment, the firm will be requested to present to the client a monthly progress report. However, the client may request the firm at any time to present any desired clarification about the progress of the assignment when it is determined to be necessary.

The final report of the EIA will be submitted to RDB for approval and the World Bank for no objection. In the event RDB or the World Bank require some clarifications to be made on the report, the consultant holds the responsibility to address issues raised until the Certificate of approval is issued.

Once reports are approved, they will be disclosed in Rwanda and submitted by the GoR to the Bank for disclosure through the World Bank InfoShop, according to Bank policy.

5. QUALIFICATIONS AND EXPERIENCE REQUIRED

5.1 Qualifications and experience required for the firm
The firm to be qualified for this study will have to be registered in Rwanda and a vast experience in consultancy services with at least 5 references in Environmental Impact Assessment studies.

5.2 Qualifications and experience required for the key personnel
To realize this assignment, the selected firm will recruit competent and qualified personnel with proven experience in similar services. The key personnel needed for this study by the firm will have the minimum qualifications below:

- One (1) Environmental Specialist with minimum Masters Degree in Environmental Science or related fields for the Assessment of Impact on the Environment
- One (1) Ecologist or specialist in botany with minimum Bachelor Degree to evaluate potential impacts of the project activities on the flora of the project site and its surrounding, and propose alternatives
- One (1) Specialist in zoology with minimum Bachelor Degree to analyse potential impacts of the project activities on fauna of the project site and its surrounding, and propose the alternatives
- One (1) Hydrologist or Water resource management Specialist with minimum Bachelor Degree to assess impacts on water resources due to water consumption, and downstream impacts on water regime.
• One (1) Specialist in sociology or related fields with minimum Bachelor Degree to evaluate potential impacts of the project activities on socioeconomic conditions of the population in the study areas.

The key personnel must have the following minimum experience:

(i) The Environmental Specialist (Team leader) for Environmental Impact Assessment (E.I.A): Experience in the domain: 5 years; specific experience: 5 references in Environmental Impact Assessment.
(ii) The Ecologist or specialist in botany: experience in the domain: 5 years; specific experience: 3 references in Assessment of Impact of project activities on the flora.
(iii) The Biologist specializing in Zoology: experience in the domain: 5 years; specific experience: 3 references in Assessment of impact of project activities on the fauna.
• The Hydrologist or water resource management specialist: experience in the domain: 5 years; specific experience: 3 references in assessment of impacts on water resources due to water consumption, and downstream impacts on water regime;
• The Specialist in sociology or related fields: experience in the domain: 5 years; specific experience: 3 references in Assessment of Impact of project activities on the socio-economy.

Nota.
1. The firm must attach the certificate of completion for each reference;
2. The key personnel must attach the CV, notified degree

6. STUDY DURATION AND LEVEL OF EFFORT

The assignment will last for two and a half months and involve approximately 90 man days of Consultant.

7. CASES OF FORCE MAJEURE.

The only circumstances under which an interruption in this study would be justified include unavoidable natural catastrophes such as extreme meteorological conditions and exceptional flooding, war, earthquakes, civil strikes, etc. Should such circumstances arise; the Consultant will have to produce without delay proof to justify the delay of the study. In this case there will be negotiation between the consultant and the client for contract extension.
APPENDIX 11: PROFILES OF THE PARTICIPATING CONSULTANTS

SONGA Silvin - holds a MSc in Environmental Science and Technology and BSc in Civil engineering. He has over 5 years professional experience in the field of environmental assessment and management and 10 years professional experience in civil works, construction related fields and public procurement. He has worked on various projects as team leader of the Environmental Assessment, projects in sectors such as; Irrigation projects, green house agriculture, mining projects, road and bridge construction projects, building and house constructions, schools and hospitals, among others. Most of these assignments have been realised in Rwanda and in the region. On the other hand in regard to civil engineering works, he has worked on a number of projects among which are; he was a member of the clerks of works for the supervision of the 7000m² complex of the Rwanda Revenue Authority, Auditor General and National Electoral Commission at Kimihurura, Kigali city, offered technical consultancy to BRD on the Kinazi Cassava processing factory construction, technical consultancy to BRD on the construction of 9 industries for the relocation of 9 industries from Gikondo Industrial wetland to the Rwanda Special Economic Zone. He was a lead member at the National Tender Board (NTB) in the procurement and contract monitoring of the rehabilitation of several marshlands for irrigation schemes under the World Bank funded RSSPI project and road construction tenders funded by EU such as; Kigali- Kayonza road to mention but a few.

BAGUMIRA Edward - holds a MSc in Hydrology and Water resources engineering and a BSc in Civil Engineering. He has over 4 years professional experience as a hydrologist in mainly agricultural related projects and over 4 years professional experience as a water engineer for hydraulic structures and civil works that involved construction works of buildings, warehouses, laboratories, among others.

UMUHUMUZA Gisele - holds a MSc in water resources engineering and management and BSc in Biology with a specific option of Zoology. She has 7 years’ experience in the domain of zoology for projects that involved Environmental Assessment for marshland developments for agriculture and road rehabilitation works. She also worked as a coordinator for the Rwanda Biodiversity Information Systems (RBIS), been a research officer in Biodiversity and worked as an Assistant Lecturer in Applied Biology department at Kigali Institute of Science and Technology (KIST).

KALIBANA Marara Celestin - holds a MSc in Biology and BSc in Botany. He has over 15 years’ experience as a consulting Ecologist in mainly Environmental Assessment assignments. Assignments that included; marshland rehabilitation for purposes of large scale agriculture of rice, rehabilitation of 17 inland lakes and their watershed areas in Rwanda, water supply projects, road construction and other commercial buildings.

UWIMBABAZI Bernadette - holds a MA in Gender and Development and BA in Sociology. She has 7 years’ experience as a consulting sociologist in environmental assessments of marshland rehabilitation projects for agricultural purposes, socio-economic assessments for rural development projects that involve; feeder road rehabilitation, school
construction, rural electrification, water projects, among others. She also has been a Senior lecturer in Sociology and Gender based development at Kigali Independent University (ULK) and held positions such as Head of department of sociology at this University.