REPUBLIC OF RWANDA

Ministry of Agriculture and Animal Resources (MINAGRI)
Rural Sector Support Project (RSSP 3)

Final Report

For:

The Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) concerning development works for Migina Marshland (347ha) located in Southern Province.

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Public Disclosure Authorized

EXECUTIVE SUMMARY

Background

RSSP3 plans to carry out civil works related to the construction of irrigation infrastructure for proper drainage and irrigation of 347ha of Migina marshland in Southern Province, Rwanda.

Objectives of the study

The objective of the assignment is to assist MINAGRI/RSSP 3 to develop an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) to ensure that the rehabilitation of Migina marshland irrigation network 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.

Approach and methodology of the study

The study begun with **scoping** to understand the project, identify its boundaries and relevant stakeholders. This was followed by **Literature review** of local and international Institutional, legislative and policy framework relevant to the EIA study, of which the most outstanding were; the National Organic law on environment and World Bank Safeguard policies.
Public consultation was carried out with government officials, local authorities, cooperatives ad farmers, guided by participatory methods such as; one-to-one discussions, focused group discussions (FGD), Informed Consultation Participation (ICP) with representatives of stakeholders and public meetings with stakeholders. By applying key questionnaires during these consultations, stakeholders were able to appreciate the importance of the project and also raise their concerns on the proposed Migina project. It is from these concerns that the likely impacts were determined and summarized in chapter 5.

Baseline data collection- Information was collected on the existing physical, biological, socio-economic environment Migina project area. The exercise involved hydrological analysis, soil analysis, ecological analysis and social economic analysis of the study area.
A comprehensive report including all collected data, analysis of the data, anticipated impacts, proposed mitigation measures, an Environmental management plan and monitoring plan has been prepared.

Project Description

Site: Migina marshland is boarded by three (3) Districts. i.e. Gisagara, Huye and Nyaruguru. Under each of these Districts, the following table indicates the project area of intervention.

Table 1: Geographical coverage of Migina marshland rehabilitation project

Districts	Sectors	Cells	Villages
Gisagara	Kibirizi	9	23
	Kansi		
	Kigembe		
	Nyanza		
Huye	Tumba	4	11
	Mukura		
Nyaruguru	Ngera	5	21
	Ngoma		

Project design:

The rehabilitation of the marshland starts at Rwasave fish ponds and ends at Migombero Bridge. The marshland is elongated with 25 Km length and 250 to 300m width (the minimum width is 150m).

It involves two perimeters of the Migina marshland:

- *Developed perimeter*- shall involve the rehabilitation of the existing irrigation network with the improvement of the irrigation system in the following manner:
    - The 4 existing head diversion weirs alongside with their gates will be rehabilitated;
    - Resizing of main canals and their equipment with structures which are stronger and more operational especially the secondary intakes;
    - Modification of the existing layout of secondary canals and their tertiary intakes.
    - A buffer zone, width of minimum 2m and average of 5m, will be established along the main canals both on the right and left banks of the marshland.
- *Undeveloped perimeter*- as a continuation of the developed perimeter, the irrigation layout will be similar in order to establish to the full extent of the marshland a homogeneous hydro-agricultural network in its design and operation.
    - The design of head diversion weirs will thus be similar to those already constructed in the upstream part. Their number will be 4 with 3 new head diversion weirs that will be constructed along the river, the fourth will be the one that is already constructed on Mukura River and it will be rehabilitated and protected against the water bypass. Those head diversion weirs will be provided with intakes on both right and left sides.
    - The main and secondary canals will be plotted with minimal earthworks and they must dominate the sectors they irrigate. The drainage network will be formed by the main drain (Migina River).
    - Plots for the undeveloped perimeter shall have a slope of 0.6 per thousand and they be converted into rice fields. Bunds of 40 cm high and 50 cm of bottom width will be constructed to separate plots and also to provide flood irrigation. These bunds serve as footpaths and other paths will be built for pedestrian and motorcycle traffic for the purpose of having access to the head diversion weirs.
    - Again, a buffer zone, width of minimum 2m and average of 5m, will be established along the main canals both on the right and left banks of the marshland.

Table 2: Net irrigable area

Marshland perimeters	***Head diversion weirs***	***Irrigable areas covered by weirs (ha)***	***Total area per perimeter (ha)***	***Total potential irrigable area (ha)***
Developed perimeter	Existing N°.1	69.42	184	**347**
	Existing N°.2	40.01		
	Existing N°.3	36.11		
	Existing N°.4	38.75		
Undeveloped perimeter	Existing N°.5 on Mukura River	38.22	163	
	Proposed N°.1	33.64		
	Proposed N°.2	29.61		
	Proposed N°.3	61.49		

Environmental and social impact assessment

Chapter 5, in form of a table, gives a summary of issues raised during the public consultation likely to be caused by MIgina marshland development that were anticipated by the locals during stakeholders' and public consultation. Details of the public consultation are addressed in the Public consultation Issues report in *appendix 1* while Positive and negative impacts are discussed thoroughly in *chapter 6* and mitigation measures proposed for every anticipated negative impact.

Positive environmental impacts expected from Migina development project include: (i) increased land productivity, (ii) Flood control and improved marshland drainage. Social benefits include: (i)Increased production from farming all year round, (ii)market access for agricultural products, (iii) collective harvest creating large quantities and sustaining markets, (iv) increased crop yield, (v) Temporary employment creation from construction works, (vi) Transfer of skills from construction activity, (vii) Affordability of medical insurance and education, (ix) land appreciation, and (xi) Empowerment of farmers.

The Migina marshland project is expected to also have adverse impacts during its different phases particularly construction and operational phases. Expected adverse impacts range from physical environment impacts, biological impacts and social Impacts.

Physical environment: soil and water contamination from oil spillage of construction equipment, air and noise pollution, soil erosion and landslides from construction works, fire outbreaks, modification of flows at the central drains, water pollution from fertilizer and pesticide application, water logging and salinization, high sedimentation levels, siltation and scouring of drains/ canals, water losses from evaporation and leakage.

Biological Impacts: Loss of biodiversity on foothills and valleys to project activity.

Social impacts: farmer's income lost by missing cultivation season due to delay in commencing construction works, crop preference between maize and rice in the undeveloped perimeter, injuries by workers on site, diseases contracted from interactions during construction, health

hazards from poor fertilizer and pesticide application, water conflict from introduction of irrigation scheme, vandalism, increased spread of water related diseases and destruction of drain/ canal boundaries from plantation encroachment.

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

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.

An estimated EMP implementation cost of 36,202US$ was reached, which included mostly; the proposed green buffer along the side drains/canals, among many other mitigation measures.

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 Migina marshland development project is bound to be executed in a sustainably efficient manner.

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ABBREVIATIONS

EA	Environmental Assessment
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction strategy
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental Social Impact Assessment
MCM	Million cubic metres
MINAGRI	Ministry of Agriculture and Animal Resources
MININFRA	Ministry of Infrastructure
MINIRENA	Ministry of Natural Resources
MINISANTE	Ministry of Health
MOU	Memorandum of Understanding
NISR	National Institute of Statistics of Rwanda
NLC	National Land Centre
PAD	Project Appraisal Document
RAB	Rwanda Agricultural Board
REMA	Rwanda Environment Management Authority
RNRA	Rwanda Natural Resources Authority
RSSP 3	Rural Sector Support Project III
SPAT II	Strategic Program for Agricultural Transformation II
SWAP	Sector Wide Approach Program
ToRs	Terms of Reference
WUA	Water Users' Association

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.
Component 2: Strengthening commodity chains.
Component 3: Project coordination and support.
RSSP3 plans to carry out civil works related to the rehabilitation of existing diversion weirs, construction of new diversion weirs, rehabilitation and construction of drainage canals and water works for proper drainage and irrigation of Migina marshland in Southern Province, Rwanda.

The currently net area cultivated with rice in this marshland is 184 ha and it's located in the upstream section of the marshland, while the total gross area of the marshland as per topographic survey is 548 ha.
RSSP III proposes to rehabilitate irrigation network of this marshland with a purpose of managing flows of water in the marshland perimeter, providing quality irrigation in order to optimize on a larger area of rice production in this marshland.
A preliminary technical study has been completed with a proposal of a net irrigable area of 347ha for the Migina marshland. Works involved in improvement of the irrigation network of this marshland requires the preparation of an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP).

We understand that a portion of the project available budget has been allocated to the study of an Environmental Impact Assessment (EIA) for the works mentioned above, with Eco-Excellence consultancy and its team of qualified and experienced personnel recruited to perform this study.

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.

Its objective will be to ensure environmental due diligence according to Rwandan Law and the Safeguard policies of the World Bank.

1.2 OBJECTIVES OF THE EIA STUDY

The objective of the assignment is to assist MINAGRI/RSSP 3 to develop an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) to ensure that the rehabilitation of the Migina marshland irrigation network (347ha) 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 development of drainage and irrigation infrastructure of Migina marshland (347 ha), 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 (including implementation requirements).

1.3 SCOPING OF THE STUDY

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. Scoping was restricted to the following boundaries.

Location- The scope of this study was based on the boundaries of the Migina marshland in which this project shall operate. Based on a scoping field reconnaissance and review of the provisional detailed technical study, the marshland boundaries touch the geographical area described in the table below.

Table 3: Geographical coverage of Migina marshland rehabilitation project

Districts	Sectors	Cells	Villages
Gisagara	Kibirizi	9	23
	Kansi		
	Kigembe		
	Nyanza		
Huye	Tumba	4	11
	Mukura		
Nyaruguru	Ngera	5	21
	Ngoma		

Project components- The study covered impacts of three sections of the marshland;

i. Rehabilitation of existing diversion weirs in the developed perimeter of Migina marshland and construction of new diversions weirs in the undeveloped perimeter,
ii. Resizing of existing primary canals and their infrastructure for the developed perimeter and constructing of new primary canals and their infrastructure for the undeveloped perimeter.

iii. Modification of existing secondary and their tertiary canals and drains in developed perimeter and constructing new secondary, tertiary canals and drains in the undeveloped perimeter.
iv. Levelling of plots in the undeveloped perimeter at slopes of 0.6/1000 and establishment of soil bunds to demarcate these plots,
v. Establishment of a buffer zone along primary canals and construction pedestrian and cyclist paths shall be developed to service especially diversion structures.

Scope of work was to-

- Identify which legislation, policies (both local and international) are likely to influence impacts caused by this project.
- Develop an overview of the baseline environment of the project intervention area. i.e. physical, biological and social environment.
- Develop an overview of likely impacts (positive or negative) that could be caused by Migina marshland rehabilitation project.
- Propose mitigation measures against of the predicted adverse impacts identified.
- Propose an Environmental Management Plan (EMP) on how these mitigation measures can be implemented.
- Propose an Environmental Monitoring Plan with measurable indicators and parameters for these mitigation measures to ensure sustainability of the project.

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 for Migina marshland. This was done 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 involved consultation and a field visit with RSSP 3 staff. A separate field visit to familiarize the study team with existing features and proposed project infrastructure was also done at the scoping stage.

Scoping continued by visiting the site area again to understand the sectors and cells the project covers, consult with the Sector Agronomists in the project area of influence on activities currently existing and those proposed for both marshlands.

The scoping established the study boundaries to include geographical coverage elaborated in *table 1* above.

The scoping exercise further entailed the following:

- Identification of the likely stakeholders who eventually were 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 a preliminary desk review on technical study for Development of Migina marshland, RSSP 3 project documentation, Strategic Programme for Agriculture Transformation III (SPAT III), other agriculture sector policies and regulations, Government Economic Development for Poverty Reduction Strategy (EDPRS II), World Bank safeguard policies and the organic law on the environment.

1.4.2 Review of Institutional, legislative and Policy framework

An intense deskwork was done of existing institutional legislation, policies, plans and programs, which are likely to influence different parts of the implementation of Migina marshland project, its sustainability and ensure enhancement of the environmental resources.

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

- Technical design studies for the execution of Hydro-agricultural Development works of Migina marshland;
- Organic Law no. 04.2005 which date establishing the modalities of protection, conservation and promotion of the environment
- Expropriation in the Public Interest (Expropriation Law – Law No. 32/2015 of 11/06/2015).
- EDPRS II,
- RSSP 3 Project Appraisal Document;
- Strategic Programme for Agriculture Transformation III (SPAT III),
- National Water Resources Management Policy
- Water and Sanitation Policy
- Land Policy
- Agriculture policy
- Biodiversity,
- wetland conservation/ marshland development master plan
- health sector
- Gisagara, Huye and Nyaruguru District Development Plans.

- Resettlement Policy framework for RSSP III
- Environmental and Social management framework for RSSP III

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

Regional protocols include:

- EAC Protocol on Environment.

Relevant World Bank Safeguard Operational Policies (OP) include;

- Environmental Assessment (OP4.01),
- Natural Habitats (OP 4.04),
- Forest (OP 4.36),
- Pest Management (OP 4.09),
- Involuntary Resettlement (OP 4.12),
- Physical Cultural Resources (OP 4.11),
- Safety of Dams (OP 4.37),
- Projects on international water ways (OP 7.50).

An institutional framework was also presented, indicating roles and responsibilities of National and international Institutions that will have a stake in implementing this project, approving the EIA and monitoring mitigation measures proposed against anticipated adverse impacts. e.g. RSSP 3, MINAGRI, REMA, MINIRENA, MININFRA, RDB, District and sector authorities and World Bank.

1.4.3 Public Consultation with Stakeholders

Identification and Involvement of stakeholders

Consultations were held with RSSP 3 Rural engineer and Environmental Safeguards specialist to understand the project, its objectives, components, specific activities and scope of the study. Hereafter, preliminary scoping field visits were ventured into, which enabled the consultant to meet RSSP 3 staff at the Southern Province, Sector agronomists that were linked to the Migina marshland for the different Districts of Huye, Gisagara, Nyaruguru.

Information collected from the preliminary desk review, preliminary consultation with the RSSP staff and key informants (KIs) during the field visit guided the study in identifying the Migina marshland rehabilitation project stakeholders. Without chronological priority, these stakeholders were identified in three categories. (1) First category of Government officials, (2) Second category of local government officials and (3) Third category of locals likely to benefit or be affected the project.

During the Public consultation, the study applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders consulted were informed on the proposed project and by using the

key guiding questionnaires in *appendix 3*, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities. Stakeholders were asked to raise their concerns on the proposed Migina marshland rehabilitation project. An issue raised by one individual or a group of people was cross-checked by discussing it over with other individuals or groups. It is from these concerns that the likely impacts were determined and summarized in chapter 5. *(A Public consultation Issues report of the field visit may be referred in appendix 1).*

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, in-situ profile verification, consultations with selected stakeholders and discussions with RSSP 3 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 3 field Rural Engineer.

Subsequent independent field surveys were done with support from RSSP 3 coordination team on site. The consultant's team was split into three; (i) the sociologist carried out public consultation with local authorities, local farmers and residents in the area, (ii) the Ecologist and environmentalist embarked on field analysis to understand existing and likely ecosystem of the project area. i.e. drainage and canal irrigation delineated areas, areas at the foothills of the marshlands, (iii) The soil scientist organised a team to support him in the field verification of soil profile description on site by the technical design study, while soil laboratory analysis results from the technical design study were found representative and applied coming up with project impacts on soil in the preparation of the EIA report.

All these activities were done to capture a broad picture of the prevailing situation at the site and in physical, biological and social assessment of Migina Marshland.

1.4.4.1 Methods used for baseline data collection and analysis

Hydrological analysis

The data applied for the hydrological assessment included; daily rainfall records, daily stream flow, monthly evaporation and temperature. This information was used to verify the potential capacity of the river system and its tributaries to sustain the proposed coverage area for irrigation.

Available historical hydrometric data on the Migina River and its tributaries of; Mukura, Ruya and Akaboti River, as well as meteorological data recorded at Butare station close to the project area was gathered from the relevant national institutions and analysed. Other data included

water quality data, water census data (i.e. principal water users downstream and upstream of the Diversion weir N°. 1 at commencement point of the project), ground water resources and surface water bodies. Topographic data including maps (both paper and digital form), land-use areas, soil types and geology, vegetation cover aided in characterisation of the Migina watersheds.

Field visits to the project area were carried out to verify information obtained during the desk study, information from the technical study performed by HYCOGEC and obtain any additional field information where necessary.

Climate- The climate of Migina catchment was characterized by analysing climatic data (rainfall, temperature and evaporation) obtained from Butare station at the University of Rwanda (UR), not more than 10km from the commencement point of the project area.

Water Use and Demand Assessment-The principal water users upstream and downstream of the proposed diversion weir sites were identified, and their current water demands determined together with their seasonality, levels of service and priority of use. The EIA study considered the water demand to be that derived from the calculations by the technical study based on crop water requirements estimated from crop patterns proposed for the irrigable area.

Water yield in catchment- A study of existing surface and ground water resources within the catchment including; geological formations, monitoring networks, and water sources was carried out. The determination of water yield into each diversion weir required analysis of compiled stream flow data at the site preferably collected during the technical study. This involved using available hydro-meteorological data for Migina and neighbouring catchments to compute flow at the site using appropriate rainfall-runoff modelling tools.

Derivation of flow data at Migina marshland- Flow data used heavily depended on the Technical Design study, which carried out discharge measures in the main drains of the two marshlands and at the outlet change of the road bridge combining the discharges from the two marshlands. This was done at the start and the end of the wet season from which an average discharge flow was obtained for each of these marshlands.

Water Quality Assessment- Water quality determination is crucial for understanding the health of the stream. To establish the status of the water quality of the streams, water samples were taken from the River (Main drain) at two (2) points (one for developed and another at the undeveloped perimeters) for laboratory test and tested at a laboratory of the University of Rwanda, College of Science and Technology in Kigali, from which results shall analysed to determine the health of the river water.

The water quality parameters analysed included pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA), Chloride, Sulphates,

Carbonates and Magnesium. The observed results of the laboratory analysis were then compared for suitability with the existing standards for irrigation water.

Expert observation of water turbidity was also applied along the River Ecological observations shall also applied by to the macro vertebra in the River to determine the health of the River and predict likely impacts of project activity

Flood assessment-Peak flow values for a five (5) year flood return period determined by the technical design study were used.

Environmental/ecological Flows analysis- The construction of the irrigation infrastructure in the marshland will interrupt the flow of water in the existing streams and rivers downstream which will impact on the livelihood of the ecosystem on the area. As such, some water of specified quantity must be allowed to continue to flow on a continuous basis for purposes of maintaining the health of the ecosystem of the central drains (streams), which is referred as the environmental or ecological flow.

To establish this environmental flow, a simple methodology referred to as 'Montana Method' proposed by Tennant (1976), where by environmental flow regimes are prescribed on the basis of the mean annual flow (MAF). This was applied. This method provides guidelines for flow management based on the percentage of average flow, daily and monthly stream flow records, that would maintain biological attributes of a river as optimum conditions (>60%), outstanding (40%), excellent (30%), good (20%), fair, poor, minimum, or degrading (10%). In this study, 10% of MAF has been quantified as it is the least for the survival of the existing ecosystem before it is considered degraded. This would essentially imply that flows can never be allowed to drop below the 10% MAF to avoid loss of aquatic biodiversity.

Soil analysis

The EIA study carried out an independent soil investigation for Migina marshland development. This investigation was based on; (i) *preparation of soil profiles and description and (ii) verification of the soil laboratory analysis done in the technical design study*.

During the soil profiles analysis**,** two representative (2) sites were chosen for soil profiling at the developed and undeveloped portions of the Migina marshland. The two soil profiles were prepared and described following the guidelines for soil profile study (FAO World Reference Base 2006). The selection of sites took into account the soil formation factors including; origin of parent materials, slope and moisture content.

As for the soil laboratory analysis**,** Soil laboratory analysis indicated in the technical design study was reviewed and found representative and hence applied in coming up with impacts likely to be caused by project activities on the marshland soils. Laboratory analysis reviewed

was from the technical study concerned the following parameters: Soil Organic Carbon, Soil pH, soil texture, exchangeable acidity, available Phosphorus, Ammonium concentration and Nitrates concentration. Un-disturbed soil samples were also collected from the top horizon of soil profiles and investigated for bulk-density.

Results both in-situ at site and from laboratory analysis were presented and interpreted and a soil profile description presented in Chapter 4 of baseline data. From this soil analysis, impacts were predicted likely to be caused by fertilizer use. Mitigation measures and best practices were proposed against each impact assessment. These were included in the chapter 7 EMP.

Ecological analysis

Assessment was done of flora and fauna for selected areas in the marshland area and the foot of surrounding hills of the marshland. Tools such as; field observation combined with GIS mapping were used to determine land cover of this area of project intervention. e.g. land cover comprising of forest area, cultivated area, and surface water. Literature review was used to predict likely fauna commonly observed with corresponding flora determined by the GIS land cover.

Expert observation was applied to understand the existing ecosystem within these areas, to determine likely eco-sensitive areas and predict flora and fauna that could emerge with the introduction of this project.

Social environment analysis

It involved collecting primary data from field and matching it with secondary data obtained from desk reviews. Methods of obtaining field data were mainly through public consultation and expert observation.

During the Public consultation, the study applied different participatory methods, namely; interviews, one-to-one discussions with Key Informants (KIs), focused group discussions (FGD), Informed Consultation and Participation (ICP) with local leaders and key stakeholder representatives, Public meetings and official meetings with stakeholders.

Social data collected from field public consultation with local government and locals were on; population project awareness, local impression of the project, identification of likely areas of expropriation, population and demography, land use, infrastructure (roads, water, electricity), health and sanitation, education, cultural heritage. This data was interpreted from which positive and adverse impacts were anticipated to be addressed in proceeding chapters.

Since the project activities are only limited to the marshland, which is land owned by Government and from field observation all irrigation infrastructure was done by Government and crops grown in the marshland are mostly seasonal crops (lasting a maximum of 4months

before harvest), it is likely that there is no physical or economic displacement to trigger requirement of a Resettlement action plan (RAP).

1.4.5 Impacts Assessment

Impacts prediction and analysis involved assessment of the entire project cycle i.e. project mobilization, construction, operation and decommissioning phases. Impact assessment applied number of tools and techniques to determine the nature (positive or negative), extent (spatial), occurrence (one-off, intermitted or constant), magnitude, whether reversible or irreversible, direct or indirect, probability of occurrence and significance with and without mitigation. These tools were:

- *Geographical Information System (GIS)* - used to show the extent of a particular project activity's influence on an area by mapping it out.
- *Checklist*- Under this section, project activities that might affect or enhance the livelihood in the project areas were listed and drawn against environment and occurrence.
- *Impact Matrix*- Under the Impact matrix, the analysis by these tools of GIS, checklist, CBA, were also tested against their significant effect on recipients in the project area of intervention. Impact matrix in tabular format was drawn, in which impacts from project activities were tested against their significant effect on the areas of intervention. These significant impacts were presented in an Impact matrix in tabular form in *appendix 4*, in categories of direct or indirect impact, reversible or irreversible and of cumulative effect.

For each adverse impact identified, its level of significance was indicated, mitigation measures for the predicted impacts were proposed and an Environmental Management Plan (EMP) developed.

1.5 REPORT STRUCTURE

This report is organised in ten 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 preliminary decommissioning plan is discussed in chapter 9. Chapter 10 provides conclusions and recommendations of the project.

CHAPTER 2: PROJECT DESCRIPTION

21. PROJECT AREA

2.1.1 Location

Migina marshland is bordered by three (3) Districts. i.e. Gisagara, Huye and Nyaruguru. Rehabilitation of Migina marshland shall cover an administrative area elaborated in Table 4.

Table 4 Administrative boundaries of the study area

Districts	Sectors	Cells	No. of Cells	No. of Villages
Gisagara	Kibirizi	Muyira, Kibirizi, Douane	9	23
	Kansi	Bwiza, Kaboti		
	Kigembe	Rusagara, Gahabwa		
	Nyanza	Higiro, Nyamugari		
Huye	Tumba	Cyarwa, Cyimana	4	11
	Mukura	Rango I, Icyeru		
Nyaruguru	Ngera	Murama, Mbuye	5	21
	Ngoma	Nyamirama, Mbuye, Rubona		

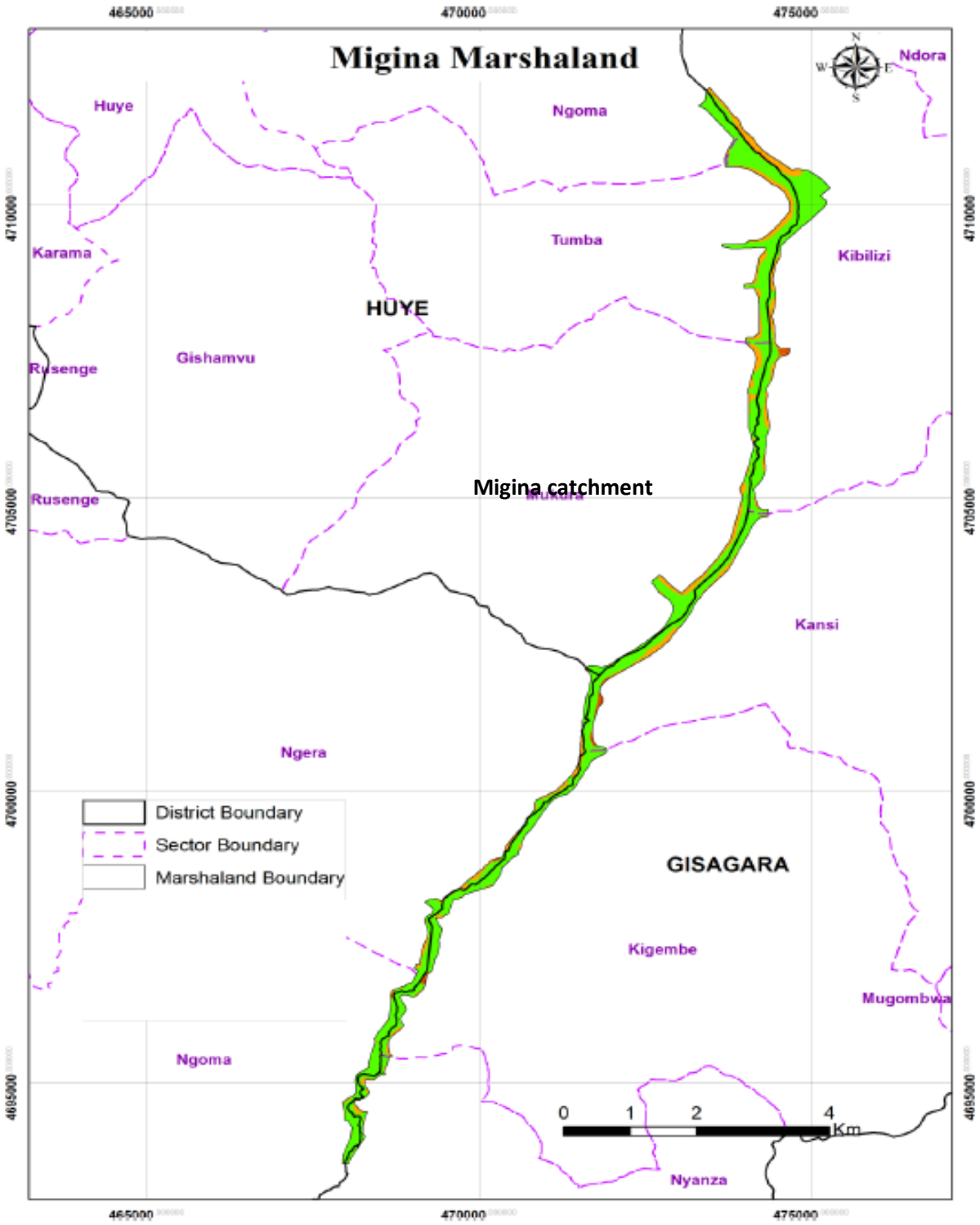

Figure 1: Migina project site location. (Source: SGIS, 2015)

2.2. DESCRIPTION OF THE PROJECT ACTIVITIES

Migina marshland rehabilitation project shall involve; rehabilitation of existing diversion weirs and canals, construction of new diversion weirs, canals, drains, levelling and demarcation of plots in the marshland to avoid flooding of the marshland during the wet season and yet provide water for adequate irrigation during the dry season.

2.2.1. Proposed project activities

In reference to the HYCOGEC technical design study, Migina marshland is located in the Southern Province boarded by three Districts. i.e. Huye, Gisagara and Nyaruguru.
The marshland is crossed by Cyihene River which receives Mukura as its main tributary on the right side at the end of the currently developed perimeter where the name of Migina is derived for the marshland. Besides Mukura River, there are also other tributaries: on the right side there is Kagera and at the left side towards the end of the developed perimeter there is Ruya while in the undeveloped perimeter we find Akaboti.

The river has a catchment area of 60 Km^2 at the upstream of the marshland (starting point of the project) and about 220 Km^2 at the end of the undeveloped perimeter (end of the project).
The currently net area of Migina marshland cultivated with rice is 184 ha and it's located in the upstream section of the marshland, while the total gross area of the marshland as per topographic survey is 548 ha. RSSP III proposes to rehabilitate this marshland with a purpose of managing flows of water in the marshland perimeter and provide quality irrigation better than that currently practiced.
The rehabilitation of the marshland starts at Rwasave fish ponds and ends at Migombero Bridge. The marshland is elongated with 25 Km length and 250 to 300m width (the minimum width is 150m).

It involves two perimeters of the Migina marshland elaborated hereafter and summarized in a table below:

1. *Developed perimeter (184ha)*- shall involve the rehabilitation of the existing irrigation network with the improvement of the irrigation system in the following manner:
    - The 4 existing head diversion weirs alongside with their gates will be rehabilitated;
    - Resizing of main canals and their equipment with structures which are stronger and more operational especially the secondary intakes;
    - Modification of the existing layout of secondary canals and their tertiary intakes.
    - A buffer zone, width of minimum 2m and average of 5m, will be established along the main canals both on the right and left banks of the marshland.

2. *Undeveloped perimeter (163ha)*- as a continuation of the developed perimeter, the irrigation layout of the undeveloped perimeter will be similar in order to establish to the full extent of the marshland a homogeneous hydro-agricultural network in its design and operation.

   - The design of head diversion weirs will thus be similar to those already constructed in the upstream part. Their number will be 4 with 3 new head diversion weirs that will be constructed along the river, the fourth will be the one that is already exists on Mukura River and it will be rehabilitated and protected against the water bypass. These head diversion weirs will be provided with intakes on both right and left sides.
   - The main and secondary canals will be plotted with minimal earthworks and they must dominate the sectors they irrigate. The drainage network will be formed by the main drain (Migina River).
   - Plots for the undeveloped perimeter shall have a slope of 0.6 per thousand and they be converted into rice fields. Bunds of 40 cm high and 50 cm of bottom width will be constructed to separate plots and also to provide flood irrigation. These bunds serve as footpaths and other paths will be built for pedestrian and motorcycle traffic for the purpose of having access to the head diversion weirs.
   - Again, a buffer zone, width of minimum 2m and average of 5m, will be established along the main canals both on the right and left banks of the marshland.

Table 5: Net irrigable area

Marshland perimeters	***Head diversion weirs***	***Codes for Sub-catchment of Diversion weirs***	***Irrigable areas covered by weirs (ha)***	***Total area per perimeter (ha)***	***Total potential irrigable area (ha)***
Developed perimeter	Existing N°.1	BEXIST1	69.42	184	**347**
	Existing N°.2	BEXIST2	40.01		
	Existing N°.3	BEXIST3	36.11		
	Existing N°.4	BEXIST4	38.75		
Undeveloped perimeter	Existing N°.5 on Mukura River	BEXIST5	38.22	163	
	Proposed N°.1	BEXT1	33.64		
	Proposed N°.2	BEXT2	29.61		
	Proposed N°.3	BEXT3	61.49		

Source: HYCOGEC Technical design study Report, 2016

Equipment used for the development – shall involve:

- During Construction- Excavator, grader, trucks, compactors, total stations, welding machines, hand tools (such as; wheel burrows, hoes, spades, trowels, dump levels)
- During operation- trowels, dump levels, wheel burrows for repair works.

Number of estimated staffing- shall involve:

- During construction- shall comprise of; engineers, hydrologists, technicians, masons and casual labourers. An estimate of up to 300 people/ day shall be employed for the mostly excavation works of the drains/canals.
- During operation- one (1) permanent mason shall be employed by the cooperatives, who may require two (2) temporary casual labourers only when repair works are required. This mason shall also be responsible for managing the diversion structures at the central drains.

Waste generated and its disposal

During construction- This stage is likely to have most waste compared to the operation stage. Most of the waste expected here is soil from excavated drains/ canals, cement debris from masonry works at the diversion structure. It is proposed that these soils may be used to backfill road ditches to level, fill borrow pits and quarries from where laterite shall be collected and the rest disposed at areas identified by the sector authorities for damping debris.

Water requirements- In reference to the technical design study, the water requirement for rice on dependable rainfall is 1.70-1.97 l/s/ha.

Water availability- In reference to the technical design study, the average ground water availability is 265mm/yr for Migina marshland.

CHAPTER 3: RELEVANT POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS

This chapter describes policies, laws, regulations and institutional framework that will be relevant, to the Migina marshland rehabilitation. Both international and national regulations are presented in the sections below.

3.1. NATIONAL LEGAL AND POLICY FRAMEWORKS

3.1.1. Organic law determining the modalities of environmental management

This organic law No 04/2005 of 08/04/2005 determines the modalities of protecting, conserving and promoting the environment in Rwanda. 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 (EIA), before obtaining authorization 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.

EIA is a tool for prevention and control of environmental impacts caused by socio-economic development. The "General Guidelines and Procedures for Environmental Impact Assessment, 2006" were prepared to improve EIA practice in Rwanda and they aim to serve agencies and individuals taking part in the EIA process.

The guidelines are designed to ensure that participants in the EIA process understand their roles and that laws and regulations are interpreted correctly and consistently. Two main principles underlie these general guidelines: first, they comply with the legal and institutional frameworks on environmental protection in Rwanda and, second, they contribute to improvement of quality and efficiency of EIA process in the country, and as such merge, step by step, with general global trends and practice of conducting EIA.

RSSP 3 understands these regulations and the need for an EIA for such a project, hence the recruitment of an Environmental firm to perform the EIA/ EMP of the Migina marshland project, with an eventual approval of this EIA/EMP report from REMA.

3.1.2. Law governing land in Rwanda

Articles of the organic law no. 43/2013 governing land in Rwanda relevant to the Migina marshland are article 14, 30 and 34. Where article 14, informs us that State land in the private

domain shall comprise of among others land reserved for public activities of which unprotected swamps/marshlands such as Migina are classified.

Furthermore article 30, respectively indicates that for purposes of optimization of productivity, an Order of the Minister in charge of Agriculture and Animal Resources (MINAGRI) shall set up procedures and modalities of land use consolidation for agricultural and livestock purposes. Development of Migina marshland to allow for organised drainage during wet season and distribution of water for irrigation during dry season are all modalities initiated by MINAGRI.

Regarding land rights, article 34, states that the State recognizes the right to freely own land and shall protect the land owner from being dispossessed of the land whether totally or partially, except in case of expropriation due to public interest.

From field public consultation and review of the technical design study, it was observed that all works are in the marshland that is owned by Government, the main canals proposed for construction along contours of the marshland foot hillsides and their buffer zone of 2-5m, shall still be within the 20m buffer zone of the marshland under ownership of Government. This implies that no land expropriation is likely under the implementation of this project.

3.1.3. Law relating to expropriation in the Public interest

Based on the *law no. 32/2015* article 3, Only Government shall carry out expropriation only in the public interest and with prior and just compensation. No person shall hinder the implementation of the program of expropriation on pretext of self- centred justifications.
Article 4 also states that every project, at any level, which intends to carry out acts of expropriation in the public interest, shall budget for valuation of the property of the person to be expropriated and for fair compensation.
Activities of public interest shall include among others water dams, water pipes and public reservoirs, of which this project falls in.

It also informs us that a person to be expropriated shall be informed of the beginning of the process of the land survey and the inventory of the properties thereon.

A just compensation shall be reached through agreement between the person to expropriate and the one to be expropriated, the just compensation may be monetary or an alternative land and a building equivalent to the determination of just monetary compensation.

A ministerial order no. 002/16.01, determining reference land prices for all areas outside Kigali city was approved in 2010 and may guide pricing of land for expropriation in Migina marshland.

Considering the rehabilitation shall cover is as far as 5m beyond the main left and right side main canals of the marshland, an area within the 20m buffer zone of a marshland and still within Government land tenure , this law and ministerial order might not apply.

3.1.4. Strategic Plan for Agricultural Transformation III (SPAT III)

Referring to the Strategic Plan for Agricultural Transformation III, 2009, 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. Four Programmes lie at the heart of the SPAT III but programme 1 is the most relevant to Migina project.

Programme 1: Physical resources and food production involves intensification and development of sustainable production systems. Migina project is involved in at least four (4) sub-programmes under it. For example; (i) *sub-programme 1.1*- Sustainable management of natural resources and water and soil conservation which is the proper drainage and water distribution in the entire marshland, (ii) *Sub-programme 1.3*- Marshland development, (iii) *Sub-programme 1.4*- irrigation development and (iv) *Sub-programme 1.5*- supply and use of inputs such as; fertilizers and certified seeds.

3.1.5. Irrigation master plan (IMP)

The IMP of 2010 has provided Rwanda with a planning tool for rational exploitation of its soil and water resources, with an intension to increase crop production of both staple foods for local consumption and high-value products for export. It supports decision making by giving guidance on; (i) identifying the most favourable areas to establish irrigation water infrastructure;(ii) estimating the water stock that can be used for irrigation; (iii) prioritising distribution of irrigation water; (iv) identifying means of transporting water to selected sites; (v) recommending means of abstraction for the chosen type of water source; (vi) establishing irrigated agriculture in small-, medium- and large-scale projects on hillsides, marshlands and other topographically suitable areas; (vii) identifying options for upgrading the agricultural value chain through appropriate training and extension (especially promoting the use of inputs, introducing mechanisation, training in postharvest management and marketing and sales); (viii) recommending options for water harvesting and storage; (ix) proposing solutions for drainage and flood mitigation; (x) recommending locations and management for water storage and hydroelectric purposes; (xi) producing a plan map for the potential irrigation areas (PIAs) that could be irrigated by the different kinds of water resources by agro climatic zone (ACZ) or even province level; and (xii) articulating the national policy options concerning the distribution of irrigation water.

With part of the Migina project involving irrigation, the technical design of the Migina irrigation scheme shall need to follow guidance and reference tools recommended in the IMP in preparing an accurate project that fits in the nation's holistic irrigation master plan.

3.1.6. Integrated water resources master plan (IWRMP)

The IWRMP policy focuses on conserving and protecting Rwanda's water, restoring its water reservoirs, ensuring efficiency and equity in allocation and use of water.

As one of the Integrated Water Resource Management (IWRM) strategy expected outcomes is the rehabilitation of the marshland to avoid flooding of the marshland and allow for proper drainage of water from the marshlands into their main streams hence restoring water reserves for the receiving water bodies and human water demand downstream.

3.2. REGIONAL POLICIES AND REGULATIONS

3.2.1. EAC protocol on environment and natural resources

This Protocol applies 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.

In regard to article 3 of this Protocol, 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; (vi) management of water resources;

Considering that Migina marshland has river streams that contribute to Akanyaru river which in turn contributes to the Akagera river that is partly a source of the Nile and even though these streams contribute low volumes to Akanyaru River, RSSP 3 activity on these streams shall need to involve hydrological investigations in the technical study to determine whether it triggers activity on shared trans-boundary resources and as such might have to follow the protocol of approval to use these streams for irrigation purposes.

3.3. World Bank Safeguard policies

3.3.1. Environmental Assessment- OP 4.01

In reference to the RSSP 3 Project Appraisal Document (PAD), the RSSP 3 project was classified under Category B project of the World Bank classification.

Migina project classified as a Category B project involves; excavation works for irrigation infrastructure, levelling of plots, interruption of existing areas of the Migina marshlands, modification of flows of river and its tributaries. It also involves social changes in the livelihood of those that currently depend on farming in the marshland. e.g. from maize crop to rice production. This would imply that study will require examination of its environmental impacts and propose mitigation measures.

3.3.2. Involuntary resettlement OP 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.

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) 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.

Considering the rehabilitation shall cover is as far as 5m beyond the main left and right side main canals of the marshland, an area within the 20m buffer zone of a marshland and still within Government land tenure , this safeguard policy might not apply. Furthermore for the crops that exist in the marshland, most of which are seasonal crops that do not last longer than 4months, these will be allowed for harvest before construction works can commence.

A RAP is therefore not required here.

3.3.3. Pest Management- OP 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 required under this safeguard policy.

The proponent is required to use various means to assess pest management in the project area, support integrated pest management (IPM) and the safe use of agricultural pesticides.

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.

RSSP 3 already has a Pest Management Plan (PMP) for 13 target crops including; rice, maize, potato, cassava, bananas, cassava, cabbage, carrots, green beans, onions, pineapple and mushroom.

Considering that the crops mainly grown in this marshland and those proposed are rice and maize, this PMP can be applied.

3.3.4. Natural habitat- OP 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 is required to 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.

Considering the study field observation, most of the project area is marshland where indigenous flora and fauna has been replaced by cultivated plantations of crops such as; rice, maize, soya beans. From an ecological point of view, the project might have minimal impact on indigenous natural habitat of this area. Instead most natural habitat influence could be on changes in existing crops.

3.3.5. Physical Cultural resources- OP 4.11

This policy addresses management of 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 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.

3.3.6. Safety of Dams- OP 4.37

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.

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.

This project shall comprise; (i) the rehabilitation of 5 already existing diversion weirs and (ii) construction of 3 diversion weirs. All this could be classified under small dams.

3.3.7. Projects on International Waterways- OP 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.

Migina marshland rehabilitation project involves managing the distribution of water from the Migina river, a tributary of Akagera River for irrigation purposes. Akagera is shared by Rwanda and Burundi at this point is one of the sources of the River Nile a transboundary river shared in East Africa. It is necessary that notification of the proposed project to riparian countries before execution, in the event that it has not yet been done.

Table 6: Safeguard policies triggered by the project

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP 4.01) The Migina project has been classified under category B as per the World Bank categorisation. The project will involve investments in drainage and irrigation infrastructure. Each of these bares impacts on the physical, biological and social environment existing hence triggering this policy.	[X]	[ ]
Natural Habitats (OP 4.04) Migina marshland has been under constant cultivation with main crops being rice and maize. This implies that the impact of project activities on flora and fauna is minimal or none since there will be no change in crops hence no change in habitat. These minimal or small pockets of emergent plants could be affected by the rehabilitation marshland.	[X]	[ ]
Pest Management (OP 4.09) With field observations of local farmers applying pesticides to their rice and maize, this policy shall be triggered and hence require the RSSP 3 Pest Management Plan will be used to address the requirements of this policy.	[X]	[ ]
Physical Cultural Resources (OP 4.11) Field studies, consultation with locals and cultural institutions such as National Museum and scholars from University of Rwanda (UR) did not indicate cultural heritage. Where as in certain incidences a chance of find procedure is prepared for unexpected findings, this project is restricted to marshland which dating from past have been protected from any cultural artefacts, hence project activities are not likely to trigger this safeguard policy.	[ ]	[X]
Involuntary resettlement (OP- 4.12) Considering the rehabilitation shall be restricted to boundaries of the marshland within Government land tenure and the farmers currently dependent on this marshland shall still remain and benefit from cultivating in the rehabilitated marshland, physical or economic displacement cannot be sighted here and hence not triggering by this policy	[ ]	[X]

Dam safety (OP 4.37) The project involves construction of rehabilitation of 5 existing diversion weirs and construction of 3 new diversion weirs. These are categorized under the small dam, requiring qualified 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	[X]	[ ]
Projects on International Waterways- OP- 7.50 This being an Irrigation project on a tributary river to the Akagera river shared by Nile basin riparian countries. It is very likely that this policy is triggered by the project	[X]	[ ]

3.4. INSTITUTIONAL FRAMEWORK

For the Migina Irrigation development scheme to succeed, a number of key implementers shall be involved that include; MINAGRI, RSSP3, REMA, MINIRENA, RNRA, RDB, Local government, local cooperatives and the World Bank. The roles and responsibilities of each of these implementers are elaborated hereafter.

MINAGRI/ RSSP 3

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 3. RSSP 3 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.

RSSP 3 has been involved in procuring and coordinating services towards, preparation of the technical study of Migina project, sensitization of locals of the project intervention in preparation of the launch of this project and will coordinate and monitor the entire drainage and irrigation infrastructure installations. RSSP3 is vastly experienced in marshland irrigation projects dating back its experience as far as 2002 and now its third phase.

World Bank

The World Bank, as the lender, shall support the project team to ensure that the Migina project follows all World Bank safeguard policies that the project is found to trigger before funds are realised for this project.

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. It shall therefore 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.

Regarding the need for notification to Nile basin riparian countries on project activities proposed for Migina River, a tributary to Akagera Basin, World Bank policy for projects on International waterways agrees to the Nile Basin Initiative (NBI) secretariat can undertake notification to other NBI riparian of the Bank financed projects as seen a quotation below picked from the World Bank policy for International waterways.

MINIRENA, with guidance from MINAGRI on project proposed activities, will request NBI Secretariat to notify all Nile basin riparian countries on Rwanda's behalf.

"The Bank has agreed that the NBI Secretariat can undertake the notification to the other Nile riparian states for Bank-financed projects, following a request to this effect from the Nile Council of Ministers. Under this agreement, the NBI Secretariat act on behalf of the borrower. It sends the notification to all the other raparians, and asks for any responses they may have. It coordinates actions during the notification process with the borrower, as well as the Bank. The Bank agreed to this agreement because it is felt that it would advance the process of the exchange of data and information and streamline the notification process among the Nile riparian states." The World Bank Policy for projects on International Waterways- A historical and legal analysis, 2009 (pg 114).

REMA

REMA is the authority in charge of supervising, monitoring and ensuring that issues relating to environment are integrated in all national development programs. REMA has following main mission: (i) to implement Government environmental policy; (ii) to advise the Government on policies, strategies and legislation related to the management of the environment as well as the implementation of environment related international conventions, whenever deemed necessary; (iii) to conduct thorough inspection of environmental management in order to prepare a report on the status of environment in Rwanda that shall be published every two (2) years; (iv) to put in place measures designed to prevent climate change and cope with its impacts; (v) to conduct studies, research, investigations and other relevant activities in the field of environment and publish the findings; (vi) to closely monitor and assess development programs to ensure compliance with the laws on environment during their preparation and implementation; (vii) to participate in the preparation of activities strategies designed to prevent risks and other phenomena which may cause environmental degradation and propose remedial measures; (viii) to provide, where it is necessary, advice and technical support to

individuals or entities engaged in natural resources management and environmental conservation; (ix) to prepare, publish and disseminate education materials relating to guidelines and laws relating to environmental management and protection and reduce environmental degradation risks; (x) to monitor and supervise impact assessment, environmental audit, strategic environmental assessment and any other environmental study. REMA may authorize, in writing, any other person to analyze and approve these studies; (xi) to establish relationships and cooperate with national and international institutions and organizations in charge of environment and any other bodies that may help REMA to fulfill its mission.

RDB

Whereas REMA, as the authorised Government institution to determine modalities of protection, conservation and promotion of the environment in Rwanda, has since 2009 delegated responsibility to review EIA reports to Rwanda Development Board (RDB). In regard to this study, RDB shall authorise the project to proceed by issuing an EIA certificate and periodically monitor the project activities to ensure mitigation measures are implemented and that it has no adverse impacts on the environment.

RNRA

It is the authority that oversees 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 especially in this case that the project is meant to divert water from the River, drain and irrigate the marshland. An ecological flow for the downstream should still be maintained even after the diversion weirs, drains and canals are operating. Working independently like REMA, RNRA will periodically visit and assess the extent of project influence on natural resources in the area.

Local Governments

Local government shall be considered under the jurisdiction of the three (3) districts (i.e. Huye, Gisagara and Nyaruguru) and the eight (8) sectors of project influence; Kibirizi, Kansi, Kigembe, Nyanza, Tumba, Mukura, Ngera and Ngoma sectors. Local authorities that include; the District Mayor and Executive secretaries for the sectors, sector Agronomists, Cell leaders, Cell Socio-economic development officers and local opinion leaders have or shall be at the forefront of organizing local farmers into group committees, cooperatives and eventually shall organise for Water Users Associations (WUAs), participating in demarcation of plots in the marshland, conflict resolutions amongst farmers, market access for farmers among others. All these activities shall be done in conjunction with RSSP 3 site coordination.

Cooperatives

Existing cooperatives such as; KOYABIRWIKI "Koperative ihinga ibigori mugishanga cya Cyihene na Rwibona" and KORAMUKI in Kigembe, play a huge role in the entire project cycle. The project shall take advantage of existence of these cooperatives to:

- Involve them in the project design
- Capacity building on the organisation and management of the cooperatives and its members .i.e. financial management, group organisation, committee selection.
- Introduction, capacity building and management of Water Users Associations(WUA)

This way the cooperatives will be able to manage the marshland during and even after rehabilitation is complete, control distribution of water in order to maintain all year crop production, ensure the marshland infrastructure is regularly maintained.

3.5. SAFEGUARDS INSTRUMENTS

3.5.1. Environmental and Social Management Framework (ESMF)

The RSSP 3 ESMF is currently used by the MINAGRI to ensure that the World Bank safeguard OP 4.01 for environmental assessment and other relevant policies (e.g. Natural Habitats, Forests, Pest Management) are adequately addressed. The ESMF is an instrument used to guide RSSP 3 sub-project's in the identification, assessment, evaluation of environmental and social impacts and in the proposal of appropriate mitigation, management and monitoring measures, designed and incorporated within the sub-project itself.

The ESMF was prepared for the overall projects at commencement of RSSP3, as the project activities were not clearly defined at the time of project preparation. It sets out guidelines of how the screening, mitigation, monitoring and institutional measures are to be taken during design, implementation and operation of sub-project activities to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The RSSP 3 ESMF has already identified likely impacts to be caused by RSSP 3 sub-projects and categorized them under the adverse and positive impacts. The ESMF is used by the project to guide the preparation of the site-specific ESIAs.

These impacts listed in the ESMF were used for screening of the activities of Migina project to determine which of them are relevant in this case before mitigation measures would be proposed.

3.5.2. Resettlement Policy Framework (RPF)

The purpose of the RPF is to ensure that the World Bank safeguard OP 4.12 for involuntary resettlement and national requirements for land acquisition and resettlement are adequately addressed. It presents the objectives, principles, organizational arrangements and funding mechanisms for any displacement and resettlements that may be necessary during implementation of RSSP 3.

The RPF highlights the difference between Rwandan legislation and the World Bank policy OP 4.12. It gives guidance on the steps taken in the preparation and implementation of a Resettlement Action Plan (RAP), such as; consultation, screening and RAP development process, notification to affected parties, agreement on compensation, contract payment, compensation payment and assistance in resettlement. It also elaborates how the grievance and redress mechanism will be done once the RAP is complete and how monitoring and evaluation of RAP recommendations shall proceed.

Considering the rehabilitation shall be restricted to boundaries of the marshland within Government land tenure, the type of crops grown are seasonal (lasting up to 3-4 months before harvesting) and the farmers currently dependent on this marshland shall still remain and benefit from cultivating in the rehabilitated marshland, physical or economic displacement cannot be sighted here and hence not requiring any resettlement.

3.5.3. Pest Management Plan

RSSP 3 already has a Pest Management Plan (PMP) for 13 target crops including; rice, maize, potato, cassava, bananas, cassava, cabbage, carrots, green beans, onions, pineapple and mushroom.

The PMP promotes Integrated Pest Management (IPM) and address the weaknesses of safe pesticide use through training of various stakeholders along the supply and use chain since the knowledge of different pesticides and awareness of the negative impacts is low among levels of sellers, users and extension agents of pesticides.

Considering that the crops mainly grown in this marshland are rice and maize, this PMP can be applied.

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, geology, hydrology, vegetation, soil, water and air quality. Physical parameters of the Migina site are discussed hereafter.

4.1.1. Climate

The average temperature in the southern part of Rwanda is relatively stable. The seasonal variations of the average temperatures are negligible. The average annual temperature varies between 19.1°C and 19.6°C. The minimum average temperatures are recorded in November (18.1°C - 19.1°C) where the maximum average temperatures are recorded in July and August (20.0°C - 20.3°C) (S.H.E.R. 2003). The diurnal fluctuations however, can exceed 12°C and can be an important factor. *Verdoodt en Van Ranst, (2003)*

Near Butare, in the northern part of the Migina catchment, annual precipitation varies on average between 1,170 and 1,270 mm/yr. The average is based on meteorological data that was recorded from 1969 to 1992 at the airport of Butare (*S.H.E.R, 2003). Figure 2* shows data for precipitation and temperature from the Butare airport station. It shows that April is the wettest month, with on average 215 mm precipitation, while July is the driest month with on average less than 10 mm precipitation.

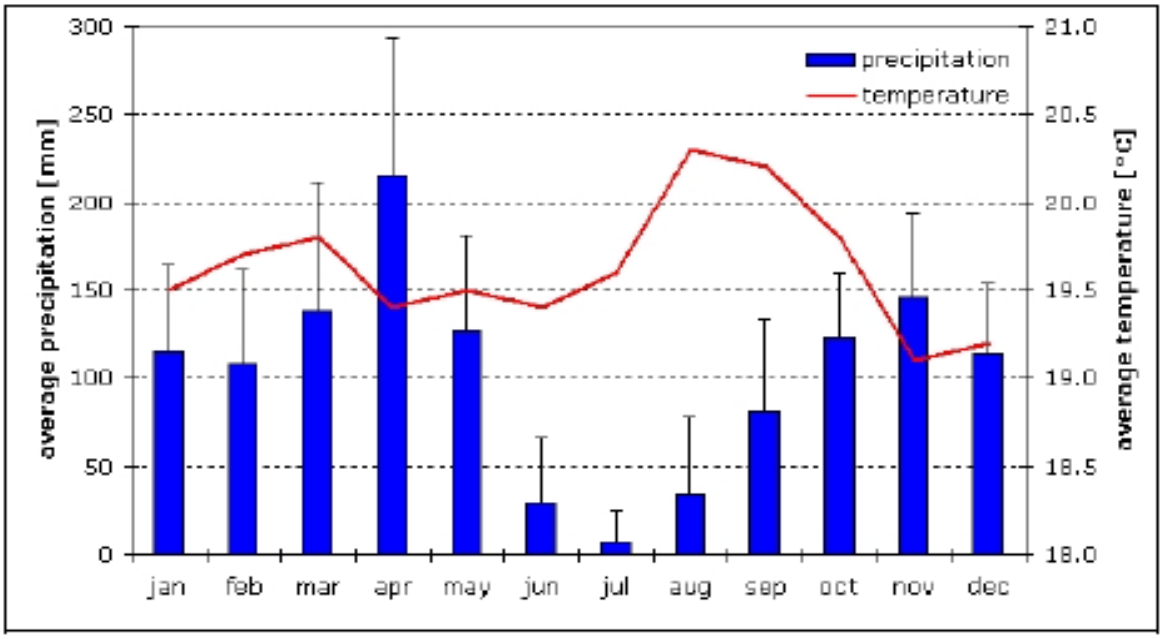

Figure 2: Average rainfall and temperatures at Butare Airport. (Source: Butare Station 2006-2013)

The annual actual evaporation in the southern part of Rwanda is estimated between 860-1,050 mm/yr. *Harmen et al. (2010).*

4.1.2. Hydrology

The Migina catchment is drained by perennial streams. The main flow direction in the catchment is from north to south. The main stream is located in the eastern part of the catchment. Therefore, most of the valleys drain from north-west to south-east towards the main stream.

In the northern part, the three main rivers are called Ruranga, Ndobogo and Rwantama. Those rivers drain into the Cyenzubuhoro, which is the river in the valley that is situated east from Butare. The Kadahokwa drains through the Mukura into the Migina, which is the name of the river until the outlet into the Akanyaru. South of Kadahokwa catchment, a river called the Kagera drains the water coming from the surrounding area into the Migina. Upstream the Kagera gains water from three smaller streams: Musizi, Umukura and Nyiranda *(figure 3).* The Migina catchment drains into the Akanyaru River, which forms the border between Rwanda and Burundi. *Harmen et al. (2010)*

Figure 3: Rivers in Migina catchment (Source: Munyaneza *et al*. 2011)

4.1.2.1. Water yield in catchment

The water yield of any catchment depends on the existing surface and ground water resources. It was important to study these existing water resources as they would affect and be affected by the water flow into the proposed infrastructure (drains and irrigation channels). Water yield is calculated by:

$$\text{Water Yield} = \frac{\text{Mean annual volume of stream flow (produced in a nested watershed)}}{\text{Area of the nested watershed}}$$

It can also be expressed as the difference between precipitation and evaporation. Based on climate conditions above; Mean annual precipitation can be estimated at 1,220mm/yr and mean annual evaporation at 955mm/yr.

This implies that water yield for Migina catchment can be estimated at:
1220-955 = 265mm/yr (retained in Migina watershed)

4.1.2.2. Derivation of flow data for Migina marshland

Discharge- Reference made to the HYCOGEC Technical Design study, the estimation of flood flows from three methods (i.e. 1-hydrograph theory, 2-hydraulic, 3-reference method) give annual average flows for a five year return flood as shown in Table 4, against each sub-watershed of existing or proposed diversion weirs.

Table 7: Flood flow estimates in m^3/s.

Methods	BEXIST1	BEXIST2	BEXIST3	BEXIST4	BEXIST5 Mukura	BEXT1	BEXT2	BEXT3
1	15.96	17.19	18.73	18.51	15.11	25.62	27.13	29.87
2	10.31	11.32	13.41	12.16	15.11	20.67	27.13	29.87
Reference method	14,87	18,02	20,95	22,42	13,37	23,28	26,55	33,40
Average	13,71	15,51	17,69	17,69	14,53	23,19	26,93	31,04

Source: HYCOGEC Technical Design Report, 2016.

4.1.2.3. Water use and demand

Principal Water Users

It was important to identify the principal water users upstream and downstream of the marshland area as the proposed irrigation developments are bound to impact the current and future uses of the water resource. Consultations with the local authorities in the area revealed that subsistence agriculture is the major use of the marshland.

Water for irrigation

Existing agricultural practices-The existing agricultural practice in Migina is subsistence farming for crops which include; rice and maize and soya beans as alternatives for maize.

Proposed agricultural development- Based on the technical Study as calculated on crop water requirements estimated for rice crop for the dry year period, water demands have relatively high values (from 1.50 to 1.98 l /s/ha) during the growing periods beginning in February and

September against a fairly significant drop (from 1.20 to 1.25 l/s/ha) as soon as the rainy season may have actually settled. *HYCOGEC Technical Design Report. (2016)*

4.1.2.4. Water Quality assessment

Water Quality Analysis

Given that the primary use for water from the proposed Migina marshland development is irrigation, water quality parameters of interest are; pH, Electrical Conductivity (EC), Phosphates, Nitrates, Colour, Turbidity, Total Dissolved Solids (TDS), Total Alkalinity (TA), Magnesium, Calcium, Chloride, Hydro carbonates and Sulphates.

During the Migina project EIA study, water samples were obtained from Migina river. The water samples were analysed and tested for nutrients, chemicals and physical variables from the University of Rwanda, College of Science and Technology water laboratory. The observed results of the laboratory analysis were then compared descriptively with the existing international standards. Results of the analysis are shown in *Table 8*.

Table 8: Water Quality Results

S/No	Parameters	Units	Migina	RS188:2013 Standards for Irrigation Water
1	E. Conductivity	µs/cm	93	<750
2	Total Dissolved Solids (TDS)	mg/l	31.2	<450
3	pH		6.6	6.5-8.4
4	Chloride	meq/l	3.13	<4
5	Calcium	mg/l	7.85	0-20
6	Magnesium	mg/l	2.64	0-5
7	Sulphates	mg/l	13.18	0-20
8	Hydro Carbonate	mg/l	16.21	<1.5

Source: Harmen et al. (2010)

Discussions:

The pH in water which describes its alkalinity or acidity affects plant growth, irrigation equipment, pesticide efficiency and drinking water. The pH tested for the River water was in the range of 6.6 which is well within the acceptable range for irrigation of 6.5 and 8.4 and is in line with that of natural waters.

High alkalinity (pH > 8), an indication of presence of high concentrations of bicarbonate and carbonates, can result in precipitation of calcium from the soil which reduces the soil's

exchangeable calcium content and increases soil sodicity and loss of magnesium, and decrease in copper and zinc. These conditions would affect plant growth.

High levels of carbonates and bicarbonates can also cause blockages in irrigation equipment or precipitation of calcium and magnesium ions, thereby increasing adsorption ratio (SAR) SAR.

The SAR is a measure of the potential sodium hazard for crops and soil. When sodium (Na+) occupies cation exchange sites at the expense of more stabilizing ions (Ca^{2+}, Mg^{2+}, CO_3^{2-}, and HCO_3^-), soil stability can be compromised resulting in dispersion of clay and breakdown of aggregates. These processes can result in soil expansion and surface crusting, which reduce infiltration and therefore, can reduce crop growth due to moisture stress. Carbonates in the water sample were within acceptable limits, while hydro carbonates were on the higher side as shown in table 6.

Electrical conductivity measures the ability of a solution to conduct an electrical current, which is directly related to the concentration of dissolved salts. High concentration of salts in the plant root zone causes moisture stress. The parameter EC indicates the extent of dissolved solids in the water and hence the intensity of non-point sources of pollution. The observed value of EC of 93µS/cm is on the lower side indicating that the impact of human activities on water quality within the catchment is still low. The results for EC can be related to the determined values of Total Dissolved Solids (TDS). These are a measure of the sum of all the ions present in a sample of water and represent the total salt content of the water which in this case as 31. 2 mg/l.
Chloride (Cl^-) have the ability to accumulate in plant leaves through transpiration and direct absorption. Given the type of irrigation proposed in this project, this will not be an issue and the tested values are within the acceptable guidelines. Sulphate can contribute to salinity problems, but also can benefit crops by increasing fertility. All are in acceptable range of irrigating water standards.

Total hardness which is the measure of the amount of calcium and magnesium in water can useful for irrigation by countering the effects of sodium in the soil. Higher magnesium and sodium levels than calcium can induce deficiencies of potassium and calcium.

Based on the laboratory results from the EIA study, results of tests done on water samples collected from Migina are summarized in the Table 6. Most parameters were within acceptable limits for irrigation water.

Key parameters to watch out for during the operation phase of Migina project is exceeding Hydro carbonate levels that could affect plant growth due to moisture stress, cause blockages in irrigation equipment through precipitation.

4.1.2.5 Flood Assessment

The maximum flood discharge of a five year return period for the marshland computed using three methods (i.e. 1-hydrograph theory, 2-hydraulic, 3-reference method) was as shown in *Table 9*;

Table 9: Flood flows (m^3/s) for 5 year return periods

Methods	BEXIST1	BEXIST2	BEXIST3	BEXIST4	BEXIST5 Mukura	BEXT1	BEXT2	BEXT3
1	15.96	17.19	18.73	18.51	15.11	25.62	27.13	29.87
2	10.31	11.32	13.41	12.16	15.11	20.67	27.13	29.87
Reference method	14,87	18,02	20,95	22,42	13,37	23,28	26,55	33,40
Average	13,71	15,51	17,69	17,69	14,53	23,19	26,93	31,04

Source: HYCOGEC Technical Design Report, 2016.

4.1.3. Ecological flow analysis for Migina River

For purposes of establishing the minimum ecological flow level of water to be released to flow along the central drains (main streams) while maintaining the aquatic ecosystem a simple methodology referred to as 'Montana Method' proposed by Tennant (1976), where by environmental flow regimes are prescribed on the basis of the average daily discharge or the mean annual flow (MAF). This method provides guidelines for flow management based on the percentage of average flow, daily and monthly stream flow records, that would maintain biological attributes of a river as; optimum to outstanding habitat (when MAF is >60%), to sustain fair survival conditions (at a MAF of 30%), fair, poor, minimum, or degrading (at a MAF of 10%).

In absence of more reliable data and due to time limitations hindering rainfall-runoff modelling, the mean annual flow (MAF) was computed against the average flow estimates from the HYCOGEC technical study of approximately 20.03m^3/s flow, was used in this study.

10% of MAF is proposed to be the minimum level of flow required to be released through the central drains for purposes of maintaining the ecosystem. Computed 10% of the MAF values is 2m^3/s.

Table 10: Environmental flow values

Marshland	Mean Annual Flow (m^3/s)	Minimum Ecological flow 10% of the average flow (m^3/s)	Minimum flow from combined sub-catchments of Migina(m^3/s)[1]

[1] Source: HYCOGEC, (2016).

Migina	20.03	2	4.79

Given that the minimum flow characteristics in the various diversion weir sub-catchments of the marshland indicated in the technical study are above the computed ecological/environmental flow, at 4.79m^3/s, the recommended environmental/ecological flow of **2m^3/s** is suitable to for the main stream for maintenance of the ecosystem**.** Any flow below this ecological flow could affect the existing ecosystem in this river and hence is not acceptable.

4.1.4. Relief

In the western part of the Migina catchment, a chain of mountains is present. The 'Mont Huye' is located at the edge of the catchment, and has an elevation of 2,278m.a.s.l.

In figure, it can be observed that the relative low areas are at an elevation between 1,375 - 1,550m.a.s.l. The highest elevations are with an elevation between 2,100 - 2,626m.a.s.l.

In general, the western part of Migina catchment has a higher elevation than the eastern part. Towards the south, the hills and elevation becomes lower, with maximum elevations up to 1,900m.a.s.l. The eastern side of the catchment is relatively low. Not only hills but also marshlands form the border of the catchment, Migina marshland being the focus of this study. The river valley in Migina marshland has an elevation of approximately 1,650 m.a.s.l. *Harmen et al. (2010)*

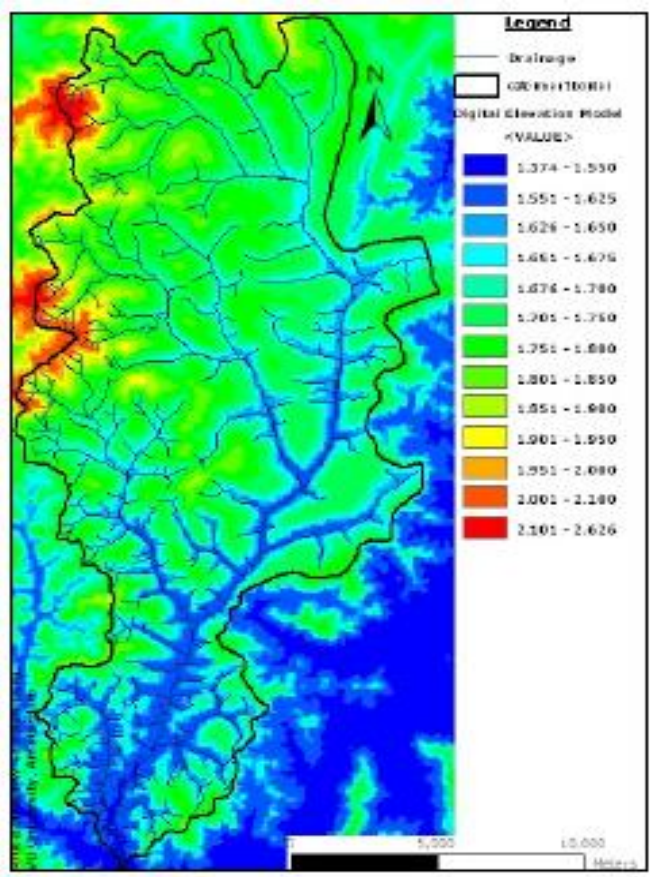

Figure 4: Topography of Migina catchment

4.1.5. Geology

The geology of the Migina catchment consists of very old granite rocks, overlain by substrates of grey quartzites and schists. These geological differences result in differences in topography. The mountain chain, with Mont Huye (2,278 m.a.s.l.), the Mont Tare, and some other hills in the western part of Migina, consists of quartz, which is very resistant against erosion. As a result, the isolated benches of hard rock that form the mountains have relatively steep slopes. The hills are in contrast with the approximately 100 m wide flat valley floors, which are mainly filled with shales, phyllite rock and alluvium. *Harorimana et al., (2007).*

In terms of groundwater productivity, quarzite and alluvial material is generally good for groundwater exploitation. The alluvial aquifer is an important storage for infiltrating river water and has potential for drinking water supply, good storage and high flow rates.

4.1.6. Soils

4.1.2.1. Soil profile

In comparison to the soil classification of Migina Marshland in the Technical design study, two representative (2) sites were chosen for soil profiling at the developed and undeveloped portions of the Migina marshland. The two soil profiles were prepared and described following the guidelines for soil profile study (FAO World Reference Base 2006). The selection of sites took into account the soil formation factors including; origin of parent materials, slope and moisture content.

A soil profile at about 1.5 to 2 m depth was prepared by casual labour under supervision of the soil scientist. The depth depended on the profile development and level of the water table.
Results in this EIA study appeared to concur with those of the technical study.
As indicated in the *Figure 5*, of the entire Migina marshland area of 548 ha, Inceptisols represents over 78.8 % (431.6 ha), while Oxisols covers around 20.0 % (108.2 ha). The remaining area of 1.2 % is covered by both Ultisols and Mollisols.

Inceptisols, *Fluventic Humitropepet* (RK- *Ruko soil series*): according to the Soil Map of Rwanda, Ruko soil series is a member of the soil family of *« Coarse-loamy, mixed, isohyperthermic Fluventic Humitropepts »* (Soil taxonomy). This series is composed of soils formed from colluvial and alluvial materials; silty, reddish gray/black, improperly drained and presenting a cambic formation between 1-2 m depth. These soils are not constrained by any gravelly load. They most characteristic pedo-climatic condition (soil moisture and temperature regimes) is *Udic Isothermic* regime. In the Migina watershed, the slope does not represent any physical constraint because this type of soil is found in lowlands, however it can be disturbed by sediments carried by soil erosion from surrounding hills. Ruko soil series covers around 430 ha in Migina scheme (~78.2 % of the total gross area). The other Inceptisols soil series found in the command area is KBA *Oxic Ustropepet (KBA)*, but covers an insignificant area of 1.75 ha at the upstream of the scheme.

Soil depth of most of Migina marshland is 0-50cm, about 79.6 % (436.2ha) classified under the Inceptisols, while at the foothills of the marshland soils of depth ranging between 100-200cm cover up to 108.26 ha classified as Oxisols.

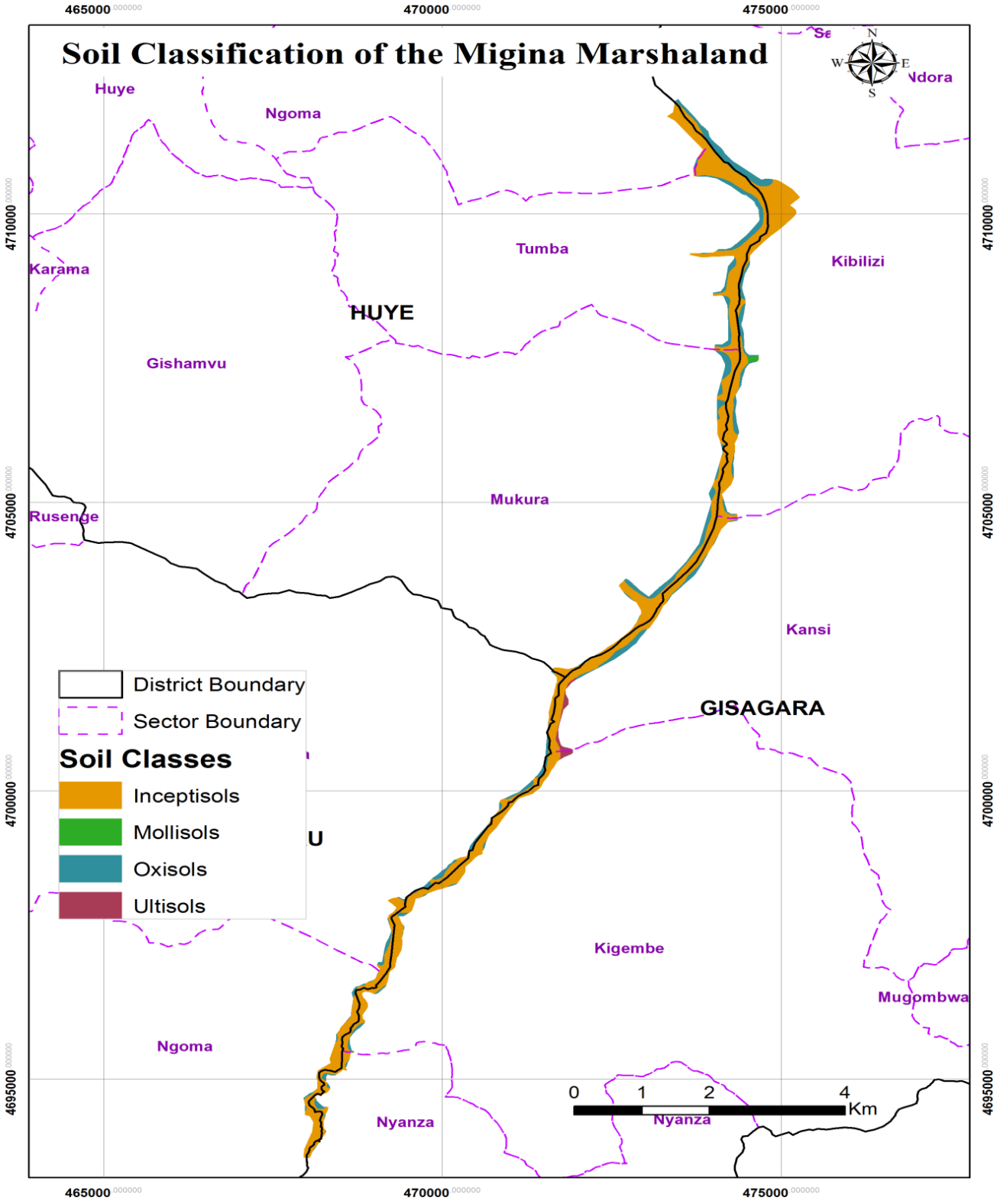

Figure 5: Soil classification in Migina marshland (Source HYCOGEC, 2016)

4.1.2.2. Soil lab results presentation and interpretation

Soil laboratory analysis indicated in the technical design study was reviewed and found representative and hence applied in coming up with impacts likely to be caused by project activities on the marshland soils. Laboratory analysis concerned the following parameters: Soil Organic Carbon, Soil pH, soil texture, exchangeable acidity, available Phosphorus, Ammonium concentration and Nitrates concentration.

Soil laboratory results presentation and discussion

The results presented in this section include:

Table 11: Summary Laboratory soil analysis results from Migina marshland

Profile & sample	*pH (Water)*	*Org. C (%)*	*TN (%)*	*Avail. P. (ppm)*	*CEC (CMolc. Kg-1)*	*Bulk density (g/cm³)*	*Texture*
Migina/Inceptisols	4.69	1.93	0.26	5.64	18.3	1.38-1.57	Sandy loam
Migina/Oxisols							Loamy sand

Results from soil analysis were discussed along three main items; Soil texture, bulk density and chemical composition. Basically discussing what these three items meant of the soils in Migina marshland and what project activities are required to improve soil fertility or avoid its degradation.

Soil texture-Soil texture strongly affects water retention capacity, infiltration rate and even nutrient availability to plants. In this case, the most dominant texture in the marshland is Sandy loam which possesses low water holding capacity and hence well drained. Though it was observed that in some parts shallow water tables exist mostly due to stratified sediment layers in deep horizons. This could be the cause of water logging in parts of the marshland, hence the need for an improved drainage system.

In terms of soil structure, repeated cultivation without efforts to redress the decline of soil structure may lead to a decrease in soil productivity in the longer term. Agriculture practices such as; organic manure application and minimum tillage will contribute in improving soil structure.

Bulk density- Bulk density of cultivated soils ranges between 0.9 and 1.8 g cm^{-3} in mineral surface horizons. *Brady and Weil, (2002).* Research evidence has shown that soil with bulk densities higher than 1.6 g/cm^3 impairs root growth due to very little macro pore space.
Soils in Migina marshland are in range of cultivable soils and below the density that constrains root growth. However, soil compaction by machinery could deteriorate these suitable qualities of this soil and hence should be avoided.

Soil Chemical composition-

- *Soil pH*- According to soil parameters standards for tropical soils, soils with a pH below 4.50 are considered to be extremely acid, whereas a pH range of 4.50 - 5.50 is judged as very strongly acid (*Landon, 1991)*. *Brady and Weil (2002)* state that most of cultivated crops require neutral to slightly acid soils for better development (pH ranging between 5.5- 7.0). At pH 4.69, most soils in Migina study area are therefore affected by very strong soil acidity. Soil acidity shall encourage, low nitrification rate, phosphorous deficiency, and aluminium and manganese toxicity, low mobility of organic pollutants and high availability of some heavy metals as indicated in *Mbonigaba, (2007).* To buffer this acidity, controlled measures of liming and application of organic manure to soils is necessary.
- *Organic Carbon (TOC)* - The 1.93 % Organic Carbon in most parts of the marshland is categorised in the low level (1.20-3.64 %), which may constitute a serious limitation for agriculture production in the area. To increase this Organic carbon level, improved cropping practices and integrated soil fertility management (ISFM) should be adopted by local farmers such as; mulching, crop residues recycling, application of organic manure and minimum ploughing.
- *Total Nitrogen (TN)* - 0.26% is considered in moderate to high category of TN in cultivable soils (0.13-0.47%). This is could be a result of the common use of NPK, DAP and Urea fertilizers in the crops currently grown in the marshland. Since TN is in abundance then limited quantities may be applied to avoid shooting beyond extreme levels. Controls such as soil tests periodically will assist in controlling TN levels and hence manage application of these common fertilizers.
- *Available P*- In reference to soil standards proposed by *Landon (1991),* a range of 5-15 mg/kg is considered to be high in tropical soils. P deficiency appears in soils with less than 5 mg/kg of available phosphorus. This marshland with an average value of 5.64mg/kg tends towards P deficiency, which could imply plant nutrition is not properly ensured if nothing is done.
- *Cation Exchange Capacity (CEC*)- An average value of 18.3 $cmol_c kg^{-1}$ is considered in the medium level(15-25 $cmol_c kg^{-1}$), a reasonable level for a cultivable soil. (CEC) of a soil refers to the total amount of exchangeable cations that a soil can retain and make available for plant uptake, or the total quantity of negative charges in soil existing on the surfaces of clay and organic matter colloids.

General proposals from the discussion of the soil in Migina marshland encourage application of organic manure, mulching, controlled use of lime to buffer acidity and controlled use of artificial fertilizers to improve soil fertility.

4.2. BIOLOGICAL ENVIRONMENT

4.1.2. Existing flora and fauna of the project area

General profile of study area

The landscape surrounding Migina marshland is hilly which are fragmented into various habitats such as; cropland and planted tree forests. The wetland in the valley is mostly cultivated with most rice and maize crops.

Diversity of flora

The vegetation varies depending on the habitat. Crops identified in the marshland include; rice and maize which occupy the largest cultivated area. Parts of the marshland that is not cultivated has mostly the following vegetation; *Cynodon spp* (locally known as Urwiri, Urucaca) and *Eragrostis spp* (locally known as Ishinge , Inyovu), shrubs like *Crassocephallus ducis-aprufii* (locally known as Isununu). Such vegetation is harvested and for some fed to cattle and others used as construction material.

Other flora seen in the marshland and at its foot hills was; *Psychotria spp* (locally known as ikibonobono), *Acanthus pubescens* (locally known as igitovu), *Bidens pilosa* (locally known as inyabarasanya), *Botriocline ugandensis* (locally known as igicumucumu), *Gynurascandens* (locally known as igifurarinda), *Solanum incanum* (locally known as igicumucumu*), Solanum capsicoides* (locally known as igitoborwa), *Solanum aculeastrum* (locally known as Igitoborwa)

Banana plantations are found on hillsides. Other vegetation includes; planted agroforestry trees such as *Calliandra calothyrsus* and *Alnus glutinosa* on the hillsides in an alley cropping system.

The following plant species dominate on hillsides in different areas of Migina marshland.

Tree/shrub species found on the hillsides along the Migina marshland have various uses such as:

- For Soil improvement: *Acacia mearnsii, Calliandra calothyrsus, Alnus acuminata*
- Soil stability: *Grevillea robusta, Eucalyptus spp. Eucalyptus maculata.*
- Shade: *Eucalyptus maculate, Acacia mearnsii.*
- Food and shelter to wildlife: *Alnus glutinosa*
- Fences: *Dracaena afromontana* and *Sambucus sp*.
- Medicinal: *Solanum aculeastrum*

Diversity of Fauna

Fauna observed in the area were some birds like; *Ardea spp* (locally known as ibiyongoyongo) which means there are perhaps some snakes or other crawling animals which the *Ardea* eat. Two species of other bird species were also observed which were *Threskiornis aethiopicus* and *Hagedashia hagedash* (locally known as Nyirabarazana). These birds eat small living in the mud.

A community of macro-invertebrate was observed in the main streams of the marshland such as; frog tadpoles, which is a good indication of a functioning ecosystem. Most common fauna in the marshland and surrounding hillsides are; cross breed Friesian cattle reared in homestead paddocks, sheep and pigs.

Diversity of Habitat

The landscape of the marshlands are characterised by a mosaic of different habitats that include; cropland, woodland and grassland. A small stream runs through each of the marshland with water at very low depth. The cropland takes up the wetland and hillsides. Hillsides are covered by temporary crops and agroforestry trees. The woodland has been planted by the local population and is sparsely found on cultivated hillsides. Grassland consists of perennial grass and sparsely found on fallow lands of hillsides.

The marshland has been alternatively exploited for agriculture of rice, maize and occasional vegetable growth. In such, it is unlikely to provide favourable niches to migratory birds and other local birds. No migration birds were observed at the site during field surveys. The survey has not also identified any endangered animal or bird species that can be affected by the developments.

From the assessment of the project area, interviews with the locals and consultation with University of Rwanda ecologist and with reference to the national ministerial order No. 007/2008, establishing the list of protected animal and plant species, the following fauna need protection:

- Black headed heron, *Ardea spp* (locally known as Uruyongoyongo). This species has existed around this marshland all the time rice and maize has been grown. Keeping in mind that project objective is to rehabilitate the marshland mainly for rice production, project activities are not likely to affect its habitat or its existence.

4.2. SOCIO-ECONOMIC ENVIRONMENT

This section attempts to understand the current social-economic status of the area of project influence versus the likely effects of the proposed project. It involved 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.

Social economic data collected from field during public consultation are; population and demography, land use, infrastructure (roads, water, electricity), health and sanitation, education, cultural heritage.

4.2.2. Social environment of project area

At Administrative level, Migina marshland is located in Gisagara District in the East, Huye and Nyaruguru Districts in the West. The Study area extends over these three Districts (i.e. Gisagara, Nyaruguru and Huye of Southern province). Four sectors Kibirizi, Kansi, Kigembe and Nyanza are from Gisagara District, Tumba and Mukura Sectors are in Huye District, while Ngera and Ngoma Sectors are located in Nyaruguru District. It covers eight (8) sectors of which 18 Cells are under the influence of project activity.

Social data collected from the field during public consultation with local authorities and locals was summarised in the *table 12* below.

Table 12: Summary of specific social environment of project area

Social Parameters	Districts		
	Gisagara	**Nyaruguru**	**Huye**
Migina Project awareness	Poor	Poor	Poor
Project local impression	Good	Good	Good
Project Activity	Diversion weirs, Drains, irrigation canals	Diversion weirs, Drains, irrigation canals	Diversion weirs, Drains, irrigation canals
No. of Sector	4	2	2
No. of Cells	18	12	9
No. of villages	9	5	4
No. of villages that will be affected	3	4	3
Population[2]	85,437	47,744	57,949
Households (HH)	18,178	10,158	5,417
Extent of community settlement "Imidugudu" (%)	70%	75%	89%
Schools	Existence of primary and secondary schools.	Existence of primary and secondary schools.	Existence of primary and secondary schools. University of Rwanda (UR) is located 3km from project site.
Health centres	1: Kibilizi Hospital. 2. 5 Health centres	1: No Hospital. 2. 2 Health centres	1: CHUB Hospital in Butare. 2. 2 Health centres

[2] Population census 2012 and its 2015 projections for Local Sectors of Migina project influence in the 3districts

Social Parameters	Districts		
	Gisagara	**Nyaruguru**	**Huye**
	3. 2 Health posts	3. No Health posts	3. 2 Health posts
Extent of Medical insurance "Mituelle de santé" (%)	80%	80%	84.3%
Resilient diseases like; malaria, dysentry, diarrhoea	Malaria is common probably from the marshland, rice and maize crops grown	Malaria is common probably from the marshland, rice and maize crops grown	Malaria is common probably from the marshland, rice and maize crops grown
Markets	All sectors have markets except Kigembe.	All sectors have markets except Ngera.	Rango market
Roads	All season Earth road around marshlands.	All season Earth road around marshlands.	All season Earth road around marshlands.
Housing	Generally, Earth houses with iron sheet roofing	Generally, Earth houses with iron sheet roofing	Generally, Earth houses with iron sheet roofing
Electricity	Only 5% Households (HH) have access to electricity in the project area	Only 5% HH have access to electricity	91% access to electricity
Cultural heritage points in the site area	None in site area, it's a marshland that has been under cultivation for a long time.	None in site area, it's a marshland that has been under cultivation for a long time.	None in site area, it's a marshland that has been under cultivation for a long time.
Maginalised people.	None	None	None
No. of cooperatives	1-Upper Developed marshland perimeter growing rice in Kibirizi in Gisagara District has no cooperatives, only groups of farmers by number of parcels, not organised. 2- Undeveloped perimeter,	1-In the Undeveloped perimeter, No cooperatives, only groups of farmers working in the marshland. Groups could include those owning up to 19 parcels.	1-Upper Developed marshland perimeter growing rice in Huye District has no cooperatives, only groups of farmers by number of parcels, not organised. Groups could include those owning

Social Parameters	Districts		
	Gisagara	**Nyaruguru**	**Huye**
	Cooperative exists in Kansi that grows only maize called KOYABIRWIKI "Koperative ihinga ibigori mu gishanga cya Cyihene na Rwibona" 3-Also in the Undeveloped perimeter, Cooperative exists in Kigembe that also grows maize called KORAMUKI.		up to 19 parcels
Cooperatives management	1-Cooperative in Kansi covers 36ha, has 400 members from Sectors of Kansi, Kigembe, Mukura and Ngera. Gender distribution- 210 women, 190 Men. 2-KORAMUKI covers Kigembe, has 623 members. Gender distribution- 310women, 313 men	Not Applicable	Not Applicable
Main income source	Agriculture	Agriculture	Agriculture
Crops commonly grown	Maize, Rice. Maize is alternated with beans, sweet potatoes and vegetables, while rice is grown in both seasons A and B.	Maize which is alternated with beans, sweet potatoes and vegetables.	Rice
Quantity produced	Rice: 50kg/acre. Maize: 100kg/acre	Rice: 50kg/acre. Maize: 100kg/acre	Rice: 50kg/acre. Maize: 100kg/acre
Farm in-puts & cost	Per parcel of 5acres: -Rice: 4kg of NPK, 2kg of Urea -Maize: 6kg DAP, 4kg of Urea, -Cost of NPK-550Rwf/kg	Per parcel of 5acres: -Rice: 4kg of NPK, 2kg of Urea -Maize: 6kg DAP, 4kg of Urea	Per parcel of 5acres: -Rice: 4kg of NPK, 2kg of Urea -Maize: 6kg DAP, 4kg of Urea -Cost of NPK-550Rwf/kg

Social Parameters	Districts		
	Gisagara	**Nyaruguru**	**Huye**
	-Cost of Urea- 390Rwf/kg	-Cost of NPK-550Rwf/kg -Cost of Urea- 390Rwf/kg	-Cost of Urea- 390Rwf/kg
Market selling price	Rice: 450-500Rwf/kg. Maize: 150-170Rwf/kg	Rice: 450-500Rwf/kg. Maize: 150-170Rwf/kg	Rice:450-500Rwf/kg Maize: 150-170Rwf/kg
Other sources of income	***Fish farming:*** Fish ponds generally cover; about 10acres for the largest pond with a fish capacity of 3-4,000Fish and the smallest pond covers 6acres with a fish capacity of 2000fish. *Cost of pond preparation* was estimated at; for the 10 acre pond it cost 600-800,000Rwf to construct, An approximate cost in the range of 60,000-80,000Rwf/acre. *Quantity estimate produced*- In 3-4months, 10 ponds harvested 200-300kg of fish. *Cost of fingerlings*- Cost of a 50g fingerling is 50Rwf, while any above 50g up to 100g would cost 100Rwf. *Cost of harvested fish*- 1kg is sold at 2,000Rwf. Total estimated revenues in 3-4 months could be 400-600,000rwf an equivalent of 130-150,000Rwf/month. Other livestock reared at fish ponds are rabbits, whose waste is improves plankton content in the water, which is good food for fish. *Pond water quality and disposal*- The study was informed that once the water quality in the ponds had degraded, it was emptied by draining it back to the main River Migina and refilling from the upper stream of the river fresh water. *Water capacity*- The amount of water an average fish pond requires is 2,700m^3 for each fill that is emptied at least once a week. *No. of fish ponds in the area*- estimated at 23 ponds, downstream, between the proposed location of the new diversion weir No.2 and 3. *Land tenure*- none of these farmers legally own the land. It is land rented from government		None

Social Parameters	Districts		
	Gisagara	**Nyaruguru**	**Huye**
Livestock reared	Cattle, pigs, goats, sheep and poultry only at home stead level.	Cattle, pigs, goats, sheep and poultry only at home stead level.	Cattle, pigs, goats, sheep and poultry only at home stead level.
Other projects in site area.	FXB	None in site area other than VUP and FXB	None in site area other than VUP and FXB
Extent of Land registration	All land complete	All land complete	All land complete
Land tenure	Cultivated marshland land is rented out from Government in this case local Sectors.	Cultivated marshland land is rented out from Government in this case local Sectors.	Cultivated marshland land is rented out from Government in this case local Sectors.
Areas of expropriation due to project	None. All project activity is in the marshland owned by Government.	None. All project activity is in the marshland owned by Government.	None. All project activity is in the marshland owned by Government.

Source: Data from field consultation and Sector records April 2016.

4.2.2.1. Social- economic data discussion:

- *Project interpretation and local impression*- Though project awareness by local farmers was reported as poor, it was observed that once the objectives of the marshland rehabilitation were explained to farmers, they appreciated purpose of this project.
- *Crop farming and crop preference*-it was observed that common crops grown in the marshland are mainly rice and maize. Although RSSP 3 advocates for rice growing as the single crop after completion of marshland rehabilitation, there is need for RSSP 3 to strike a balance between already established areas and cooperatives already dealing in maize. Some of the maize cooperatives, an example of KORAMUKI and that it Kigembe, already have established contracts to supply maize to World Food Program (WFP) and Rwanda Agricultural Board (RAB) which cannot be forgone for rice.
- *Market infrastructure access*- All Sectors have market infrastructure except for Kigembe and Ngera. Whereas Maize cooperatives are organised and have been able to have collective harvests from its members, collectively bargained selling price for maize and obtained consolidated supply contracts, Rice farmers are still individually harvesting, threshing and selling in a disorganised manner.
- *Education levels*- Availability of primary, secondary and tertiary institutions with proximity of the marshland, this area has skilled labour to support technicalities involved in the construction of the irrigation infrastructure and its maintenance during operation.
- *Resilient diseases*- Records from the sectors and public consultation indicate that Malaria is the common diseases. This is probably due to conducive conditions for mosquito breeding. i.e. Marshland, rice and maize growing.
- *Medical insurance*- As per this financial year, all sectors indicate a very good coverage of medical insurance (above 80%) by its locals. This could imply a low mortality rate in this area from diseases.
- *Access roads to proposed drains and canal infrastructure*- Whereas the roads that surround these marshlands are well compacted all season earth roads, there are no roads or clear paths to the existing or proposed diversion weirs. Considering the extent of project works that does not require heavy equipment, existing roads shall sustain these works but with a need to have access paths to diversion weirs.
- *Cultural heritage*- Cultural heritage was investigated on site, such as; Genocide memorial sites, cultural monuments, religious set-ups, grave yards or cemeteries, traditional heritage. Information from public consultation with locals and their authorities indicated that there were no such things especially since the project is restricted to the marshland area under cultivation only.
- *Cooperatives*- KORAMUKI in Kansi and the Cooperative in Kigembe are the only cooperatives operating in Migina marshland and only growing maize.

Other Sectors lack cooperatives, only have farmer groups that are not well organised, harvest and sell individually, which could lead to poor management of the marshland and low income from crop sell. It was further noticed that whereas these cooperatives are operating, their management shall require more skilled training and most importantly in the areas of maintaining irrigation infrastructure, water distribution, water conflict management and financial management.

For existing cooperatives there is a good representation of women with more than 50% membership a good sign of gender equality and empowerment.

- *Comparison of Crop profitability*- Comparison of rice versus maize indicates that although rice produced per acre is half that of maize, the amount of fertilizer applied per acre of rice is half that of maize and its selling price per kg is over thrice the price of maize. This could mean rice is more profitable than maize, however, decision on what crop shall be grown where on the marshland shall be have to be discussed and agreed with the existing farmers before its implemented to encourage ownership by the local farmer, considering that the organised cooperatives grow maize and already have established contracts for supply.

  In the event that maize is considered a new crop water requirement for maize shall be analysed to determine whether flows designed for rice growing are sufficient.

- *Economic activities*- Source of Income in Households is mainly from crops harvested, in particular rice and maize. Other income sources are from fish farming. Small periodic income could be fetched from selling small livestock like; goats and at times cattle. Illegal sand mining and brick making along the river are practiced, however, owners of these sources of income were not receptive to public consultation considering their illegality. There is hardly any income from trading.

  From public consultation with rice and maize farmers in the marshland, income from crops harvested, a farm is capable of earning about:

  - From rice- a farmer is capable of earning profits of 24,400Rwf /acre of cultivated rice, considering revenue of 25000Rwf/ acre with about 600Rwf/acre of NPK and Urea In-puts.
  - From maize- a farmer is capable of earning profits of 16,000Rwf/ acre of cultivated maize, considering 17,000Rwf/ acre with about 1000Rwf/acre of NPK and Urea in-puts.

The other source of income from fishing shows that fish farmers are likely to to a *t*otal estimated revenues in 3-4 months of 400-600,000rwf an equivalent of 130-150,000Rwf/month.

CHAPTER 5: STAKEHOLDERS CONSULTATION AND PUBLIC PARTICIPATION

a) Stakeholders consulted and how they were approached:

Reference made to methodology applied in identification of stakeholders and their concerns, the study was able to conduct public consultation of the three (3) categories of stakeholders.

- *First category* of Government officials were met, which included; RSSP 3 and MINAGRI. By using the key guiding questionnaires in *appendix 3*, we were able to guide discussions and obtained relevant information on project activities.
- The *Second category* met was of Local government officials, which included; Sector agronomists for the Districts of project intervention. (i.e. Kibirizi, Kansi, Kigembe, Mukura sectors). With the assistance of RSSP 3 District Rural engineer, we were able to approach these officials. Our discussions with them were again guided by the social interview questions *in appendix 3,* from which information on project benefits, constraints in implementing the project and impacts likely to be caused by the project were reflected.
- The *Third category* was most important were the local farmers that cultivate in Migina marshland. These were farmers from; Tumba and Mukura currently organised in groups that grow rice, Kibirizi farmers currently organised in groups that grow rice, Kigembe, Ngoma and Ngera farmers currently organised in the Cooperative KORAMUKI that grow Maize, Kansi, Tumba and Nyanza farmers currently organised in the Cooperative Cyihene na Rubona that grow Maize. These too were guided by the social interview questions *in appendix 3,* from which information on project benefits and adverse impacts were aired out.

b) Method for reaching stakeholders:

- Other than RSSP 3 Staff, an introduction letter was used to approach other government institution and local authorities at the sector level during the consultation. Also RSSP 3 coordination team at the project area assisted in getting appointments with local authorities at the sector and cell levels.
- Once the study had consulted with the Sector, the consultant was assigned an agronomist of the Sector planned to be visited. From these local authorities, cooperatives of the local farmers working these marshlands were identified and appointments made to meet heads of these cooperatives along with local farmers (members of the cooperatives). Group discussions and interviews were used as techniques of disseminating information to the farmers and obtaining information from them.
- Methods applied were: different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD), public meetings with farmers and Informed Consultation Participation (ICP) with Key stakeholder representatives.

c) Schedule of consultations

Meetings and group gatherings with stakeholders were scheduled as such:

- *21stMarch 2016-* In Kigali, meetings were held with RSSP 3 Rural engineer and Environment safeguards specialist.

- *31st March 2016*- A field acquaintance visit of the Migina project area. Tumba and Mukura Sectors of Huye District, Kibirizi, Kansi, Kigembe, Nyanza Sectors of Gisagara District, Ngera and Ngoma Sectors of Nyaruguru Districts were visited guided by RSSP 3 District Rural Engineer.
- *8th, 11th – 13th April 2016*- In the project area, field public consultation meetings were held with the Sector agronomists and members of the Cooperatives and groups of farmers operating in the marshland, likes of; KORAMUKI and Koperative ya Cyihene na Rwibona and rice growing groups of Kibirizi (i.e. From Sectors of Kibirizi, Tumba, Mukura, Kansi). In the meantime, separate Hydrological, ecological and environmental assessments of the water catchment, marshland and command areas were done.
- *18th- 20thApril 2016*- In the project area, public consultation were held with Sector agronomists and members of cooperatives for Kigembe, Nyanza, Ngera sectors, working in the marshland. Soil sampling and profiling was done around this time.

From these meetings issues raised were first cross referenced by what had been obtained in one meeting with one group against issues from another group to determine their authenticity. These issues were also tested against secondary data obtained during desk review and also against baseline data collected for the project area.

d) Issues raised by the different categories of stakeholders

An issues report with raw data collected and issues raised during the field public consultation in the Migina project is presented in in *appendix 1* for reference.

Issues raised and responses addressing them during the stake holder engagement process were compiled and summarized in the *table 13* below and have been considered in proceeding chapters for impact assessment and incorporated in the Environmental impact and management plan.

Table 13: Summary of issues raised during Public consultation

Issues at hand	Stake holders	Response to issues at hand
Destruction of Crops as construction of Diversion weirs, rehabilitation drains and canals area without earlier warning	Local farmers	Clear planning schedule will be drawn, which will be used to inform farmers to avoid cultivation for the season construction commences.
Redundancy of farmers where the weirs, drains and canals will be constructed	Local farmers/local government authorities	Alternative source of income by employing them in the construction of the irrigation infrastructure
Possibility of low wages	Local residents of	RSSP 3 project coordination to ensure minimum

Issues at hand	Stake holders	Response to issues at hand
to local workers during construction works.	the area	wages by Rwanda labour law are followed by the contractor.
Oil spillage	RDB	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.
Occupational health hazards	REMA/District and sector officials	Safety wear is proposed on site. Spraying water to reduce dust is also proposed.
Noise pollution	Local residents/ sector officials / REMA	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
Air/dust pollution	Local residents/ sector officials / REMA	Use of automobiles in good condition (with certification from the "National Automobile Inspection centre") to minimise on noise emitted, Use of silencers for generators.
Soil Erosion	Local authorities/ sector officials /REMA	Soil erosion prevention techniques are required, such as; terracing, contour bunds, afforestation. Excavation at stages to prevent huge soil hips liable to erosion.
Fire outbreaks	Local authorities/ District and sector officials /REMA	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.
Pollution and human health damage by exposure from poor pesticide and fertilizer management	RDB	Proposal to utilize the prepared PMP. Technical support by Agronomists to farmers. Training of farmers in application of pesticides and fertilizers.
Water pollution	REMA/ MINIRENA/ Riparian countries sharing the receiving water bodies	Efficient use of fertilizers to avoid excess amounts washed away to the receiving waters. Baseline tests and progressive tests of water quality of Migina river and its tributaries to understand project effects on water quality and propose mitigation measures.
Water conflicts from Irrigation/ parcel land	Local farmers/ Local authorities	Farmers organised under WUAs to manage the irrigation process.

Issues at hand	Stake holders	Response to issues at hand
consolidation		
Vandalism of irrigation infrastructure	Local farmers / Sector authorities	Regulations on penalties for perpetrators proposed. Punitive measures for perpetrators proposed. Community policing by cooperative members to avoid vandalism.
Increased spread of water related diseases (e.g. malaria)	Local farmers/ local authorities/RSSP 3	Provision of Mosquito nets to locals for those who do not have.
Canal siltation	Local farmers/Local authorities/RSSP 3	Soil erosion control techniques on the hillside of the marshland. Regular inspection and maintenance of the canals.
Water logging and salinization	Local farmers/ local authorities/ REMA	Controlled release and use of water and proper drainage to the plantations to avoid water logging or salinization

CHAPTER 6: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS

This section entails assessment of impacts of the Migina marshland development 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 including; the catchment areas, drains and irrigation canals and command area.

The approach taken in this chapter is to analyse anticipated impacts expected throughout the project cycle;–planning/formulation, design, implementation (mobilization, construction and operational activities), monitoring and possible decommissioning. The impacts described below are both positive and negative, with mitigation measures proposed for the negative impacts.

6.1. POSITIVE IMPACTS

Development of Migina marshland to embrace marshland drainage and Irrigation scheme for large scale crop production identifies with many of the positive impacts of the proposed activities discussed in the proceeding sub-chapters.

6.1.1. Social Environmental impacts

6.1.1.1. *Employment creation*

Manpower for civil works of drains and canals for irrigation to employ 500 people per day paid about 1,500Rwf as a casual labourer. This is a sure deal of an employment opportunity. It will not only benefit locals in these eight (8) sectors but will attract skilled and unskilled labour from areas beyond.

6.1.1.2. Transfer of skills from the construction phase

Considering the kind of construction works in this project, locals will be able to acquire skills in masonry works from local professionals which they can in turn apply at the operation stage for maintenance works of the small irrigation infrastructure such as; diversion structures, maintenance of metal floodgates, wooden beams, stone masonry channels. It is these skilled acquired workers that are again used to initiate new projects.

6.1.1.3. Affordability of education and increased access to medical Insurance

Increased crop yields, ability to bargain for profitable farm-gate price and incomes from employment at the construction works of the irrigation infrastructure, all this will hand the locals of the area the ability to pay school fees for their children and increase their access to medical insurance “Mituelle de santé” moving from the current sector minimum of 80% access to closer to the 100 mark. This will improve literacy levels, give children the opportunity of education and improve health status in the area.

6.1.1.4. Increased crop production by farming all year round

With the construction of the diversion weirs, drains and canal irrigation infrastructure in the command area, farmers 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), failing to cultivate in some flooded parts of the marshlands during wet season and facing drought in the dry season. This will eliminate the redundancy that occurred in the flooded parts during wet season and dry season. For example, increase in production from 50kg/acre of rice to 75kg/acre, 2tons of maize per hectare (ha) to 4tons/ha.

6.1.1.5. Market access for agricultural products

Based on data from public consultation during the field visits, farmers' organization from groups to cooperatives allows farmers to bargain fairly the farm gate prices with profits without the influence of middle-men as is the case currently where farmers possess individual low bargaining power. Organising the farmers in these cooperatives will hence empower farmers economically. For example; farmers now have a unit price of maize at 150-170Rwf/kg to middlemen but in other organised cooperatives selling unit prices 250Rwf/kg and for seed multiplication at a price of 400Rwf/kg. Price for threshed rice currently is at 450-500Rwf/kg sold by individual but as cooperatives rice is sold at 700Rwf/kg.

Under such organisation, these cooperatives will also be able to find market for their products by ensuring production in large quantities, good quality and continuity of market supply of agricultural products.

6.1.1.6. Collective harvest for large quantities and market continuity

The Migina project will involve establishment of post-harvest infrastructure for storage of produce to promote large volumes of high value harvest, control market price of their produce and enhance continuity in supplying demanding markets for their produce, locally, regionally and internationally.

6.1.1.7. Land Appreciation

With the coming of this project, land that was once less productive will now have well done irrigation during dry season ensuring all season cultivation and increased production. This could lead to appreciation of the land from 199-413Rwf/m^2 to much higher land price, all to the benefit of the locals of these areas.

6.1.1.8. Empowerment of farmers

By organizing local farmers into groups, 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.

6.1.2. Physical Environmental impacts

6.1.2.1. Increased land productivity

With the introduction of controlled quantities of organic manure, inorganic fertilizer such as NPK and Urea, availability of follow–up agronomists specific for the marshland cultivation and not the overstretched Sector Agronomist, improved agricultural practices and land husbandry, the soil fertility is expected to improve, thereby increasing farm yield, for example from 50kg/acre of rice to 75kg/acre, maize production previously at close to 2 tonnes per ha to an anticipated 4 tonnes of maize per ha, in some places after RSSP 3 support.

6.1.2.2. Flood control and drainage management

It was observed that the central drain (River) of the marshland is not able to cater and drain the marshy areas during large rainfall events. Thus, both the problems of surface drainage during intense rainfall events and the problem of sub-surface drainage of the marshland needed to be addressed.

By rehabilitating the 5 existing diversion weirs and constructing 3 new diversion weirs to direct water into the left and right primary canals, constructing receiving secondary/ tertiary canals and drains that will act as drains during wet seasons and used for irrigation during dry season, the issue of uncultivable flooded areas, losses of crops to flooding, high ground water levels will be solved hence allowing for higher land productivity in the marshland.

6.2. ADVERSE 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.

6.2.1. DESIGN AND PLANNING PHASE

The design phase of this RSSP 3 project involved identification of suitable location of new diversion weirs in the un-developed perimeter of Migina marshland, rehabilitation of existing ones, rehabilitation of existing and new drains and canals for irrigation of the marshland and undertaking of a detailed technical study. There is no adverse impacts expected at this stage except for the issue of preference of crop, however, it recommended that best practices in the design of such diversion weirs, drains/canals are followed.

6.2.1.1. Impacts on Social environment

6.2.1.1.1. Crop preference

From public consultation, areas in the undeveloped perimeter of the marshland especially Kansi and Kigembe sector with already established Cooperatives, for example KORAMUKI, have

been growing maize in this marshland for some time now even with the issues of flooding. With already established contracts to supply maize to WFP refugee camps and a contract with RAB for seed multiplication. These farmers prefer maize to the proposed rice. It is therefore important at this stage to agree with the farmers on the crop/s that will be grown in order to guide the design of the irrigation and drainage system of the marshland especially since maize and rice could have different Crop water requirements that are crucial in the design.

6.2.2. CONSTRUCTION PHASE

The construction phase involves several activities including; site clearing for the location of diversion weirs, drains and canals, site installation, trench excavations, earth stripping, path network clearing and levelling and construction of canals/ drains. Anticipated adverse impacts are discussed hereafter.

6.2.2.1. Impacts on Physical environment

6.2.2.1.1. Soil and water contamination

During the rehabilitation existing diversion weirs, construction of new weirs, canal construction, heavy machinery, such as; excavators, wheel loaders, etc., might be used for earth moving construction works. This equipment will require re-fuelling, maintenance works, repair works, which in effect result in oil spillage. Contamination of soils and run-off ending in the Migina River could cause water quality degradation.

Excavation and earth moving will also mean creation of soil stockpiles at points where new diversion weirs will be built, expose them to potential erosion and storm water that could also contaminate existing Migina river stream.

Lack of proper or poor sanitation for workers on site could result in human waste littering all over the hillside and marshland areas of construction area of influence, which, eventually could contaminate the River water and become a health risk to workers and communities, if no mitigation measures are implemented.

Laterite soil shall be required during this construction for canals, river bank and diversion weirs. For any borrow pits degraded from collecting soils, there is need to rehabilitate them.

Impact significance

This impact can be considered of low magnitude, duration and spatial extent since it shall only be experienced during the early construction phases of clearing, excavating and compacting. It also will occur only at the central/main drain area and not to the other catchment areas. In order to avoid or reduce its occurrence mitigation measures are proposed.

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.
- To avoid huge stock piles, a requirement shall be included in the technical specifications of the tender document for the contractor to present and implement a plan on how excavation shall be done in stages to avoid opening up of big sizes of the area and increasing the level of risk to erosion at any one time.
- A requirement of a storm water management plan shall be included in the technical specifications of the construction tender documents requiring the contractor to prepare one with particular attention on how run-off will kept on the scattered site positions of construction and run-off avoided from draining into receiving water bodies like Migina river.
- Requirement of Ventilated Improved Pit (VIP) or Eco-san latrines shall also be included in the technical specifications and Bills of Quantities in the tender document for contractors to implement at the time of site installation. At least the hillside of each Administrative cell shall have a toilet for use by the scattered employees throughout the drainage rehabilitation works, a minimum of 9 toilets on site.
- Borrow pits shall be rehabilitated by backfilling with soils excavated off site in the various activities such as drainage canals and diversion weirs. The pits shall be levelled and re-vegetated to avoid effect of storm water runoff and any soil erosion.

6.2.2.1.2. 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 and trucks plus other machinery such as concrete mixers, dumpers, etc.

Impact significance

This impact can be considered of low magnitude, duration and spatial extent as it occurs only during the construction phase. Also, the area of the drains and canals is in the marshland with far from any human settlement, down in the valley, to cause significant pollution.

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 3 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.

6.2.2.1.3. Soil erosion and land slides

The steep hills bordering the marshland could be subject to soil erosion. Also activities including; site clearing, excavations of trenches for the primary canals along the foot hills of the marshland, could destabilise soil composition and expose it to the agents of erosion, mostly run-off, resulting in increased erosion and landslides. 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.

Impact Significance

This impact shall be of low significance in terms of magnitude since there is a clear presence of trees grown along the hills of the marshland, soil conservation by progressive terraces is practiced along these hills. The effect shall be during site clearance, excavation works, and minimal effect in on the embankments of primary canals.

Mitigation Measure(s)

Soil erosion effect can be avoided or reduced by implementing a number of measures. These are;

- Along the upper parts of the primary canals on the hillside, it is proposed to grow Napier grass "Urubingo" along the embankments to hold soils and avoid erosion. 2-5m wide buffer along the primary canal with such grass is proposed to curb erosion and avoid encroachment by farmers.
- Avoid excavation during rainy season.
- 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 bear 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 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. Proposed tree species may include any of these; *Yushania alpine, Markamia lutea Bambusa vulgaris, Polyscias fulva, Albizia gummifera, Newtonia buchannani, Ficus thonningii, Ficus valli-schoudea, Maesa Lanceolata, Domberya torrida, Erythrina abbysinica, Prunus Africana and croton megalocarpus.*

6.2.2.1.4. Fire outbreak

Construction works will require a fuel store for re-fuelling the heavy equipment used for earth works. 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.

Impact Significance

This impact is of low in significance in terms of magnitude and spatial extent. It could occur only during construction phase and only in areas of refuelling or uninsulated areas, however, it is a precautious and avoidable impact.

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.

6.2.2.1.5 Water pollution and its impact on fish ponds

Civil works at the diversion weir No. 2 at Ngera Sector and excavation works for the primary, secondary and tertiary canals of the marshland could be a risk of contaminating the clear river water with cement and muddy waters that in turn affect the water used by the fish ponds just before the position of the diversion weir No. 3.

Impact Significance

This impact is of low significance in terms of magnitude and spatial extent. It could occur only during construction phase, however, it is a precautious and avoidable impact.

Mitigation measures

- Diversion of water away from diversion weir civil work points, excavation canal areas and re-directing water back to the central river for downstream use by fish ponds and other users is proposed at the time of construction. This will divert the water from cement and muddy contamination points, hence protecting water for downstream fish ponds use .

6.2.2.2. Impacts on Biological Environment

6.2.2.2.1. *Loss of biodiversity on the hillsides and valley*

From the baseline data on biological environment of the project area, some of the biodiversity likely to be lost could be:

- In the undeveloped perimeter of the marshland valley are: *Cynodon spp* and *Eragrostis spp,* some shrubs like *Crassocephallus ducis-aprufii*, commonly used for house construction material as sticks.
- Scattered plant species mostly at the foot of the hills by the marshland such as; *Psychotria spp, Acanthus pubescens, Bidens pilosa, Botriocline ugandensi, Gynurascandens, Solanum incanum, Solanum capsicoides, Solanum aculeastrum,* Some of which are invasive species that have come as a result of human activity, such as; *Solanum capsicoides*.

From field survey and GIS application no forest plantations shall be lost to the alignment and buffer of the primary canals.

Impact Significance

This impact is of medium significance in terms of magnitude since it is an area that has been under agriculture and only main canal could be the only infrastructure that will encroach on the hillsides.

Mitigation Measure(s)

- Lost local species can be offset by planting them at the buffer of 2-5m width off the side primary canals and central drains of the River. The buffer shall cover an area of about 3ha along the primary canals comprising of species such as; *Solanum incanum, Solanum aculeastrum*.
- *Solanum capsicoides* shall not be replanted to avoid its characteristic nature of being an invasive weed.

6.2.2.3. Socio-economic Environment

6.2.2.3.1. Income losses from missed season cultivation and fish farming due to delays in construction

Complaints from farmers and sector agronomists during field visits were observed, of the possibility of missing seasons of cultivation due to delays in progress of marshland development. This implies that the farmer loses the produce that he or she could have obtained that missed season hence a loss in home income and in most cases domestic food. It also affects targets of crop production set by local government officials for their respective district sectors.

Furthermore, from public consultation with fish farmers they are able to earn 130-150,000Rwf/ month from their ponds. Any delays in construction works in areas around the fish ponds, could disturb fish, cause fish water contamination, thereby affecting the quantity of fish harvested and indeed reducing their monthly income.

Impact significance

This impact can be of medium magnitude to the affected farmers since it affects their apparent livelihood, however, it is not an impact of regular occurrence and a number of measures shall be applied by RSSP 3.

Mitigation Measure(s)

- A clear implementation program indicating phases of areas where diversion weirs and canals shall be built, dates when they will occur and a monitoring exercise involving RSSP 3 staff, sector agronomists and cooperative committees should established. It should also be shared with the local farmers as an awareness campaign.
- Farmers who have been affected should be given an affirmative priority in employing them for jobs for excavation works occurring at that time. This will be an alternative income source to sustain their domestic requirements.
- Fish ponds will continue to operate normally, river water will diverted from construction or excavation points to avoid contamination. Most importantly, construction works in areas around the fish ponds shall need to be given priority of quick completion to minimise adverse impact on fish production and income. In the event the contractor delays for more than 2months (considering 21 days for concrete at diversion weirs to set), RSSP III may consider penalties of 150,000Rwf for every extra month beyond the 2 months, derived from fish farmers monthly income estimates..

6.2.2.3.2. Injuries by workers from construction (Occupational health hazards and safety OHS)

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 oils, injuries from stepping on or using sharp objects and fires.

Impact Significance

This impact is also of medium significance in terms of magnitude, since it directly affects the humans. Injuries are common in construction but can be reduced to an extent with safety precautions taken.

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:

- Workers on the site should be provided with appropriate protective gears such as; wellington boots, helmets, nose masks, eye goggles and overalls. Wearing of safety gear should be enforced on site by introduction of a safety compliance department.
- The contractor shall be required to have an insurance policy taking care of any injuries or deaths that might occur on site.

6.2.2.3.3. Diseases from construction activity

During construction, communicable disease hazards due to interactions among the workers or with service providers such as; food vendors, 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.

Impact Significance

This impact is also of medium significance in terms of magnitude, since it directly affects the humans. Contraction of diseases are common in construction but can be reduced to an extent with safety precautions taken.

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, use of gas masks and googles for dusty sections is strongly recommended;
- The contractor together with local authorities are required to enforce acquiring medical insurance “mituelle de sante” for all workers as a means of affordability of treatment.

The lost insurance is at 1000-3,000rwf/ person, an average of 2 day work pay for workers on a construction site.

- Regular sensitization on ways of HIV prevention, importance of proper hygiene is important during execution of this project.

6.2.2.3.4 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.

Impact Significance
This impact is also of low significance in terms of magnitude, since construction works are not that complex and most works do not require highly skilled labour, for example; excavation of canals which can easily be done by the locals in this area. It is also minimised by the fact that the marshland is located near Huye town with skilled labour.

Mitigation Measure(s)

- Sectors along with the Districts are 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.
- 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.

6.2.2.3.5 Possible child labour

There is a likelihood that relaxed monitoring of recruitment of casual labour during construction could result in employment of workers under the national employment age of 16 years, thereby breaching the National child labour code.

Impact Significance
This impact is also of low significance in terms of magnitude, since Government is quite strict on compliance to employment age.

Mitigation Measure(s)

- Recruitment of workers shall be based on submission of a copy of National ID, where those below the age of 16 years shall not be employed as per article 4 of the National law

regulating labour in Rwanda No. 13/2009. Employment records shall be availed to inspection teams from the District and Sector offices.

6.2.2.3.6 Access to jobs for women and youth

Construction works have been seen as to employ to grown adult men. Cost of a day's work for a casual labourer is in the range of 1000-1500Rwf. Compared to a day's hired work on plantation of 800Rwf, casual labour on construction sites is more paying. Women and youth could miss out on improved income from this rehabilitation project if no measures are in place to employ them. Vulnerable groups are already catered for by the Government initiative under Vision Umurenge Programme (VUP), where they are given work for cash to rehabilitate roads, Direct financial support per month or credit financing in order to improve their livelihood. Addressing their needs in this project would duplicating government initiatives, hence not considered as a group to support here.

Impact Significance

This impact is also of low significance in terms of magnitude, since the Rwanda government supports a gender policy of having at least 30% women representation in most decision making positions. This however does not trickle down to employment as prerequisite and might continue to affect women and youth.

Mitigation Measure(s)

- A requirement to be included in the technical specifications of the construction tender document, under employment, a minimum percentage of 30% of workers should be women and youth. This way they can also benefit from improved income during the construction period of the project.

6.2.3. OPERATION PHASE

6.2.3.1. Environment impacts

6.2.3.1.1. Modification of flows for downstream usage

Construction works for the marshland drainage entail diversion of the central drain/Migina river at 8 weirs towards the left and right primary canals to irrigate approximately 347ha and eventually drain remaining water back into the river. This irrigation system shall be controlled during the wet season to avoid flooding and dry season to irrigate dry parcels in the marshland. This arrangement is likely to destabilize the receiving population downstream and temporary destabilize the ecosystem dependent on the current river flow.

Impact Significance

This impact is of medium significance in terms of magnitude, severity and spatial extent. Its effect will be felt mostly during the construction of the diversion structures along the central

drains, after which a regulated amount will continue to be released for human use downstream and also for ecological life to be sustained. If well designed, it can be of short term effect. The main purpose of the project is to avoid flooding of the marshland that has led to loss of crops and livelihoods dependent on cultivation of the marshland but also to management of water for irrigation during dry season.

Mitigation Measure(s)

- Design of diversion structures should incorporate release on environmental flow of $2m^3/s$ from the central drain especially during the driest days to maintain a specific water level downstream and maintain the existing ecosystem.
- Design should ensure a proper drainage network allowing for return flow from the plantation plots into the river during the dry season.

6.2.3.1.2. Water pollution from fertilizers and pesticides

Use of fertilizers and pesticides is a non-point source potential for introduction of nutrients into the likely receiving waters downstream of the catchment plantations as a result of run-off. Agrochemical fertilizers such as; DAP, NPK and Urea ($CO(NH_2)_2$) containing compounds of Nitrogen, Phosphorus and Potassium and, proposed for boosting soil fertility and pesticides will very likely drain into the river.

Nutrients will cause de-oxygenation of the water bodies, in this case the Migina marshland, and downstream recipients of its waters (Akanyaru river), 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 (through a process called eutrophication) and restraining navigation and fishing activities in these waters downstream.

Uncontrolled use of agrochemicals could also pollute the same water used for fish farming downstream, create eutrophication by aquatic growth at the ponds, denying fish of adequate oxygen and thereby reducing fish harvests and possible fish deaths.

Fish bioaccumulation is used to describe build- up of chemicals in fish through food chain from sediments to macro-invertebrates to fish that eat them and eventually to human beings, accumulating in each stage of the food chain. Persistent stable chemicals that do not breakdown over time mostly considered as, PCBs, DDT, dioxins and mercury, which are not part of the fertilizers and pesticides chemical composition. However, through a similar food chain, chemicals can accumulate at each of the stages mentioned above, eventually causing long term human risk to those that consume fish from the ponds downstream of this marshland.

Impact Significance

The impact could be of high significance in terms of magnitude and considering the quantities of chemicals applied. The effect of the impact will go beyond the non-point source of application on the plantations either by runoff or soil infiltration later draining into surface and ground

waters. If not regulated to have only adequate quantities applied, the impact of fertilizer and pesticide could be a long term effect.

Mitigation Measure(s)

- To avoid this impact, the farmers should adopt the RSSP 3 Pest Management Plan (PMP) practices proposed for these crops (Rice and maize). For fertilizer, the farmers should be trained on the right application of fertilizer and safe use of pesticides.
- A baseline test of the water quality, preferably every two years, 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 University or Rwanda (UR) laboratory at Butare to monitor the quality of these waters for precaution purposes.
- Quarterly water quality tests are necessary at fish pond water entry points to determine whether the water is at quality level suitable for fish growth. This again can be included in an MOU with UR, to have these reports availed to the fish farmers, marshland cooperatives, District, sector officials and RSSP III for monitoring purposes. Water quality levels failing acceptable norms shall require speedy action in controlling the use of the agrochemical fertilizers.
- In case water quality levels are above acceptable water standards and fish are tested by bioaccumulation markers to realise their contamination levels are above acceptable WHO levels then for a period fish shall not be eaten from contaminated ponds, water shall be replaced and pond owner shall have to be compensated for loss of income by the project or cooperatives managing the marshland depending on the time of occurrence.

6.2.3.1.3. 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 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 a probability of salt build up to occur in the intervention areas especially through the residue salts and salt build up in the soil profile.

Impact Significance

The impact could be of high significance in terms of magnitude and considering the quantities of chemicals applied. The impact could have a long term deteriorating effect on the soil.

Mitigation

- With a properly determined crop water (CropWat) 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.
- 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.
- Regulated amounts of fertilizer applied based on actual nutrients required.

6.2.3.1.4. High sedimentation levels for the primary canals

The hillsides surrounding the marshlands were found to have slope categories in the range of 20-30%. Even with the progressive terraces and planted tree forests along the hills bordering the marshland, there is still likelihood of some level of sedimentation into the primary canals hence low flows insufficient to meet the crop water requirement for the plantations in the command area.

Impact Significance

The impact could be of low significance in terms of magnitude considering that the Migina project involves soil conservation practices along the 2-5m buffer zone of the primary canal and the conservation practices are already practiced along the hills.

Mitigation Measure(s)

- It is proposed that a green buffer of at least 2-5m at the main left and right canals is proposed. It shall comprise of vegetation to filter off sediment before it gets to the canals. This buffer can be interchanged with local species such as; Napier grass, (*Solanum aculeastrum*) or *Bidens pilosa* or *Acacia mearnsii*.

6.2.3.1.5. Siltation or scouring of drains/ canals

Open drain surface consists of alluvial soil which can be easily scoured. Moreover, if the velocity is low silting is likely to occur. Therefore, in an alluvial channel both scouring and silting may occur if the channel is not properly designed. The quantity of silt transported by stream water in an alluvial channel varies from section to section due to scouring of bed and sides as well as due to silting (or deposition). If the velocity is too high, scouring may occur. If the velocity is too low, silting may occur.

Impact significance

This impact is considered of low negative significance considering the design of these open canals should have taken this into consideration.

Mitigation Measures

- Open canals of trapezoidal section designed by using Manning's formula shall ensure siltation and scouring are brought to a minimum influence for the drains and canals.

6.2.3.1.6. Water losses from evaporation and leakages

Exposure of water in the primary canals and secondary canals will lead to increase in evaporation and seepage into the ground. Evaporation rate in this area amounts to 860 -1,050 mm/yr of the rainfall which is quite significant. Open canals will increase the surface area exposed to evaporation of runoff from the hills into the stream. Further still, there are possibilities of water losses from open channel cracks. The magnitude of this impact is considered to be medium negative.

Mitigation Measures

- Regular canal inspections to detect possible leakages early enough so as to reduce on avoidable water losses.
- Irrigation canals need to be lined in areas with pervious soils to prevent ground seepage of water into the soil.
- The design of the drain and canal system has included proper drainage network allowing for collection of runoff at foothills of marshland and return flow into the river as a means of recharging it.

6.2.3.2. Socio-economic Impact

6.2.3.2.1. Health hazards from poor pesticide and fertilizer application

Use of fertilizer is crucial in improving soil fertility while pesticides will kill likely pests that might destroy crops.

Based on the public consultation, for rice 4kg of NPK, 2kg of Urea on a 5 acre parcel and for maize 6kg DAP, 4kg of Urea on 5 acre parcel.

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.

Impact Significance

The impact could be of high significance in terms of magnitude and considering the quantities of chemicals applied. The effect on human health from exposure to continuous exposure to

pesticides or fertilizers either directly or by food chain effect could be long term and irreversible if it turns out cancerous.

Mitigation Measure(s)

- Adapt the Pest Management Plan (PMP) prepared for RSSP 3 to the crops proposed for this project. This is in compliance with the "pest management- OP-4.09".
- Farmers and extension staff shall be trained over season long period on weekly basis on the pests and diseases identification, damage problems, yield loss caused, control methods and safe pesticide use.
- Combined efforts of the marshland project Agronomist and those of the sector should be able to offer technical assistance to the farmers once the project has taken off. Their responsibility is 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.

6.2.3.2.2. Water conflicts arising from the creation of irrigation scheme

With the coming of the irrigation schemes that involves; land consolidation program for collective growing and harvesting, distribution of water through open canals, if the locals are not organized into institutional frameworks, might cause conflict over who gets water for irrigation and what amount is meant for each of the plots, quarters or sectors, who is wasting water by leakage or spillage. This can escalate in conflicts, enmity or vandalism.

It was already evident that the upstream developed perimeter growing rice had no organised cooperative, only small farmer groups existed with individual interests in the marshland and how water is managed, which could fuel water conflict now and after project completion.

Impact Significance

The impact could be of low significance in terms of magnitude and duration. It will be of short term effect or even avoided since most of RSSP 3 project similar to this one, RSSP 3 begins by encouraging and facilitating in organising farmers in cooperatives through which such issues can be resolved.

Mitigation Measure(s)

- The project should start by organising farmers in legal cooperatives. This will be followed by establishing Water Users' Associations (WUA) to manage distribution, maintenance of the irrigation infrastructure and resolve arising conflicts over water distribution within the marshland. These WUAs shall attend field recognisance visits to marshlands developed in a similar manner, an example of the upstream Rwasave marshland bordering the project commencement point.

6.2.3.2.3. Vandalism and poor maintenance of Irrigation infrastructure

The Irrigation project shall comprise a number of infrastructure made from metal, steel, concrete, PVC for example; sluice gates, valves. Considering that most cooperative members using the marshland are farmers with no technical skills on how to manage diversion weirs, sluice gates, poor maintenance of this infrastructure could cause early depreciation of this infrastructure and fail the purpose of the project in a short lifespan than was planned.

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 organized in such as to have community policing to guard the infrastructure, they will be vandalized and sold elsewhere.

Impact Significance

The impact could be of low significance in terms of magnitude. With community policing encouraged in Rwanda and organized cooperatives operating in the project area, such an impact might be of short term scattered periods of vandalism.

Mitigation Measure(s)

- Early establishment of farm organization (i.e. into groups and cooperative) 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 to perpetrators convicted of vandalism are necessary. Punitive actions towards perpetrators by the authorities will facilitate compliance by the locals thereby avoiding vandalism.
- Establishment of Water Users Associations (WUA) with technicians specifically trained to manage and maintain the irrigation infrastructure will solve the risk of poor maintenance of irrigation infrastructure. These technicians shall be paid for services provided off revenues obtained from collective marshland crop harvests.

6.2.3.2.4. Increased spread of Water related diseases

In reference to social data from field public consultation, Malaria already stands out as the resilient disease observed in the area, probably due to the marshland, rice and maize production.

With the introduction of the weirs and main canals, this will be conducive habitat for mosquitoes for spots with stagnant water. This is likely to increase the number of malaria patients in the area.

Water borne diseases such as; dysentery, diarrhoea, stomach-related disorders specifically infestation by worms, all resulting from using the canal water for domestic purposes (drinking and cooking).

Impact Significance

The impact of disease spread will be long term for as long as the drainage canals exist which are habitats for disease vectors and the scale and severity is also moderately high and can be severe especially for children under 5 years and pregnant mothers who are vulnerable to malaria. The scope of the impact will initially be localized but transmission of the disease is likely to extend the scope beyond the project area.

Mitigation Measure(s)

- Government under MINISANTE is currently issuing free mosquito nets to all homes in the country. Also spraying of homes in rural areas was evident in homes of farmers around this marshland. The project may work along with MINISANTE in issuing mosquito nets for those who don't have, to reduce on the spread of malaria. 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 drains/canals for domestic consumption. As a matter of fact, RSSP 3 shall support construction of water points during construction works as alternatives close enough to the locals in order to prevent locals from resorting to fetching unhealthy water from the canals.

6.2.3.2.5. Destruction of central drain boundaries and open canals

With the primary canals, central drain, canals and drains in place, there is a likelihood of local farmers encroaching their boundaries in cases of insufficient water supplied to the plantations.

Impact Significance

The impact will be short term considering locals are aware of restrictions by a buffer zone of 10 m from the river and they have the experience of local authorities already having grown Napier grass and bamboo along portions of Migina River to protect it from encroachment by plantations.

Once a similar buffer zone is set, it is assumed the locals will respect as they have tried to for the river buffer.

Mitigation Measure(s)

- The recommended green buffer of at least 2-5m from the primary canals and the central drain/Migina river to the nearest plantation shall act as buffer zone preventing locals from encroaching the drains and canals.

6.2.3.2.6 Resistance to change of crop and livelihood

A number of activities are done in the marshland, as examples; (i)there is cultivation of crops such as; maize and rice, (ii) fish farming, (iii) illegal brick making since there are clay soils in the marsh, (iv) illegal sand mining from the rivers.

Fish farming shall not be tampered with, while brick making and sand mining is illegally done. Brick makers and sand miners were not receptive to public consultation to inform the study on their operation and opinions on the impacts of the marshland rehabilitation to their livelihood.
Clear resistance against rice growing by maize growers from Kansi, Kigembe sectors and further downstream was evident. There is already resistance against developing the marshland for only rice production. From public consultation, areas in the undeveloped perimeter of the marshland especially Kansi and Kigembe sector with already established Cooperatives, for example KORAMUKI, have been growing maize in this marshland for some time now, even with the issues of flooding. With already established contracts to supply maize to WFP refugee camps and a contract with RAB for seed multiplication. These farmers prefer maize to the proposed rice. It is therefore important at this stage to agree with the farmers on the crop/s that will be grown in order to guide the design of the irrigation and drainage system of the marshland especially since maize and rice could have different Crop water requirements that are crucial in the design and operation.

Impact Significance

The impact could be of high significance for the project implementation to be effective. It is from these existing cooperatives that the management of the marshland shall rely during construction and operation. Also ownership of the project by the marshland farmers is crucial at this point of the project, so any resistance towards the project activities could result in project failure.

Mitigation Measure(s)

- It is proposed that though the brick makers, sand miners are illegally practicing in the marshland, they are all integrated into the rice scheme by allocating them plots of land for rice production.
- Intense sensitization by RSSP III, District and sector officials on the profitability of rice production as opposed to maize is of paramount importance. Already from public consultation, rice profits are at 24,600Rwf/acre, while maize are at 16,000Rwf/acre of produce.
- In case of continued resistance, rice and maize production can be produced on the separate perimeters of the Migina marshland.

6.2.3.2.7 Wastage of water

Ignorance of farmers on the irrigation especially since this irrigation scheme will be new in the undeveloped perimeter of the marshland could result in poor management of water distribution to plantations. In-experienced people managing the diversion weirs, water realised from the River into the primary and secondary canals, excessive amounts of water released into the plantations, water leakages in the open channels, could all result in wastage of water meant for efficient irrigation during dry seasons.

Impact Significance

The impact is of low significance especially since Migina project involves organizing existing farmer groups into strong cooperatives, to manage issues arising at the catchment areas and also the irrigation facilities. This impact shall occur all through the operation phase but can be easily resolved technically through this organized farmers' structure.

Mitigation Measure(s)

- Establishment of Water Users Association (WUAs) to manage quantities of apportioned for each plantation 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.
- Water allocation infrastructure such as; off take structures of metal flood gates, wooden beams should only be managed by trained technicians. This will avoid excessive distribution of water thereby preventing wastage of water from the central drain.

6.2.4. DECOMMISSIONING PHASE

The Irrigation infrastructure might remain in operation for many years with an estimated life span of open channels given as 25 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

6.2.4.1.1. Dust and noise Pollution from demolition activities

Dust and noise pollution might occur when demolishing the diversion structures, filling canals and demolishing other infrastructure.

Impact significance

This impact can be considered of low magnitude, duration and spatial extent as it occurs only during the decommissioning phase. The canal area will by that time not be closely settled after a long time of its operation, which implies that the air and noise pollution will not significantly affect communities.

Mitigation Measure(s)

- 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 from demolition

In the event of future rehabilitations and upgrading of this site area, 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 (Migina river and eventually Akanyaru river), especially land and water resources.

Impact significance

This impact can be considered of fairly severe magnitude and spatial extent considering its contaminating impact on the existing river could trickle down to the receiving Akanyaru River downstream.

Mitigation Measure(s)

- Monitoring of the waste disposal to authorized damping 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. Land depreciation from abandoned Infrastructures

The Migina 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 cause the land to depreciate or permanently render the project land useless.

Impact significance

This impact can be considered of fairly severe magnitude since the land that had previously appreciated from irrigation and high productivity, could at this stage lose its appreciation, leaving land owners at a loss of land and crop productivity hence affecting their livelihood.

Mitigation Measure(s)

- Establishment of cooperatives, income and profits earned from the irrigation scheme will ensure locals have savings in their SACCOs and businesses to turn to as alternative sources of income.
- RSSP 3 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. e.g. basket knitting, tailoring, welding and carpentry.

6.2.4.2.2. Loss of livelihood

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

Impact significance

This impact can be considered of fairly severe magnitude since most of the local farmers by this time would be dependent on the drainage system preventing flooding of their plantations and irrigation for high crop productivity. Losing it without an alternative could return them to two season planting as opposed to all year planting. It could also affect their livelihood by decreasing income earnings from crop productivity.

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; Small-Medium Enterprise trading, making of Rwandan traditional basket "Agaseke" on a large scale by women as an off-farm activity done after returning from their plantations, carpentry, welding and tailoring could be turned to as an alternative income earner.

6.3. CONSIDERATION OF ALTERNATIVES

6.3.1. Siting

The choice of development of Migina marshland was based on the limited utilization of these marshlands due to difficult drainage problems, with considerable areas around the main river/ central drain inundated during the wet season causing huge loss of crops and devastating livelihoods of farmers dependent on the marshland.

Current developed perimeter of the marshland under cultivation is 184ha at the upstream, while the total gross area of the marshland with cultivable potential as per topographical survey is 548ha. Underutilization of 364ha of the marshland on grounds of poor drainage, flooded areas and poor functioning irrigation systems was the main reason of choosing Migina marshland as a site to develop.

Development of the drainage system of these marshlands ensures:

- Canals/drains and hydraulic structures shall channel out excess water from the main river to avoid inundation of the marshland allowing for a sure certainty of crop production in these marshlands as opposed to loss of crops to floods.
- It will also allow for irrigation of fields during the dry season from the flowing river/central drains and side canals.

Considering the drainage of the marshland is successfully completed, a socio-economic impact on the local farming in this area is anticipated to show an increase in production from 50kgs of rice to 75 kgs/ acre, 2tons of maize per hectare (ha) to 4tons/ha, per cultivation season for cultivable area of 347ha of Migina marshland.

6.3.2. Design and Technology selection

6.3.2.1. Drainage system alternatives

Drainage of excess surface and sub-surface water from the marshland was necessary to enhance crop growth without loss of to flooding. Two alternative systems could have been applied:

1. *Vertical Drainage (tube wells)* - which involves boring of tube wells and pumping by installing electric motors to remove the excess sub-surface water.
2. *Horizontal Drainage (surface & sub-surface drains)* - which involves; building diversion weirs at the main river, channelling water into open earth primary canals that feed secondary canals and then tertiary canals into the plantation parcels and drain out in tertiary drains back into the main river and land grading to allow for gravitational flow of water.

The project area only has in most sectors up to secondary school education as the highest level of learning with exception of the tertiary University UR in Huye which is requires stiff National competition for admission with very minimal or none for a student from schools around here to qualify for it.

It therefore implies that there is inadequate skill to manage vertical drainage system later on not more than 5% electricity coverage of the project affected areas in Gisagara and Nyaruguru, which is insufficient to run electric motors required for the vertical drainage. Vertical drainage is cost intensive, requires skilled labour to operate these tube wells and hence was not preferred over horizontal drainage.

Based on these socio-economic attributes, the horizontal drainage system was chosen.

Furthermore, regarding the drain/canal system, two alternatives could have been applied:
a) Open earth canal system, and
b) Pipe System, using pipes for the main and the secondary network.

Open drain/canal system was considered the most optimal on the following grounds:

- Open earth canals are much cheaper to construct than the pipe system, involve less skilled labour that would mean more local labour and income for the locals in the area and require less skilled labour to maintain such systems compared to the pipe system, making it suitable for operation by local cooperatives and Water User Associations (WUAs).
- It would also involve less equipment and item importation as opposed to usage of local construction material.

6.3.2. No-Project Alternative

This alternative of no-project alternative is considered not feasible on grounds of losing out on socio-economic grounds as discussed from the following facets:

- For quite a long time the marshland has had flooding of crops during wet season as the major problem, with water levels rising up to the root zone of plants and suffocating the air circulation hence affecting productivity and fertility of the marshland. For dry crops like maize, flood tolerance level would be smaller. Migina marshland also has had conflicts over water during the dry season by farmers that cultivate it with downstream farmers not farming in the dry season. Without applying the designed drainage system that allows for distribution of water adequately to all parcels in the upstream and downstream of the marshland for an area of 347ha whether in wet or dry season, the marshland will continue to flood in the wet season, lack water in the dry season, become less productive and less fertile for crop production.
- Anything short of the drainage and irrigation project for both marshlands will imply productivity cannot increase from 50kg/acre to 75kg/acre of rice, 2tons/ha to 4tons/ha for maize. This could inhibit increment of household income for farmers in this marshland.
- Use of water for irrigation during dry seasons would imply crop cultivation throughout the year without the interference of the dry season in Migina marshland hence increased crop yield resulting in increased income.

- All year cultivation would mean no drought or hunger during the dry season (Season C).
- 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.
- 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.
- 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 14* provides a way forward for implementation of the identified mitigation measures. RSSP 3 project coordination shall be responsible for overall implementation of the EMP. The project Environmental and social safeguards 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 judgment to come up with these figures.

Table 14: Environmental Management Plan

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
Construction phase	Refuelling of construction equipment and vehicles. Mechanical repairs of equipment.	Soil and water contamination	• Ensure site Automobile are taken for inspection at the National Automobile Inspection centre every six months to ensure good condition hence reduce spillage. • Allocation of a restricted area for re-fuelling, oil change, maintenance works, repair works will be, far from the water stream or valley. • Establish a cemented floor and a sand stock at refuelling points. • Contractor to submit in the bid for tender and implement	During construction	• Contractors.	Repetitive through construction	10,000Rwf or equivalent 14.3US$ for each truck or automobile good condition certification for every 6 months. Total estimated cost for 12months of execution for 2 trucks is 40,000Rwf equivalent to 50US$. Cost of an Ecosan

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			a plan on how excavations shall be done in phases to avoid opening up a lot of ground that result in huge soil stock piles and eventually significant soil erosion. • Contractor to present in the bid for tender and implement a storm water management plan for project • VIP or Ecosan clean and hygienic toilets for workers at least one at each administrative village touching the marshland. Each toilet shall have both male and female separate doors. At least 9 toilets in total for proper hygienic sanitation to avoid sources of contamination from littered human waste.				or VIP toilet is 173500Rwf (equivalent of 210US$) per toilet. 9 toilets will cost 1,890US$. Cost of the preparation of storm water master plan and excavation plan is included in the contractor's bid and its implementation can be only be determined in the Bills of quantities at the time of bids opening.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Site clearance, excavation works, disposal of debris, supply of construction material, compression and vibrations.	Air and noise pollution	• Ensure construction activities are restricted to normal working hours (7h00-17h00) to prevent noise for neighbours at night • Use equipment and automobiles that have certification of good working conditions. • Ensure routine maintenance, repair of trucks and machines. • Spray water regularly when clearing land to reduce the dust.	Through the construction	• Contractor	Repetitive through the construction	Cost of sound meter level is about 110US$ for excessive noise avoidance. 5m^3 tank of water spray could cost up to 60,000Rwf or 85US$ per trip for two trips per week for the 3dry months. A total estimate cost of 1,440,000Rwf equivalent of 1,800US$.
	Site clearing and excavation exposing the ground to potential erosion agents such as; wind and storm water	Soil erosion and landslides	• Fast track project to minimise exposure to potential erosion agents. • Ensure immediate backfilling and resurfacing after excavation to avoid facilitation of erosion agents. • Light compaction to stabilise the soil. • Re-vegetate the cleared sites	• Throughout the construction phase	• Contractor • RSSP 3	Repetitive during construction	500Rwf or 71 US cents/ m^2 total estimated for re-vegetation.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			with local plant species.				
	Welding, electrical installations to or from the power source, refuelling of equipment, smoking on site.	Fire outbreaks	• Perform regular checks on electrical installations and proper insulation of cables, to prevent short circuits that could trigger fires. • Allocate a specific area for fuel storage, restricted to only authorized personnel and should have fire extinguishers. • Equipment at the sites should include Water tank automobiles with hose pipes for purposes of extinguishing fires. • Perform Fire management drills for the workers regularly.	• Throughout construction	• Contractor	Any time during construction	Cost of each trip of a water tank is 60,000Rwf equivalent 85US$. Each Fire extinguishers range of 35-75US$. Total estimate cost of 160US$ reserved for any fire incidence
	Civil works at the new Diversion weir No.2 and excavation of canals	Water pollution and its impact on fish ponds	• Diversion of water away from diversion weir civil work points, excavation canal areas and re-directing water back to the central river for downstream use by fish ponds and other users is necessary at the time of construction at that point. This will divert the water from cement and muddy	• Throughout construction	• Contractor	At the stage of construction between the new Diversion weir No.2 and No.3	Total estimate of 2,125,000Rwf for river diversion equivalent of 2700US$

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			contamination points.				
	Site clearing resulting in destruction of trees and crops.	Loss of biodiversity on the hillsides and valley	• Offset the biodiversity inundated, by replanting it at 2-5m buffer along the central drains and side primary canals. • Among the species to be replanted *Solanum capsicoides* shall not be replanted to avoid its characteristic nature of being an invasive weed.	• During construction period	• RSSP 3	Once after construction is complete	500Rwf or 71 US cents/ m^2 for re-vegetating. Cost offsetting the lost biodiversity to the buffer area of about 3ha could be 15Million Rwf or 20,689US$
	Excavation and installation of drain/ canal infrastructure, diversion structures, access roads	Loss of income from missed cultivation season and fish farming due to delays in construction	• Prepare a clear project implementation program understood by RSSP 3, sector agronomists and farmers. • Affected farmers shall be granted priority in employment of workers on terraces. • Priority to quick completion in areas around fish ponds. In case of delays beyond 2months, the contractor could be required to compensate payment up to 150,000Rwf/month to the fish	• Any time after previous seasonal harvest and before season cultivation. • During site mobilization and recruitment.	• RSSP 3	All through construction.	5000Rwf or 6US$/ person/ day of work for 10 stakeholders meeting for 3 working days. An estimate cost of 180US$ Fish farmer compensation 150,000Rwf or equivalent of

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			farmers derived from fish farmers monthly income estimates.				188US$/month
	Excavations, construction of the drains/canals, diversion structures, access roads, compaction of soils for the canal embankments	Injuries of workers from construction activity	• Ensure the site has appropriate protective gears for workers such as; wellington boots, helmets, nose masks, eye goggles and overalls, with assurance of compliance by a safety department. • An Insurance policy covering injuries or death at the site should be presented by the contractor at contract signature.	• Through construction	• Contractor • RSSP 3.	All through construction	Complete safety gear kit is up to 70,000Rwf or 87.5US$ per person for 100 employed. A total estimate of 7,000,000Rwf an equivalent of 8,750US$. Insurance policy is determined against the contract price of works.
	Construction of the drains/canals, diversion structures, access roads	Contraction of diseases by workers during construction	• Spray of water regularly to suppress excessive dust during construction is strongly recommended; • Provide workers on site with appropriate protective gears	• Through construction	• Contractor	All through construction	5m^3 tank of water spray could cost up to 60,000Rwf or 85US$ per trip. Medical insurance

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			such as; wellington boots, helmets, nose masks, eye goggles and overalls. • Enforce of medical insurance "mutuelle de santé" acquisition for all workers. • Regularly sensitize on ways of HIV prevention and importance of proper hygiene is important during execution of this project.				"Mituelle de sante" costs 1000-3,000Rwf per person equivalent of 1.5- 4.5US$/ person. For 100 contractual employees cost is 300,000Rwf for 12months equivalent to 375US$.
	Project construction and rice cultivation	Population migration in search for employment	• Sectors along with the Districts are 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. • 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	• During planning and construction phase as they notice migration occuring	• Gisagara, Huye and Nyaruguru Districts	Throughout project cycle	Not applicable part of the Districts obligations and within its salary budget to perform this duty.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			the locals in the area. This would reduce on the migrating population.				
	Construction recruitment of workers	Possible child labour	• Recruitment of workers against National ID to avoid employing those under age of 16 years.	• Entire Construction phase	• Contractor	Entire construction phase	No cost implication in verifying age of employees
	Construction employment	Access to jobs for women and youth	• Requirement in the tender document and contract for contractor to employ at least 30% women and youth in the workforce during construction	• Entire Construction phase	• Contractor	Entire construction phase	No cost implication in employing female and youth to minimum requirement
Operation stage	Regulation of water flow from central drain through the metal flood gates	Modification of flows for downstream usage	• Based on the Montana method applied to determine the minimum environmental flow for fish survival, maintain an environmental flow of $2m^3/s$ downstream of the central drain. Since only Montana method was used, other methods such as; wetted perimeter method, Physical Habitat simulation systems, could be used to verify this environmental flow and monitor the flow is complied with during the actual irrigation	• At the time of releasing water for irrigation	• RSSP 3 • Water User's Association (WUA)	During dry season irrigation	No cost applicable

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			operation stage. • Design should ensure a proper drainage network allowing for return flow from the plantations into the main river.				
	Application of excess fertilizers and pesticides to plantations which are eventually washed by run-off into Migina river, also used by fish ponds.	Water pollution from non-point sources	• Apply the RSSP3 Pest Management Plan (PMP) as guidance for pest management. • Train local farmers on the safe and appropriate amounts of application of pesticides and fertilizers. • Take water quality tests to understand the impact of the project on the quality of water bodies and curb any likely impacts there may be before water quality deteriorates. • Quarterly water quality tests are necessary at fish pond water entry points to alert responsible parties when beyond acceptable norms and hence requiring speedy action to control the use of the agrochemical fertilizers	• Training before every season of planting. • Water quality tests at the end of every 2 years of cultivation	• RSSP 3 • REMA • Districts of Gisagara, Huye and Nyaruguru	Training twice a year. Tests once every 2 years. Quarterly tests at fish ponds	Cost of water quality tests might not exceed 150US$ for parameter tests per sample. e.g. parameters such as; E.C, Ph, P, N, TDS, CO_3^{2-}. 600US$ annually spent on water tests for the two years left for RSSP III. Total estimate cost is 1200US$ for the 2 years.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Application of fertilizers	Water logging and salinization	• Regulate water quantity released for irrigation based on crop water requirement could minimise occurrence of water logging and salinization. • Train farmers to regulate quantities of water used will be a long term investment in sustaining the chemical properties of the soil for continuous fertility.	• Through the irrigation	• RSSP 3 • Formed WUA.	As long as irrigation scheme exists	Cost of training WUAs and Cooperatives is catered for in the RSSP 3 Component 2, Sub-component 2.1.
	Cultivation on the hillside catchment area close to the main canals.	High sedimentation levels in the main canals	• Plant a green belt buffer zone of at least 2-5m from the side canals is proposed. It shall comprise of vegetation to filter off sediment before it gets to the canals. The local species to grow can be interchanged on this 2-5m buffer with either; Napier grass, *Solanum aculeastrum* or *Bidens pilosa*.	• Green belt- once demarcations of main canals/ drain have been established.	• RSSP 3. • Kibirizi, Kansi, Kigembe, Tumba, Mukura, Nyanza, Ngera, Ngoma sectors.	Once	Cost of green buffer approximately 3ha could be 15Million Rwf or 20,689US$.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Drainage and Irrigation	Silting or scouring of drains/ canals.	• Construct open drains of trapezoidal section designed by using Manning's formula shall ensure siltation and scouring are brought to a minimum influence for the drains and canals.	• During design and construction.	• Design team. • Contractor • RSSP 3 • WUAs	Once during design	Expensed towards the completed technical study
	Irrigation	Water loss from evaporation and leakage	• Inspect regularly drains/canals and repair of any leakages. • Implement of the designed drainage network to return flow from plantations to recharge main streams of both marshlands.	Monthly inspection. Recharge implemented at construction phase	• RSSP 3 • WUAs	Inspection done through life cycle of irrigation network. Once for recharge drainage implementation.	Cost of inspection and repair dependent on WUAs salary structure. To be determined at operation stage.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Fertilizer and pesticide application	Human health hazards from poor pesticide and fertilizer application	• Adapt recommendation of PMP done for RSSP 3. • Provide technical assistance to farmers by agronomists on how to use them. • Strong awareness towards the farmers on risk of water pollution from fertilizer and pesticides.	• Every time fertilizer and pesticides are applied.	• RSSP 3 • District agronomists.	Every time fertilizer and pesticides are applied.	Cost of training WUAs and Cooperatives is catered for in the RSSP 3 Component 2, Sub-component 2.1.
	Water distribution through the canals for irrigation of command area plantations.	Water conflicts from the creation of the Irrigation scheme	• Create Water Users' Association (WUA) which will manage the amount of water used for each plantation and also resolve arising conflicts over water distribution.	• Establish WUAs before commissioning irrigation infrastructure.	• RSSP 3 • Sector Agronomists.	Once	No cost for creation of WUAs.
	Irrigation	Vandalism of Irrigation infrastructure	• Ensure early organisation of existing cooperatives as the management of structure at the project site. • Community policing for security. • Penalties and punitive action for perpetrators convicted of vandalism.	• Every time vandalism occurs	• Formed Cooperative and WUAs • Project intervention sectors	All through the irrigation	Community policing estimated to cost 200US$/ month around the irrigated command area.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Use of water from the main canal and drains by locals for bathing, washing clothes, drinking and cooking food.	Increased spread of water related diseases (such as; Bilharzia, malaria, dysentery, diarrhoea, etc.)	• The project may work along with MINISANTE in issuing mosquito nets for all farmers to reduce on the spread of malaria. • Restrict locals from using water from the central drain and main canals for domestic consumption. • Construction of water points for communities at the hillsides for domestic consumption	Planting done once canals demarcations have been established. Issuing mosquito nets can be done at the time of project commissioning. Water points as part of site installation	• RSSP 3 project • MINISANTE • Project intervention sectors	Once	Cost of a mosquito net is 2500Rwf equivalent of 3.5US$ but cost offset to MINISANTE as part of its annual responsibility. Water point estimate cost is 1,553,333Rwf (equivalent of 1,871US$)[3] 9 water points for 9 administrative villages costs 16,839US$.
	Farmers cultivating closer to the central	Destruction of drains and canal boundaries	• Restrict a 5m distance from the central drain, primary canals and diversion weirs to the nearest plantation has already	• All through the operation	• RSSP 3 • Project intervention	All through the operation	Cost of green buffer approximately 3ha could be 15Million

[3] Reference from AfDB funded project appraisal in Rwanda for Rural Water supply and sanitation programme for Rwanda.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	drain and main canals		been planned for.	phase	sectors. • Formed Cooperative.	phase	Rwf or 20,689US$.[4]
	Introduction of mono-crop cultivation of rice in the entire marshland	Resistance to change of crops and livelihood	• Integration of brick markers and sand miners into the rice scheme by allocating them plots of land for rice production. • Intense sensitization by RSSP III, District and sector officials on the profitability of rice production as opposed to maize is of paramount importance. • In case of continued resistance, rice and maize production can be produced on the separate perimeters of the Migina marshland.	• Planning and project design stage and later at commencement of operation stage.	• RSSP 3 • Districts of Gisagara, Huye and Nyaruguru.	Planning to operation stage	Cost of sensitisation is catered for in the RSSP 3 Component 2, Sub-component 2.1
	Water released from the central drain for irrigation of the plantations.	Wastage of water	• Train WUAs technicians to manage quantities apportioned for plantation from metal flood gates and wooden beams to reduce water misuse.	• Through the operation phase	• WUAs. • RSSP 3.	As long as irrigation occurs	No cost implication.

[4] Reference from EIA for Nyabirande and Ndongozi marshland rehabilitation by RSSP III 2014.

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
			• Inspect frequently and repair leaking infrastructure. • Sensitize farmers on proper management of water allocated for their plantations.				
Decommissioning Phase	Demolishing of the drain/ irrigation infrastructure	Land depreciation from abandoned Infrastructures	• Plan for a better income generating project for the area before this project is replaced.	• At the pre-feasibility stage of a replacing project	• MINAGRI • Existing cooperative.	Once	Cost can only be determined at the time of demolition.
	Demolition of the drains and canal irrigation infrastructure	Dust and noise pollution from demolition activities	• Provide Protective gear, such as; eye goggles, ear phones and nose masks. • Spray water to reduce dust. • Compact 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.	• During demolition	• Contractor.	All through the demolition period	Cost can only be determined at the time of demolition.
		Contaminatio	• Monitor the waste disposal in	• During	MINAGRI	Once	Cost of water

Phase	Activity	Adverse Impacts	Proposed Mitigation/Enhancement measures	Implementation schedule	Responsible Institution	Occurrence	Estimated costs (US$)
	Disposal of debris during demolition	n and impaired environment	authorized damping areas to avoid contamination of receiving waters or causing human health hazards.	demolition	Farmers' Cooperative. District	during debris disposal	quality test is 150US$ per sample. For any other tests cost determined at demolition.
	Decommissioning of the drainage and irrigation project	Loss of livelihood	• Farmers should have organized themselves into Cooperatives dealing in commercial agriculture. • Off-farm income earning activities as alternatives, for example; Small- Medium enterprise trading, making of Rwandan traditional basket "Agaseke" on a large scale by women as an off-farm activity done after returning from the plantations.	• After demolition	• MINAGRI • Existing Cooperatives.	After demolition	Cost can only be determined at the time of demolition.

CHAPTER 8: ENVIRONMENTAL MONITORING PLAN

In this chapter a monitoring plan is proposed in **Table 15** below indicating measurements of parameters, responsibility and cost estimates of outcomes of the proposed mitigation measures.

Table 15: Environmental and Social Monitoring Plan

Activity/ mitigation measures	Parameters	Indicator	Method	Frequency of measurement	Responsibility	Cost estimates (US$)
Construction phase						
Inspection of Equipment and automobiles in good shape to reduce on air, noise and soil pollution	• Certification from Automobile inspection centre	• Number of Automobiles with certification on site	• Counting qualifying automobiles	• Quarterly through the construction phase	• Contractor	Cost of inspection is 10,000-15,000Rwf (or 14-21US$)/ automobile for every six months.
Restriction of noise emitting activities to working hours. Use of certified construction equipment in good condition. Spraying of water to reduce dust.	• Sound decibels. • Greenhouse gas content (CO_2, CO, CH_4) and dust particles in the air.	• Sound levels • Air quality emission levels	• Application of noise monitoring systems. • Gas emission tests	• At the time of works that emit a lot of noise or vibrations, for example; like; earth works or concrete vibrations. • During excavation and backfilling works	• Contractor • Project intervention sectors.	Cost of a sound meter level is about 110US$.

Activity/ mitigation measures	Parameters	Indicator	Method	Frequency of measurement	Responsibility	Cost estimates (US$)
Offset species planted in the 2-5m buffer along the primary canals and diversion weirs	• Planted area with Napier grass, *Solanum aculeastrum*, *Bidens pilosa*	Number of planted hectares (ha)	• Area measurement	• Every quarter of a year	• RSSP 3	For 3ha of the buffer along main canal 15,000,000 Rwf or 20,689US$[5]
Regular inspection of electrical installations, Fire extinguishers, water tanks	• Fire management equipment	• Number of fire extinguishers and water tanks	• Inspection by Counting extinguisher equipment	• Quarterly through the construction phase.	• Contractor • RSSP 3.	150US$/ trip to inspect.
Safety gear for workers	• Safety gear versus number of workers	• Number of workers with safety gear	• Inspection by Counting.	• Quarterly through the construction phase.	• Contractor • RSSP 3.	150US$/ trip to inspect.
Green buffer at the central drain and main canals and diversion weirs	• Planted area with Napier grass, *Solanum aculeastrum*,*Bidens pilosa*	Number of planted hectares (ha)	Area measurement	• Annually	• RSSP 3	15,000,000 Rwf or 20,689US$
Operation phase						

[5] Reference from EIA for Nyabirande and Ndongozi marshland rehabilitation by RSSP III 2014.

Activity/ mitigation measures	Parameters	Indicator	Method	Frequency of measurement	Responsibility	Cost estimates (US$)
Environmental flow of 2m^3/s at the central drain to maintain flows and ecosystem downstream during dry season	• Water quantity/flow rates	• Flow rate, Q (m^3/s)	Flow measurement records at the weirs of the diversion structure.	• Annually	• MINAGRI • RSSP 3	250US$/ annual flow analysis and interpretation.
Water quality tests to determine level of Water pollution from use of pesticides and fertilizers	• Water quality	Nutrient load in water recipients from non-point sources (NO_3^-, PO_4^{2-}, K).	• Samples of water and soil quality tests.	• Twice a year.	• RSSP 3	Cost of water quality tests might not exceed 150US$/ sample for a complete quality test.
Soil tests to avoid soil degradation and guide on nutrient requirement	• pH, nitrates, ammonia, organic carbon, phosphorous, Exchange acidity	• soil acidity and other parameter levels	• Soil quality tests of plantations	• Every 2years	• RSSP 3.	Cost of soil test is 800US$/ sample test of all parameters.

CHAPTER 9: PRELIMINARY DECOMMISSIONING PLAN

Decommissioning of the proposed RSSP 3drainage and irrigation project will become necessary when the project completes its life cycle or when there is change of use. In a situation where the drains/ canals, diversion structures, metal flood gates and small civil engineering infrastructure complete their lifecycle, decommissioning process will typically involve dismantling of the equipment, 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 drainage 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; drains, canals, diversion structures 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 canals 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 damp 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 3project (if still in existence) or the Cooperative shall obtain all permits required to undertake removal of the project. This basically will include REMA, RRA, Project intervention Districts (Huye, Gisagara and Nyaruguru), MINIRENA, MININFRA.
- **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 Migina marshland development project. The issues/impacts have been assessed and described in 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. The study is recommending that the Project Proponent (RSSP 3) assigns the Environmental and social safeguard officer to undertake the monitoring of the mitigation measures for the project through its existence. This 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

Based on the findings of this EIA study, our recommendations are:

- A green buffer of at least 2-5m along the central drain and primary canals is recommended to prevent farmers from encroaching and hence avoid damage and erosion of their boundaries.
- Baseline and progressive water quality tests of the receiving main river of Migina marshland are necessary to determine whether proposed mitigation measures are working in reducing water pollution from project activity.
- Water abstraction quantities require monitoring through periodic water level measures to avoid water resource depletion. An ecological flow rate of $2m^3/s$ has been recommended for

the existing ecosystem downstream to be maintained for the central drain/ Main River during dry season irrigation.

- The existing Integrated Pest Management (IPM) prepared for RSSP 3 at its commencement should be adapted as guidance in pesticide application for the agreed crops.
- 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.
- Establishment of a cooperative/cooperatives and Water User's Association (WUA) for the Migina project to ensure well managed water distribution, land husbandry and irrigation infrastructure maintenance, collective crop harvest and economic development of farmers.
- Capacity building framework for project beneficiaries is recommended in a number of sectors such as; modern crop growing, irrigation techniques, irrigation infrastructure maintenance and management, water distribution, regulated fertilizer and pesticide application, management of cooperatives and importance of savings accounts.
- In case there is need for notification to Nile basin riparian countries on project activities proposed for Migina River, a tributary to Akagera Basin, MINIRENA, with guidance from MINAGRI on project proposed activities, will request NBI Secretariat to notify all Nile basin riparian countries on Rwanda's behalf. World Bank policy for projects on International waterways agrees to the Nile Basin Initiative (NBI) secretariat can undertake notification to other NBI riparian of the Bank financed projects under the World Bank policy for International waterways.

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: PUBLIC CONSULTATION ISSUES REPORTS

PROJECT TITLE: DEVELOPMENT WORKS OF MIGINA MARSHLAND (55OHA), LOCATED IN GISAGARA DISTRICT, SOUTHERN PROVINCE
PROVINCE: SOUTH
DISTRICT: GISAGARA, NYARUGURU, HUYE
SECTORS: KIBIRIZI, KANSI, KIGEMBE, NYANZA, NGOMA, NGERA, TUMBA, MUKURA

Issues Report for Migina marshland development

Project: RSSP 3 **Project title: Development works of Migina marshland** Date: 21st, 31st March, 8th, 11th- 13th April, 18th-20th April 2016.	

Public consultation/ Field observations:

Methods for reaching stakeholders

The study was able to reach stakeholders in the following manner:

- *First category* of Government officials were met, which included; RSSP 3 and MINAGRI. By using the key guiding questionnaires in *appendix 3*, we were able to guide discussions and obtained relevant information on project activities.
- The *Second category* met was of Local government officials, which included; Sector agronomists for the Districts of project intervention. (i.e. Kibirizi, Kansi, Kigembe, Mukura sectors). With the assistance of RSSP 3 District Rural engineer, we were able to approach these officials. Our discussions with them were again guided by the social interview questions *in appendix 3,* from which information on project benefits, constraints in implementing the project and impacts likely to be caused by the project were reflected.
- The *Third category* was most important were the local farmers that cultivate in Migina marshland. These were farmers from; Tumba and Mukura currently organised in groups

that grow rice, Kibirizi farmers currently organised in groups that grow rice, Kigembe, Ngoma and Ngera farmers currently organised in the Cooperative KORAMUKI that grow Maize, Kansi, Tumba and Nyanza farmers currently organised in the Cooperative Cyihene na Rubona that grow Maize. These too were guided by the social interview questions *in appendix 3,* from which information on project benefits and adverse impacts were aired out.

- *8th, 11th – 13th April 2016*- In the project area, field public consultation meetings were held with the Sector agronomists and members of the Cooperatives and groups offarmers operating in the marshland, likes of; KORAMUKI and Koperative ya Cyihene na Rwibona and rice growing groups of Kibirizi.(i.e. From Sectors of Kibirizi, Tumba, Mukura, Kansi). In the meantime, separate Hydrological, ecological and environmental assessments of the water catchment, marshland and command areas were done.
- *18th- 20thApril 2016*- In the project area, public consultation were held with Sector agronomists and members of cooperatives for Kigembe, Nyanza,Ngera sectors, working in the marshland. Soil sampling and profiling was done around this time.
-

Scheduling of consultation activities

Dates	Place	Activity
21st March 2016	Kigali	Meetings with: • RSSP 3 Rural engineer • RSSP 3 Safeguard specialist
31st March 2016	• Kibirizi, Kansi, Kigembe, Nyanza sectors in Gisagara District. • Mukura, Tumba sectors in Huye District. • Ngera, Ngoma sectors in Nyaruguru District.	Field acquaintance visit • RSSP 3 District Rural Engineer • Sector Agronomists
8th, 11th – 13th April 2016	• Kibirizi, Kansi, Kigembe, Nyanza sectors in Gisagara District. • Mukura, Tumba sectors in Huye District. • Ngera, Ngoma sectors in Nyaruguru District.	Meetings with: • Sector agronomists. • Cooperatives like KORAMUKI, Koperative ya Cyihene na Rwibona. • Farmer groups of the marshland. • Hydrological, ecological and environmental assessment of project areas.

18th- 20thApril 2016	Kigembe, Nyanza,Ngera sectors	Meetings with: • Sector agronomists. • Members of cooperatives and farmer groups. • Soil sampling and profiling. • Ecological and environmental assessment of project areas

Record of field consultation:

Gisagara District consultations

- Administrative structure:
  - Sectors under Project area of influence (Migina marshland) are: Kibirizi, Kansi, Kigembe and Nyanza.
  - Cells under project influence-9 and 23 villages.
  - Extent of Community settlement "Imidugudu" at 70% coverage.
- Common crops grown in marshland- Maize on subsistence farming, with seasonal crop rotation with sweet potatoes and vegetables.
- Markets available- All Sectors except Kigembe have food markets, which operate on Tuesday and Friday.
- Other income earning activities- None other than agriculture and small scale livestock keeping.
- Cooperatives existing legally registered-
  - KOYABIRWIKI "locally called Koperative Ihinga Ibigori mu Gishanga cya Cyihene na Rwibona" in Kansi with member from Ngoma of Nyaruguru District.
  - KORWAMUKI "locally called Koperative Rwanya Ubukene Muhinzi Kigembe" in Kigembe with members from Nyanza and Ngoma of Nyaruguru District.
- Education- primary and secondary schools exist in close proximity for children to attend.
- Health centre- 2 health posts, 5 health centres and Kibirizi Hospital.
- Medical health insurance "Mutuelle de sante" at 80%.
- Electricity-only 5% households have access to electricity.
- Water-no access to piped portable water. They have to fetch water from hillside water collection points that are close by.
- Crop prices: Maize- cost of seed is covered by the MINAGRI CIP project, Price of harvest- 150Rwf/kg. Quantity produced is 100kg/acre.
- Cost of farm in-puts Per parcel of 5acres:
  - -Maize: 6kg DAP, 4kg of Urea,

- -Cost of NPK-550Rwf/kg
- -Cost of Urea- 390Rwf/kg

- Land tenure- Marshland rented from local government. Hillside area- land registered and owned by individuals.
- Progressive Terraces exist at the foothills, done under the sector budget. Planted tree forests exist along the hills sides.
- Other NGOs operating in the area- None other than the catholic church
- Religious affiliations existing- Mostly Catholic with scattered Pentecostal, Anglican, Adventist.
- Cultural heritage- No memorial centres, religious monuments, churches or mosques, grave yards or ritual areas within the boundaries of the marshland.
- Problems faced in cultivating the Migina marshland:
  - Flooding of most of the area.
  - Rotting of crops from flooded area.
  - Insufficient water during dry season causing water conflicts at times.
  - Need to be informed when construction shall commence to avoid losses of produce to construction works.

Huye District consultations

- Administrative structure:
  - Sectors under Project area of influence (Migina marshland) are: Tumba and Mukura.
  - Cells under project influence- 4 and 11 villages.
  - Extent of Community settlement "Imidugudu" at 89% coverage.
- Common crops grown in marshland- Rice on parcels.
- Markets available- Rango food market, which operate on Tuesday and Friday.
- Other income earning activities- None other than agriculture and small scale livestock keeping.
- Cooperatives existing legally registered- No cooperatives only groups of farmers that harvest and sell individually.
- Education- primary and secondary schools exist in close proximity for children to attend. Furthermore, a tertiary institution of the University of Rwanda (UR) at Butare is in close proximity.
- Health centre- 2health posts, 2 health centres and CHUB Hospital in Butare.
- Medical health insurance "Mutuelle de sante" at 84.3%.
- Electricity-only 91% households have access to electricity.

- Water-no access to piped portable water. They have to fetch water from hillside water collection points that are close by.
- Crop prices: Rice- cost of seed is 500Rwf/kg, Price of threshed rice- 450-500Rwf/kg. Quantity produced is 50kg/acre.
- Cost of farm in-puts Per parcel of 5acres:
  - -Rice: 4kg of NPK, 2kg of Urea
  - -Cost of NPK-550Rwf/kg
  - -Cost of Urea- 390Rwf/kg
- Land tenure- Marshland rented from local government. Hillside area- land registered and owned by individuals.
- Progressive Terraces exist at the foothills, done under the sector budget. Planted tree forests exist along the hills sides.
- Other NGOs operating in the area- None other than the catholic church
- Religious affiliations existing- Mostly Catholic with scattered Pentecostal, Anglican, Adventist.
- Cultural heritage- No memorial centres, religious monuments, churches or mosques, grave yards or ritual areas within the boundaries of the marshland.
- Problems faced in cultivating the Migina marshland:
  - Flooding of most of the area.
  - Loss of crops from flooded area.
  - For areas like Tumba and Mukura farm groups and no cooperatives affects their bargaining power for farm gate pricing.
  - Insufficient water during dry season causing water conflicts at times.

Nyaruguru District consultations

- Administrative structure:
  - Sectors under Project area of influence (Migina marshland) are: Ngera and Ngoma.
  - Cells under project influence-5 and 21 villages.
  - Extent of Community settlement "Imidugudu" at 75% coverage.
- Common crops grown in marshland- Maize on subsistence farming, with seasonal crop rotation with sweet potatoes and vegetables.
- Markets available- Ngera does not have a food market but Ngoma has one, which operates on Tuesday and Friday.
- Other income earning activities- None other than agriculture and small scale livestock keeping.
- Cooperatives existing legally registered-
  - KORWAMUKI "locally called Koperative Rwanya Ubukene Muhinzi Kigembe" in Kigembe with members from Ngoma.
  - For Ngera no cooperatives exist, only small groups of farmers who sell their produce

individually.

- Education- primary and secondary schools exist in close proximity for children to attend.
- Health centre- No health posts, 5 health centres and No Hospital.
- Medical health insurance "Mutuelle de sante" at 80%.
- Electricity-less than 5% households have access to electricity.
- Water-no access to piped portable water. They have to fetch water from hillside water collection points that are close by.
- Crop prices: Maize- cost of seed is covered by the MINAGRI CIP project, Price of harvest- 150Rwf/kg. Quantity produced is 100kg/acre.
- Cost of farm in-puts Per parcel of 5acres:
  - -Maize: 6kg DAP, 4kg of Urea,
  - -Cost of NPK-550Rwf/kg
  - -Cost of Urea- 390Rwf/kg
- Land tenure- Marshland rented from local government. Hillside area- land registered and owned by individuals.
- Progressive Terraces exist at the foothills, done under the sector budget. Planted tree forests exist along the hills sides.
- Other NGOs operating in the area- None other than the catholic church
- Religious affiliations existing- Mostly Catholic with scattered Pentecostal, Anglican, Adventist.
- Cultural heritage- No memorial centres, religious monuments, churches or mosques, grave yards or ritual areas within the boundaries of the marshland.
- Problems faced in cultivating the Migina marshland:
  - Flooding of most of the area.
  - Loss of crops to floods.
  - Insufficient water during dry season causing water conflicts at times.
  - For areas like Ngera farm groups and no cooperatives affects their bargaining power for farm gate pricing.
  - Road access hinders their access to potential markets out of their areas with better prices.

APPENDIX 2: LIST OF PUBLIC OR PARTICIPANTS CONSULTED

Name	Institution & Position	Contacts
Didace Habamenshi	RSSP 3 Environment specialist	0788613065
Ramazhan Bizimana	RSSP 3 Rural Engineer	0788461580
Pacifique Muhirwa	RSSP 3 District Rural Engineer	0788890383
Gisele Umuhumuza	REMA	0785130407
Sindayigaya Janvier	Mukura Sector Agronomist	0788831157
Serge Musabyimana	Kigembe Sector Agronomist	0788680928
Viateur Nshuti	Nyanza Sector Agronomist	0788657777
Valens Ndatimana	Kansi Sector Agronomist	0781615123
Jean Claude Niyotwizeye	Kibirizi Sector Agronomist	0785346528
Ntezimana Andre	Cooperative KOYABIRWIKI,Kansi	0786401592
Uwizeyimana Francois	Cooperative KOYABIRWIKI,Kansi	-
Nzabirinda Claude	Cooperative KOYABIRWIKI,Kansi	-
Habimana Jean Bosco	Cooperative KOYABIRWIKI,Kansi	-
Mukandekezi Alphonsine	Cooperative KOYABIRWIKI,Kansi	-
Niyonsaba Gondance	Cooperative KOYABIRWIKI,Kansi	-
Uwimana Immaculee	Cooperative KOYABIRWIKI,Kansi	0783412176
Mayiro Jean Claude	Cooperative KORAMUKI, Kigembe	0783833816
Nyirimagabo Anastase	Cooperative KORAMUKI, Kigembe	0726130843
Ngukumbuje Jean	Cooperative KORAMUKI, Kigembe	-
Mukakamanzi Peraziya	Cooperative KORAMUKI, Kigembe	-
Sibose Jean De Dieu	Cooperative KORAMUKI, Kigembe	-
Mukankusi Venerande	Cooperative KORAMUKI, Kigembe	-
Nyirahabimoko Alphonsine	Cooperative KORAMUKI, Kigembe	-
Nyirashumbusho Francine	Cooperative KORAMUKI, Kigembe	-
Musengiryayo Libereta	Cooperative KORAMUKI, Kigembe	07836338205
Mukamukiza Sipesiyoza	Cooperative KORAMUKI, Kigembe	-
Sibomana Eduoard	Cooperative KORAMUKI, Kigembe	-

APPENDIX 3: KEY GUIDING QUESTIONS

Sociologist Interview Questionnaire

- **Interview guide with Local Population/Migina farmers**

1. Have you ever been told that the irrigation project for rice production? *Mwigeze mubwirwa ko hari umushinga wo kuhira igihingwa cy'umuceri?*
2. How do you appreciate this project? *Uyu mushinga murawumva mute?*
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 bahari barabimenyeshejwe?*
4. Are there school infrastructures and health centers? *Hano amashuri n'amavuriro arabegereye?*
5. Don't you see any effects due to irrigation activities such malaria? *Ubu buryo bagiye kuzatega amazi bayagomera mubona nta ngaruka bizabagiraho? Ese nta malaria bishobora kubatera?*
6. What are the main activities that enable you to earn money in this District? *Ni iyihe mirimo mufite yinjiza mafaranga?*
7. Do you own any of the land in the marshland and has you land been registered? *Ufite ubutaka bukwanditseho mu gishanga. Ese ubutaka bwa hano bwose bwarabaruwe?*
8. Do you think that this project will improve your living conditions? *Mubona uyu mushinga wo gutunganya igishanga no guhinga igihingwa kimwe hari icyo uzahindura ku mibereho yanyu ya buri munsi?*
9. What are the consequences of the displacement of the population due to the project? *Ni izihe ngaruka zaba hari abaturage bimuwe kubera gahunda yo gutunganya iki gishanga?*
10. Have you ever cultivated rice? If yes, where? If no, why? *Mwaba mwarigeze muhinga umuceri? Niba ari yego, hehe? Ryari? Kuki mwabiretse? Niba ari oya. Kubera iki?*
11. Do you have cooperatives? *Mubumbiye mu ma koperative?*
12. Do you see any consequences on your lives by project? *mubona hari ngaruka uyu mushinga uzagira ku buzima bwanyu?*
13. There some insects, birds and other animals that appreciate such crops, do you see any effects due to these pests on your livilehood dependence on this crop? *Ko hari udukoko*

n'udusimba twinshi dukunda ibibihingwa, mubona dushobora kugira ingaruka ku buzima bw'abahinga iki gishanga?

14. What can you suggest RSSP III that this project may be useful for your families? *Ni iki mwasaba RSSP III kugira ngo uyu mushinga uzagirire rwose akamaro imiryango yanyu?*

- **Interview guide with RSSP III staff**

1. Are the population aware on the project development of irrigation infrastructure for rice production? If yes, when? If no, why? *Ese abaturage bagejejweho mbere gahunda yo gutunganya iki gishanga no guhinga umuceri? Niba ari yego, ryari? Niba ari oya, kubera iki?*
2. Are they people who will be displaced due to the project ? *If yes are they informed? Ese hari abagomba kwimurwa kubera iyi gahunda? 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 ahandi?*
4. Does the project have a time limit? *Gahunda yo gutegura igishanga no guhinga umuceri ni gahunda izahoraho? 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 hagize ikibazo kivuka kibangamiye abaturage ku mitunganyirize y'igishanga, ubwo byabarwa kuri nde?*
6. Have you thought about the market for rice production? *Ese uyu mushinga utekerezwaho, mwatekereje n'aho abaturage babona isoko ry'umuceri?*
7. How can you assure the population that the project will improve the living conditions of the population? *Ni ikihe cyemezo mwaha abaturiye uyu mushinga ko wazazamura imibereho yabo?*

- **Interview guide with local authorities**

1. Have you ever been told that this project? *Mwigeze mubwirwa uyu mushinga?*
2. How do you appreciate this project? *Uyu mushinga murawumva mute?*

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 bahari barabimenyeshejwe?*
4. What are the main activities that enable you to earn money in this District? *Ni iyihe mirimo mufite yinjiza mafaranga?*
5. Do you think that this project will improve the population living conditions? *Mubona uyu mushinga wo gutunganya igishanga no guhinga igihingwa kimwe hari icyo uzahindura ku mibereho y'abaturage banyu?*
6. Are there cooperatives or associations operate in this marshland? *Hari amacooperatives cyangwa ama associations akora muri iki gishanga?*
7. What are the main activities in those cooperatives or associations? *Ayo makoperative cg amasosiations yibanda ku yihe 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 guhura nabyo ni ibihe?*
10. What are the consequences of the displacement of the population due to the project? *Ni izihe ngaruka zaba hari abaturage bimuwe kubera gahunda yo gutunganya iki gishanga?*
11. Are the population aware on the project of development of irrigation infrastructure for rice production? If yes, when? If no, why? *Ese abaturage bagejejweho mbere gahunda yo gutunganya iki gishanga no guhinga umuceri? Niba ari yego, ryari? Niba ari oya, kubera iki?*
12. If there is any problem that could affect the population due to this project, who will be responsible of that? *Ese hagize ikibazo kivuka kibangamiye abaturage ku mitunganyirize y'igishanga, ubwo byabarwa kuri nde?*
13. Have you thought about the market for the suggest crop production? *Ese uyu mushinga utekerezwaho, mwatekereje n'aho abaturage babona isoko ryo kugurishirizamo icyigihingwa?*
14. How can you assure the population that the project will improve the living conditiond of the population? *Ni ikihe cyemezo mwaha abaturiye uyu mushinga ko wazazamura imibereho yabo?*

15. How this project will help specifically vulnerable people of this Sector? *Ese uyu mushinga wo gutunganya iki gishanga by'umwihariko uzamarira iki abatishoboye?*
16. How are you going to face the problem of students drop out due to looking for job? *Muzahangana mute n'ikibazo cy'abana bava mu mashuri bajya gushaka akazi mu mirima y'imiceri?*
17. What can you suggest RSSP III that this project may be useful for your families? *Ni iki mwasaba RSSP III kugira ngo uyu mushinga uzagirire rwose akamaro imiryango yanyu?*

- **Interview guide with un registered groups, zones, registered Cooperative, NGO members (if any)**

1. How many cooperatives or associations are they in this cell or sector? *Hari amacooperatives angahe cyangwa ama associations angahe muri aka kagari cyangwa umurenge?*
2. What are the main activities in those cooperatives or associations? *Ayo makoperative cg amasosiations yibanda ku yihe 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 guhura nabyo ni ibihe?*
5. Do you think that rice is convenient to replace your common local crops? *Mubona ibi ikihingwa bya simbura ibyo mwari musanze muhinga?*
6. Have you been told that this project? *Mwigeze mubwirwa uyu mushinga?*
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 bahari barabimenyeshejwe?*
9. Do you see any effects due to irrigation activities? *Ubu buryo bagiye kuzatega amazi bayagomera mubona nta ngaruka bizabagiraho? Ese indwara zishobora kubatera? Nizihe?*
10. Do you have land in the marshland? Has you land been registered? *Ufite ubutaka mu gishanga? Ese ubutaka bwa hano bwose bwarabaruwe?*

11. Do you think that this project will improve your living conditions? *Mubona uyu mushinga wo gutunganya igishanga no guhinga igihingwa kimwe hari icyo uzahindura ku mibereho yanyu ya buri munsi?*
12. Have you ever cultivated rice? If yes, where? If no, why? *Mwaba mwarigeze guhinga umuceri? Niba ari yego, hehe? Ryari? Kuki mwabiretse? Niba ari oya. Kubera iki?*
13. What can you suggest RSSP III that this project may be useful for your families? *Ni iki mwasaba RSSP III kugira ngo uyu mushinga uzagirire rwose akamaro imiryango yanyu?*

APPENDIX 4: MATRIX ANALYSIS

Impacts Analysis

Environmental Impact	**Impact type**									
Migina marshland development project	***Positive***		***Negative***						**Mitigation**	
1. Construction of drains, canals, hydraulic structures for the drainage and irrigation of Migina	***Significant***	***Not significant***	***Significant***	***Not significant***	***Short term***	***Long term***	***Irreversible***	***Cumulative***	***Required***	***Not required***
Increase of production from farming all year through (all season)	**X**									**X**
Market access for agricultural products	**X**									**X**
Collective harvest for large quantities and market continuity	**X**									**X**
Increased crop yield	**X**									**X**
Affordability of education	**X**									**X**
Affordability of medical insurance	**X**									**X**
Employment creation	**X**									**X**
Transfer of skills during the construction phase	**X**									**X**
Improved soil fertility	**X**									**X**
Agricultural Intensification	**X**									**X**
Land Appreciation	**X**									**X**

Empowerment of farmers	**X**									**X**
Gradual soil acidification										
Oil spillage resulting in soil and water contamination			**X**		**X**	**X**		**X**	**X**	
Air and Noise pollution			**X**		**X**				**X**	
Soil Erosion and land slides			**X**			**X**	**X**	**X**	**X**	
Fire Outbreak			**X**		**X**		**X**		**X**	
Loss of biodiversity on hillsides and valleys			**X**			**X**		**X**	**X**	
Income loss from missed season cultivation			**X**			**X**		**X**	**X**	
Injuries from construction works			**X**			**X**		**X**	**X**	
Diseases from interactions of construction activity			**X**			**X**		**X**	**X**	
Modification of flows for downstream usage			**X**			**X**	**X**	**X**	**X**	
Water pollution by fertilizer and pesticide application			**X**			**X**	**X**		**X**	
Water logging and salinization			**X**			**X**		**X**	**X**	
High sedimentation levels			**X**			**X**		**X**	**X**	
Siltation and scouring of canals/drains			**X**			**X**		**X**	**X**	
Water loss from evaporation and leakage			**X**			**X**		**X**	**X**	
Health hazards from poor pesticide and fertilizer application.			**X**			**X**		**X**	**X**	
Water conflicts from the creation			**X**			**X**		**X**	**X**	

of irrigation scheme										
Vandalism of irrigation infrastructure			**X**			**X**		**X**	**X**	
Increased spread of Water related diseases			**X**			**X**		**X**	**X**	
Encroachment of the central drain and main canals			**X**			**X**		**X**	**X**	
Abandoned Infrastructure			**X**			**X**	**X**		**X**	
Dust and noise pollution from demolition activities			**X**		**X**				**X**	
Contamination and impaired environment			**X**			**X**		**X**	**X**	
Loss of livelihood			**X**						**X**	

APPENDIX 5: TERMS OF REFERENCES

CONTEXT

The Government of Rwanda (GoR) is pursuing a comprehensive Poverty Reduction Programme. In support of this Programme, the GoR has received a credit from the International Development Association (IDA) towards the implementation of 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: Infrastructure for Marshland, hillside and commodity chain 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: Capacity building for Marshland, hillside and commodity chain development. 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 development of irrigation infrastructures to enhance rice production in Migina marshland in Gisagara District, Southern Province. This activity requires the preparation of an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP). For the purpose 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, OP/BP 4.37 Safety of dams 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.

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 development of irrigation infrastructure of Migina (±550 ha) marshland, 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.

SPECIFIC TASKS

The present terms of reference were designed to guide the study for Environmental Impact Assessment of the works related to the proposed development of irrigation infrastructure for rice production in Migina (±550 ha) marshland 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), Rwanda Development Board (RDB), Rwanda Natural Resources Authority (RNRA), Ministry of Agriculture and Animal Resources (MINAGRI), Districts authorities and RSSP. The EIA study will carry out environmental analysis and planning to support irrigation developments that:

- Realize agricultural benefits while improving marshland ecological services (eg. water retention, downstream flood mitigation, biodiversity) within and around each site;
- Minimize potential adverse environmental health impacts (eg. malaria, bilharzias, etc.) and pollution (runoff of fertilizer and pesticide, etc.)

The study will also provide an environmental management plan that:

- identifies opportunities and provides specific measures for the conservation or restoration of ecological services (eg. water retention, downstream flood mitigation, biodiversity) within and around the site;
- provides design and operation measures to minimize the risk of pollution and environmental health impacts;
- prescribes other mitigation measures needed to ensure long-term subproject sustainability (eg. institutional capacity building for environmental management at all levels, public safety measures around reservoirs, domestic water sources, cattle watering facilities on hillsides) and,
- outlines a monitoring program to track agricultural and environmental performance of the target watersheds and implementation of the mitigation measures for the refinement of future management action as required.

In order to gather the required data, field surveys in Migina marshland and their surrounding catchments will be required. This will be done in close collaboration with RSSP, MINAGRI, RDB, RNRA, REMA and Districts authorities. In each site, the study will include mapping sensitive natural habitats and important ecological conservation zones and working with SPIU RSSP/LWH Environmental Officer, RDB 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 the present 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, marshland flooding, 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 production of targeted crops in the rehabilitated marshlands

The selected firm will conform to the regulations of Rwanda Environmental Management Authority (REMA) regarding EIA process in Rwanda and will prepare the EIA in compliance with World Bank Operational Policies, especially OP 4.01 Environmental Assessment, OP 4.04 Natural Habitats, OP/BP 4.37 Safety of dams, and OP 4.09 Pest Management.

Marshland rehabilitation activities in Migina 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:

Requirements of EIA

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

Review of Baseline Data

Assemble, evaluate and present baseline data on the relevant environmental characteristics of the Project area. This includes information on any changes anticipated before the project commences as detailed below:

- **Physical environment**: |Geology; topography; soils and fertility status; climate; ambient air quality; surface and ground- water quality; ecological flow analysis for existing streams.
- **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.
- **Socio-cultural environment**: population; community structure; socio economic activities, infrastructures, cultural properties.
- **Analysis of interactions** likely to occur with all activities in the vicinity of the command area and cumulative impacts on the environment.

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.

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.

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:

Site screening

Describe how project sites are selected and screened. 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 the construction of infrastructure or civil works. Possible impacts to

be screened for include:

- Social impacts related to the displacement of the people and livestock in the marshland to be developed) ;
- Impacts on cultural heritage, such as archeological sites if relevant;
- Impacts on the fauna and flora, particularly on endangered species if relevant;
- Impact of marshland rehabilitation on infrastructure (roads, electric wires, channels), biodiversity and air quality;
- Management of Waste materials: re-use or recycling of construction waste such as mixture of cement concrete, pieces of timber etc. and their impacts on humans, biophysical components;
- Erosion and disturbance of the vegetation, the soil water seepage and infiltration of water into the irrigation channels and evaporation;

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 or acidity 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.

Irrigation and crop production

Possible impacts to be screened for with regard to irrigation and crop production include:

- The salinity or acidity 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) ;
- The high concentrations of nitrate in the drinking water, particularly in underground water source;
- The increased incidences of malaria, especially in the irrigation channels;

Detailed soil analysis will be conducted to determine whether the soil of the marshland is suitable for the rice production.

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).

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), Involuntary Resettlement (OP 4.12), Physical Cultural Resources (OP 4.11), and 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-economical impacts

Environmental Management Plan (EMP):

The Environmental Management Plan includes the following components:

Mitigation

The EMPs 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.

REPORTING

Reporting requirements

The findings of the reviewed relevant literature and field visits will be compiled into **one EIA report**. The report will be based on the above terms of reference and will be submitted to SPIU RSSP/LWH in one printed copy, 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:

Executive summary
This concisely discusses significant findings and recommended actions.

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

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.

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.

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. , access roads, , 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:

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

Analysis of alternatives

This section **s**ystematically 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.

Assessment of 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.

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

Conclusions and Recommendations of the author/Consultant or Developer

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.

References

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

The consultant will refer to the project documentation covering environmental and social aspects to develop this report. These documents are available on RSSP website and World Bank InfoShop and include: Environmental and Social Management Framework, Resettlement Policy Framework, Pest Management Plan and Small Dam Safety Guidelines.

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 (eg. 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

Report presentation and Deadlines

The first draft of the EIA report for Migina site will be presented within 60 calendar days from the date of signing the contract by both parties. SPIU RSSP/LWH will have 5 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 for each site will be presented within 15 calendar days after submitting the comments to the consultant. SPIU RSSP/LWH will have 5 working days to check the documents. The final draft EIA report will be sent to World Bank for review and request some modifications on it, if any.

The consultant will have 5 days calendar to incorporate all comments from World Bank. The Final version of the EIA report for Migina site will be presented in 3 printed copies and one 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 reports 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.

QUALIFICATIONS AND EXPERIENCE REQUIRED

Qualifications and experience required for the firm

The firm to be qualified for this study will have a vast experience in consultancy services with at least 5 references in Environmental Impact Assessment studies.

Qualifications and experience required for the key personnel

To realize this assignment, the selected firm will hire competent and qualified personnel with proven experience in similar services as follows.

1. Team Leader who is Environmental Specialist and with minimum Masters Degree in Environmental Science or related fields and with a background in soil and water management for the Assessment of Impacts on the Environment, the key personnel needed for this study by **the firm** will have the minimum qualifications below:
2. An Ecologist or a specialist in Biology (Botany or Zoology) with minimum Bachelor Degree to evaluate potential impacts of the project activities on the flora and fauna of the project site and its surrounding, and propose alternatives;

3. A Specialist in Soil management with minimum Bachelor Degree to analyze potential impacts of the project activities on soil of the command area and its surrounding, and propose the alternatives;
4. 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.
5. 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); e*xperience in the domain*:* 5 years; specific experience: 5 references in Environmental Impact Assessment.

(ii) The Ecologist or specialist in biology (botany or zoology): experience in the domain: 5 years; specific experience: 3 references in Assessment of Impact of project activities on the flora and flora

(iii) The Soil Scientist: experience in the domain: 5 years; specific experience: 3 references in assessment of impacts on soil resources due to land husbandry works, irrigation, use of chemicals;
(iv) 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;
(v) 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 and copies of academic certificates.***

STUDY DURATION AND LEVEL OF EFFORT

The assignment will last for two (2) calendar months of Consultant.

APPENDIX 4: PROFILES OF THE PARTICIPATING CONSULTANTS

SONGA Silvin- holds a MSc in Environmental Science and Technology and BSc in Civil engineering. He has 9 years professional experience in the field of environmental assessment and management and 13 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.

Edward Bagumira- holds a MSc in Hydrology and Water resources engineering and a BSc in Civil Engineering. He has over 8 years professional experience as a hydrologist in mainly agricultural related projects and over 13 years professional experience as a water engineer for hydraulic structures and civil works that involved construction works of buildings, warehouses, laboratories, among others.

Prof. Naramabuye Francois Xavier- holds a Phd in Science and Agriculture sciences, MSc in Applied environmental soil science and BSc in soil science and Rural engineering. He has over 15 years of experience in studies involving soil science. He is senior lecturer in the department of soil science for the University of Rwanda (UR).

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.

Nyiransabimana Venantie- holds a MA in Gender and Development and BA in Sociology and is currently completing a PhD in Gender. 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.