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# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

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## CONSULTANCY TO CONDUCT THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF MUGESERA WATER SUPPLY SYSTEM PROJECT



ESIA PREPARED BY:



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# 0. EXECUTIVE SUMMARY

## 0.1. PROJECT BACKGROUND

The provision of adequate Water Supply System services is more generally a prerequisite and indicator for socio-economic development. The Government of Rwanda has a plan to develop towns near borders interacting with the neighbouring countries and among those towns includes Ngoma City bordering the Northern Burundi.

Ngoma District is situated in Eastern part of the country, less endowed with water natural sources, a part the three lakes Bilira, Mugesera and sake connected to Ahagera river. According to EICV3, around 67.6% of Ngoma households have access to safe water including (74.2%) of households using an improved water source. The Government's objective is to increase a hundred percent (100%) access to clean water supply which will contribute to enhanced hygiene and sanitation hence reducing waterborne diseases in the target area.

In this line, through the loan received from the African Development Bank (AFDB), Water and Sanitation Corporation Ltd (WASAC) representing the Government of Rwanda intends to apply a portion of it to the Feasibility Study, Detailed designs and Supervision of the Construction of Mugesera Water Supply System, Phase I (6,000 m<sup>3</sup>/day treatment plant and distribution network). The implementation of such a development project will surely generate an array of positive socio-economic benefits, but also adverse impacts to human community and environment.

In reference to the Ministerial Order N° 001/2019 dated on 15/04/2019 establishing the list of works, activities and projects that have to undertake an ESIA, Mugesera WSS project is in a category of "water distribution activities and sanitation". Thus, in compliance with the requirements of the Law on Environment N°48/2018 of 13/08/2018 as well as the Ministerial Order mentioned above, an ESIA should be prepared which will be approved by Rwanda development board (department of EIA) prior to the implementation of the project.

## 0.2. PROJECT DESCRIPTION/PROJECT ACTIVITIES

During the construction, operation, and decommissioning phases of Phase I of the Mugesera Water Supply Project, the following activities will be undertaken:

### 1. Construction Phase:

- Collecting Raw Water Intake

- Water Treatment Plant of a capacity of 6,000 m<sup>3</sup>/day.
- Storage Reservoirs:
- Pumping Stations:
- Pressure Breakers:
- Pipeline Network

2. **Operation Phase:**

- Water Treatment and Distribution:
- Reservoir Management:

3. **Decommissioning Phase:** In the event that Phase I of the project reaches the end of its lifespan or becomes obsolete, the decommissioning phase will involve the following activities:

- Infrastructure Removal
- Site Restoration
- Waste Management: Appropriate disposal or recycling of any construction or operational waste generated during the project's lifespan.
- Closure and Handover: Completion of all necessary administrative tasks, documentation, and transfer of responsibilities to relevant stakeholders or authorities.

Division of works	Infrastructures proposed
Preliminary works	Site installation, installation of 4 site signboards, elaboration of working drawings, factory acceptance testing for materials and equipment, elaboration of the as built drawings and site evacuation.
Construction of raw water intake	Construction of the intake channel, construction of pump house, construction of security booth, external paving and fencing works, landscaping and drainage works, supply and installation of electromechanical equipment, supply and installation of hydraulic equipment and fittings, testing and commissioning.
Construction of water treatment plant	Construction of a water treatment plant with three treatment channels of 11,000 m <sup>3</sup> /day each, construction of power house for generator, construction of pump house, construction of treated water tank 3,750 m <sup>3</sup> , construction of a laboratory, construction of a storehouse, construction of an administration block, construction of 3 roomed residential buildings, construction of security booth, external paving and fencing works, landscaping and drainage works, supply and installation of electromechanical equipment, supply and installation of hydraulic equipment and fittings, testing and commissioning.
Supply and installation of pipes	Supply and installation of pipes with a total length of 487 km.
Construction of inspection chambers	Construction of the following concrete inspection chambers: <ul style="list-style-type: none"> <li>◆ 340 air-release chambers;</li> </ul>

Division of works	Infrastructures proposed
	<ul style="list-style-type: none"> <li>◆ 343 washout chambers;</li> <li>◆ 113 control valve chambers;</li> <li>◆ 7 sectioning valve chambers;</li> <li>◆ 202 valve chambers to connect the existing WSS with the new water supply system;</li> <li>◆ 27 pressure breakers.</li> </ul>
Construction of water storage reservoirs	<p>Construction of the following concrete water storage reservoirs:</p> <ul style="list-style-type: none"> <li>◆ 1 reservoir of 50 m<sup>3</sup> – RS12;</li> <li>◆ 2 reservoirs of 200 m<sup>3</sup> – RS7 and RS11;</li> <li>◆ 1 reservoir of 500 m<sup>3</sup> – RS6;</li> <li>◆ 1 reservoir of 1,000 m<sup>3</sup> – RS8;</li> <li>◆ 2 reservoirs of 1,500 m<sup>3</sup> – RS5 and RS9;</li> <li>◆ 1 reservoir of 2,000 m<sup>3</sup> – RS4;</li> <li>◆ 1 reservoir of 2,500 m<sup>3</sup> – RS2;</li> <li>◆ 1 reservoir of 3,000 m<sup>3</sup> – RS3</li> <li>◆ 1 reservoir of 3750 m<sup>3</sup> – RS10;</li> <li>◆ 2 reservoirs of 4,000 m<sup>3</sup> to make 8,000 m<sup>3</sup> – RS1.</li> </ul>
Construction of booster stations	<p>Construction of 3 booster stations with the following works:</p> <ul style="list-style-type: none"> <li>◆ Construction of pump house;</li> <li>◆ Construction of guardhouse;</li> <li>◆ External paving and fencing works;</li> <li>◆ Landscaping and drainage works;</li> <li>◆ Supply and installation of electromechanical equipment;</li> <li>◆ Supply and installation of hydraulic equipment and fittings, testing and commissioning.</li> </ul>
Construction of community water points	Construction of 84 community double water points

### 0.3. JUSTIFICATION OF MUGESERA WSS's ESIA study

Mugesera water supply project is located in the southeast of Rwanda, in the Eastern Province within Ngoma District, region essentially dominated by lowlands and hills with low slopes, but also without flowing natural sources of water a part Akagera river and lakes Bilira, Bugesera and Sake fed by this river through wetlands.

Moreover, the recent socioeconomic survey has ascertain that half of the interviewed population has access to an improved water resource (their own stand pipe or borehole), with 54.31 percent of the households using a shared well, borehole or stand pipe compared to 35.4 percent at national level.

Pumping raw water to be treated will be in Lake Mugesera more connected with Akagera River system and has a sustainable recharge of water through marshlands areas. Mugesera has been selected to be used as it has a positive water balance on its own.

The implementation of Mugesera Water Supply System will surely generate an array of positive socio-economic benefits, but as a development project to be executed within the Ngoma District described above, it will likely generate adverse impacts to human community and environment in general, such as for example: (i) acquired individual lands and destruction of crops for water infrastructures construction, (ii) mismanagement of sludge and backwashed water susceptible to pollute the lake and affect aquatic biodiversity, (iii) loss of natural habitats and their biodiversity, (iv) soil and water pollution by domestic waste water et.....

Thus, ESIA for Mugesera WSS should be elaborated in order to constitute a tool highlighting on how to manage the identified impacts which should be minimized, reduced, mitigated or eradicated during all phases of project execution.

Another reason is that Policy/Legal and International Finance Institutions' requirements constitute also key factors justifying the elaboration of Mugesera WSS's ESIA.

#### **0.4. OBJECTIVES OF THE ESIA STUDY**

The first objective of the present ESIA study is to produce a document which will serve as an important tool highlighting on how to manage the potential impacts generated through Mugesera WSS planned activities, likely to affect human community and the environment in general.

The second objective is to ensure that Mugesera WSS development activities will not undermine existing critical resources, ecological functions of Lake Ecosystem or the well-being, lifestyle and livelihood of biological communities who depend on these.

The third objective is to meet the national regulations and international finance institutions' requirements.

## **0.5. METHODOLOGY UTILIZED**

The present study was conducted following procedures aligned in the Law on environment, the Ministerial Order N° 001/2019 dated on 15/04/2019 establishing the list of projects that must undergo an EIA and in compliance with AfDB Environmental and Social safeguards procedures.

The general methodology utilized has focused on: (i) in-depth review of existing literature on the project, (ii) field surveys conducted for gathering baseline conditions on physical, biological and socio-economical environment, (iii) observations for appreciation of impacts likely to be generated during project implementation and (iv) consultations with different stakeholders and public for socioeconomic information and also getting their opinions and expectations about the project.

## **0.6. SCOPE OF THE STUDY**

The present study was undertaken by the Consultant with the intention of collecting enough and relevant information inherent to ensure the production of an appropriated ESIA document including an Environmental and Social Management Plan (ESMP).

The scope of this study will be restrained to areas located in Ngoma District of the Eastern Province of Rwanda. It is restricted to the project main components such as construction of intakes to collect water, booster pumping stations, water treatment plant, reservoirs for stocking water, installation of pipelines network, considering project activities such as: design, construction, upgrading existing water infrastructures and access roads as well as water distribution.

## **0.7. POLICY-LEGAL AND INSTITUTIONAL FRAMEWORK**

The Mugesera Water Supply System (WSS) project has undergone a comprehensive review of relevant national laws, policies, plans, and strategies, as well as international conventions to assess their applicability to the project and highlight their relevance. The national statutes and legislation that were reviewed include the Constitution of the Republic of Rwanda (revised in 2015), the Law on Environment (2018), the Law on the use and management of water resources in Rwanda (2018), the Law on mining and quarry operations (2018), the National Land Law (2020), the Law relating to expropriation in the public interest (2015), the Law regulating Labour in Rwanda (2018), and the Ministerial Order establishing environmental impact assessment requirements and procedures (2019), among others.

The project also considered various policies, plans, and strategies such as Rwanda Vision 2050, the National Biodiversity Strategy (2015), the Sanitation Policy (2016), the National Water Supply

Policy (2016), the Integrated Water Resources Management Policy, the National Strategy for Transformation (2017-2024), the National Environment and Climate Change Policy (2019), the National Land Policy (2019), the National Policy for water resources management (2011), the National Occupational Safety and Health Strategy (2019), the National Strategy for Climate Change and Low Carbon Development (2011), and others. These documents provide a framework for sustainable development and guide the environmental, social, and economic aspects of the Mugesera WSS project.

Furthermore, the project has taken into account the AfDB Integrated Safeguards System (ISS), which aims to protect the environment and people from potential adverse impacts and ensure the sustainability of project outcomes. The specific operational safeguards of the AfDB's ISS that were considered include environmental and social assessment, involuntary resettlement, biodiversity, renewable resources and ecosystem services, pollution prevention and control, hazardous materials, resource efficiency, labor conditions, health, and safety.

By incorporating these laws, policies, plans, strategies, and the AfDB's ISS, the Environmental and Social Impact Assessment (ESIA) report ensures that the Mugesera WSS project complies with the relevant regulatory frameworks and international standards. This comprehensive approach enables effective management of the project's environmental and social aspects, promoting sustainability and minimizing potential adverse impacts

## **0.8. BASELINE CONDITIONS IN THE PROJECT AREA**

Under this chapter, physical and biological environmental conditions prevailing within the project's circumscription as well as socio-economic profile in the administrative entities covering the project were considered to understand the current conditions of the project areas.

**Baseline Bio-Physical Environment:** The baseline bio-physical environment of the project area for the Mugesera Water Supply System (WSS) project comprises various natural features and ecosystems. The following aspects provide an overview of the baseline bio-physical environment: Topography and Geology; climate, Water Resources; Vegetation and Land Cover; Biodiversity.

**Baseline Socio-Economic Environment:** The baseline socio-economic environment encompasses the social and economic aspects of the project area. The following elements provide an overview of the baseline socio-economic environment: Population and Settlements, Economy and Livelihoods, Infrastructure and Services, Social and Cultural Aspects.

## 0.9. PROJECT ALTERNATIVES

These alternatives included the selected area, design and construction techniques, as well as the no-project alternative. The purpose of considering these alternatives was to evaluate the socio-economic importance of the project, its location within Ngoma District, and the adherence to water infrastructure construction standards.

**Selected Area:** Different potential areas for implementing the project were evaluated. Factors such as proximity to the water source (Akagera River), accessibility, terrain characteristics, and socio-economic considerations were taken into account. The selected area was determined based on these factors to ensure efficient water supply, minimal environmental impact, and maximum benefit to the communities.

**Design and Construction Techniques:** Various design and construction techniques were analyzed to identify the most suitable approach for the project. This included evaluating different treatment plant designs, storage reservoir configurations, pipeline materials, and construction methods. Factors such as efficiency, cost-effectiveness, durability, and environmental sustainability were considered to determine the preferred design and construction techniques.

**No-Project Alternative:** The no-project alternative was also assessed as part of the evaluation process. This alternative considers the scenario where the Mugesera WSS Project is not implemented. The potential consequences, such as the continued lack of access to safe drinking water, socio-economic implications, and environmental impact, were evaluated to highlight the necessity and importance of the project.

Based on the evaluation of these alternatives, the preferred options were selected for the Mugesera WSS Project. The selected area ensures optimal water supply and distribution to the target communities while minimizing environmental impact. The chosen design and construction techniques adhere to established standards to ensure the sustainability and longevity of the infrastructure. The project's socio-economic significance, location within Ngoma District, and the need for improved water infrastructure were key factors that justified the selection of the preferred alternatives.

Rejected alternatives, if any, would have been assessed based on their feasibility, environmental impact, cost-effectiveness, and alignment with project objectives. These alternatives did not meet the desired criteria or were deemed less suitable compared to the selected options.



## **0.10. PROJECT IMPACTS**

Adverse impacts associated with the Mugesera Water Supply System Project can occur during different project phases, including pre-construction, construction, operation and maintenance, and decommissioning. The activities undertaken during each phase can lead to potential adverse impacts. Here is a summary of the potential adverse impacts and the activities associated with each phase:

### **Pre-construction Phase:**

- Land Clearance and Excavation: Clearing land and excavating for infrastructure development can result in soil erosion, habitat disturbance, and loss of vegetation.
- Material Transportation: Transportation of construction materials to the site can contribute to air pollution, noise, and traffic congestion.
- Spreading of HIV, COVID and other transmissible diseases.
- Labour Influx: The pre-construction phase may involve an influx of workers to the project site, which can have social and economic impacts on the local community. This includes potential challenges related to housing, increased demand for local services, and changes in community dynamics.

### **Construction Phase:**

- Construction Activities: Various construction activities, such as excavation, foundation laying, and building construction, can generate noise, dust, and vibration, affecting nearby communities and ecosystems.
- Water Pollution: During the construction phase, there is a risk of water pollution due to various activities such as land clearing, excavation, and construction material handling. This can lead to sediment runoff, erosion, and the introduction of pollutants into nearby water bodies.
- Employment opportunities and services provision,
- Soil and Water Disturbance: Construction activities may lead to soil erosion, sedimentation of water bodies, and potential contamination of nearby water sources.
- Air Pollution: Construction machinery, vehicles, and dust emissions from construction sites can contribute to air pollution, affecting air quality in the vicinity.
- Waste Generation: Construction activities generate waste materials such as construction debris, packaging waste, and hazardous materials, which require proper management to avoid environmental pollution.
- Spreading of HIV, COVID and other transmissible diseases.

- Labour Influx: The construction phase typically requires a significant workforce, potentially leading to an increased demand for labor. Adequate management and accommodation facilities should be provided to mitigate any adverse social impacts on the local community.
- Fire Hazards at Treatment Works: Construction activities at the treatment works site may pose fire hazards due to the presence of flammable materials, equipment, and temporary electrical installations. Proper fire safety measures should be implemented to prevent accidents and minimize the risk of fire incidents.

### **Operation and Maintenance Phase :**

- Water Extraction and Treatment: The extraction of water from the source and the operation of the treatment plant can potentially affect the ecological balance of water bodies and require proper monitoring to avoid over extraction or pollution.
- Improvement of life quality of local population
- Access to reliable potable water supply,
- Local socio-economic diversification and improvement with the scale of economic development
- Increasing of public revenues and tax incomes,
- Contribution of population businesses to local and national economy
- gender balance enhancement
- Energy Consumption: The operation of pumping stations and other infrastructure may result in increased energy consumption, leading to greenhouse gas emissions and potential environmental impacts associated with energy production.
- Water Distribution and Leakage: Inefficient water distribution systems and leakages can result in water losses, affecting water availability and potentially leading to water scarcity in certain areas.
- potential pollution of lake water by release of mixed sludge and backwash water from WTP,
- Spreading of HIV, COVID and other transmissible diseases.

### **Decommissioning Phase :**

- Infrastructure Removal: The dismantling and removal of infrastructure at the end of the project's life cycle can generate waste materials and potential soil and water contamination if not managed properly.
- Site Rehabilitation: Restoration of the site to its original or improved condition may be necessary to mitigate the impacts caused during the project's operation.
- Increasing accumulation of earth materials leading to sedimentation pollution of lakes,

- impact of water uptake on lake hydrological regime;
- potential pollution of lake water by release of mixed sludge and backwash water from WTP,
- Spreading of HIV, COVID and other transmissible diseases.

The potential cumulative impacts of a water supply system project that involves water abstraction from Mugesera Lake, was described some of them are: Alteration of water levels, Disruption of aquatic ecosystems, Decreased water quality, Erosion and sedimentation, Introduction of invasive species and Socioeconomic impacts (Changes in water availability can have socio-economic consequences for local communities and stakeholders)

#### **0.11. RISKS MANAGEMENT OF ENVIRONMENTAL-SOCIAL AND SAFETY COMPONENTS**

In three chapters, environmental, social and safety risks management have been considered through delivery of detailed information consigned in Contingency Plan, Community health, safety and security management Plan, Traffic management Plan and Chance Find Procedure.

#### **0.12. HUMAN CAPACITY BUILDING**

In public institutions, stakeholders' companies and non-government organizations involved in natural resources exploitation, management and environment conservation, there is a strong need for human capacity building in order to fulfill their responsibilities, but also maintain within their working places environmental, social, safety and health better conditions.

Those needs have been highlighted in this report and a Capacity Building Plan prepared which includes: main themes, subjects to be taught, targeted beneficiaries and duration of the training sessions.

#### **0.13. STAKEHOLDERS AND PUBLIC CONSULTATIONS**

As part of the ESIA preparation for the Mugesera Water Supply System Project, the consulting team conducted several stakeholder consultations to gather valuable input and address concerns. The following is a summary of the consultations conducted:

**Ngoma District Authority:** The consulting team met with the Vice-Mayor of Ngoma District Authority to discuss the project. This meeting provided an opportunity to understand the district's perspective and receive input from a high-level representative.

**Zaza Administrative Sector:** At the Zaza Administrative Sector, the consulting team engaged in consultations with the Executive Secretary of the Sector and key technicians. These discussions allowed for a deeper understanding of the sector's specific needs and concerns related to the water supply project.

**Regional Direction of WASAC:** The team of consultants visited the regional Direction of Water and Sanitation Corporation (WASAC) and held consultations with the Director and the water technical team. This engagement facilitated discussions on technical aspects, water management strategies, and the integration of the project within the existing water infrastructure.

**Key Informants:** The consulting team gathered information from key informants who provided insights into the perceptions and expectations of the local population regarding the new water project. These informal discussions helped identify community priorities and concerns.

**Project Affected Persons (PAPs):** Consultations were conducted with potential Project Affected Persons (PAPs). The team of consultants organized meetings in the project areas and facilitated discussions with local residents. These consultations were accompanied by Community Economic Development Officers (CEDO) from the respective sectors. The purpose was to ensure that the concerns and perspectives of those directly affected by the project were taken into account. The stakeholder consultations played a crucial role in the ESIA process, enabling the consulting team to understand the diverse perspectives, address concerns, and incorporate local knowledge and expectations into the environmental and social management planning of the Mugesera Water Supply System Project.

#### **0.14. INSTITUTIONAL IMPLEMENTATION ARRANGEMENTS AND REPORTING REQUIREMENTS**

##### **Rwanda Environment Management Authority (REMA):**

- Monitoring and supervising the implementation of the ESIA's and conduct environmental audit after project implementation.
- Monitoring and assessing project compliance with the laws on environment during its preparation and implementation phases.

##### **Rwanda Development Board (RDB):**

- RDB serves as the main investment promotion and facilitation agency in Rwanda.
- Its role includes reviewing and approving the Environmental Impact Assessment (EIA) report and ensuring that the project adheres to environmental safeguards.

- Its role includes facilitating the investment process, ensuring necessary permits and licenses are obtained, and promoting private sector participation in the project.
- RDB may provide support and guidance to the project in terms of investment regulations, business facilitation, and coordination with relevant stakeholders.

#### **Water and Sanitation Corporation (WASAC):**

- WASAC is the national water utility responsible for water supply and sanitation services in Rwanda.
- Its role in the project includes providing technical expertise and guidance on water infrastructure design, construction, and operation.
- WASAC may be involved in overseeing the implementation of the water treatment plant, reservoirs, pumping stations, and pipeline network.
- It plays a crucial role in ensuring the sustainability and reliable operation of the water supply system.

#### **Rwanda water board (RWB)**

- Monitor the water supply system
- To establish strategies related to the protection of catchments and coordinate the implementation of erosion control plans;
- To control and enforce water resources use efficiency
- To monitor the implementation of Drainages and flood mitigation measures and water storage during the implementation of project

#### **AfDB:**

- Provision of loans and grants financing for project
- Technical assistance in the implementation of project activities;
- The AfDB, as the lender, shall support the project team to ensure that the project follows all AfDB's Integrated Safeguards System (ISS) that the project is found to trigger before funds are realized for this project.

#### **Rwanda Land Management and Use Authority**

- to promote activities relating to investment and value addition in the activities related to the use and exploitation of land resources;
- to register land, issue and keep land authentic deeds and any other information relating to land;
- to supervise all land-related matters and represent the State for supervision and monitoring of land management and use

- to execute or cause to be executed geodetic, topographic, hydrographic and cadastral surveys in relation to land resources

### **Rwanda Mines, Petroleum and Gaz Board**

- RMB is responsible for licensing quarries, and borrow pits to be used for implementation of the project and insure their environmental management, restoration and rehabilitation as initial state

### **Contractor and Supervising Engineer:**

- The contractor is responsible for the physical construction of the project, including infrastructure components like the treatment plant, reservoirs, pumping stations, and pipelines.
- The supervising engineer provides technical oversight and ensures that the construction activities are carried out according to the design specifications, quality standards, and contractual agreements.
- The contractor and supervising engineer work closely together to ensure timely and efficient execution of the project, while adhering to technical requirements and safety regulations.

## **0.12. CONCLUSION**

An effective implementation of Mugesera Water Supply System will surely generate an array of positive socio-economic benefits as mentioned in point above, and by the way, will accelerate access to clean water supply in Ngoma District, contribute to alleviation of poverty within the area as well as enhance hygiene and sanitation hence reducing water borne diseases.

Nevertheless, as development project to be implemented in densely populated region, it will likely generate adverse impacts to human community and environment in general.

In the present ESIA study, potential positive and negative impacts have been highlighted, mitigations measures proposed, responsibilities to implement and monitoring these mentioned. Therefore, the present ESIA document will constitute an important tool highlighting on how to manage the identified adverse impacts which should be minimized, reduced, mitigated or eradicated during all phases of its execution.

It is obvious that envisaged total benefits of Mugesera water supply system project during its operational phase will far outweigh the sum total of adverse impacts highlighted during the other phases of project implementation.

In conclusion, the implementation of Mugesera WSS project's activities will not pose irreversible damages to the socio-environment and there is no adverse impact for which remediation is not feasible. Furthermore, it is assumed that the socioeconomic returns as a result of all planned activities efficiently executed worth to the investment.

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## ACRONYMES AND ABBREVIATIONS

AfDB	African Development Bank
ARAP	Abbreviated Resettlement Action Plan
CAE	Child Abuse and Exploitation
CBO	Community Based Organization
CIRA	Conseil Ingénierie Recherche Appliquée
DDP	District Development Plan
DRC	Democratic Republic of Congo
EA	Environmental Assessment
EDPRS	Economic Development & Poverty Reduction Strategy
EHS:	Environment, Health and Safety
EICV	Integrated Households Living Conditions
ESA	Environment Social Assessment
ESAP	Environment and Social Assessment Procedures
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environmental and Social Management Plan
FGDs	Focal Groups discussion
GBV	Gender based Violence
HFCs	Hydro-Fluorocarbons
HIV	Human Immunodeficiency Virus
INRM	Integrated Natural Resources Management
ISS	Integrated Safeguards System
ITEC	Infrastructure Transportation & Environment Consulting
MINAGRI	Ministry of Agriculture and Livestock
MININFRA	Ministry of Infrastructure
MINISANTE	Ministry of Health
MoE	Ministry of Environment
MPL	Ministry of Public Labor
NGO	Non-Governmental Organization
NISR	National Institute of Statistics of Rwanda
NRM	Natural Resources Management
NST	National Strategy for Transformation

OHS	Occupational Health and Safety
OS	Operational Safeguards
PAPs	Project Affected Persons
PCE	Project Construction Enterprise
PPE	Personal Protective Equipment
RDB	Rwanda Development Board
REMA	Rwanda Environment Management Authority
RLMUA	Rwanda Land Management and Use Authority
RSB	Rwanda Standards Board
RURA	Rwanda Utility Regulatory Authority
RWB	Rwanda Water Resources Board
SC	Supervision Company
SEDO	Socio economic Development Officer
SPIU	Single Project Implementation Unit
STD	Sexually Transmitted Disease
ToRs	Terms of Reference
TS	Technical Services
TTC	Teachers' Training College
VIP	Ventilated improved pit
WASAC	Water and Sanitation Corporation
WHO	World Health Organization
WSS	Water Supply System
WTP	Water Treatment Plant



# CHAPTER I: INTRODUCTION

## 1.1. PROJECT BACKGROUND

The provision of adequate Water Supply System services is more generally a prerequisite and indicator for socio-economic development. The Government of Rwanda has a plan to develop towns near borders interacting with the neighbouring countries. Towns would decentralize urbanization and reduce the rate of immigration to the City of Kigali, especially youth and unemployed people.

Those towns include:

- Musanze: borders Southwest of Uganda and is on the road linking Rwanda and Uganda;
- Nyagatare and Gatsibo: borders Southwest of Uganda and Northwest of Tanzania;
- Rubavu and Nyabihu: Rubavu borders Eastern DRC;
- Ngoma: borders Northern Burundi;
- Ngororero, Muhanga and Kamonyi: at the Centre of Rwanda. There is a high economic development and estate development along the road Kigali-Muhanga mainly in Kamonyi District;
- Nyanza and Ruhango: located in the Centre of the country and have water scarce area (Amayaga).

In line with the above, through the loan received from the African Development Bank (AFDB), Water and Sanitation Corporation Ltd (WASAC) representing the Government of Rwanda intends to apply a portion of it to the Feasibility Study, Detailed designs and Supervision of the Construction of Mugesera Water Supply System, Phase I (6,000 m<sup>3</sup>/day treatment plant and distribution network). The target is to increase the access to clean water in Ngoma District (Source: Project terms of reference).

The elaboration of the present ESIA document related to Mugesera Water Supply System project, which is in a category of “water distribution and sanitation activities” complies with the Ministerial Order N° 004/2008 of 15/08/2008 establishing the list of works, activities and projects that have to undertake an environmental impact assessment.

In addition, in compliance with the requirements of the Law on Environment N°48/2018 of 13/08/2018, the present ESIA is prepared and will be approved by Rwanda Development Board prior to the implementation of the project.

## **1.2. OBJECTIVES OF THE ESIA STUDY**

The first objective of the present ESIA study is to produce a document which will serve as an important tool highlighting on how to manage the potential impacts generated through Mugesera WSS planned activities, which are susceptible to affect human community and the environment in general.

The second objective is to ensure that Mugesera WSS development activities will not undermine existing critical resources, ecological functions of Lake Ecosystem or the well-being, lifestyle and livelihood of biological communities who depend on these.

The third objective is to meet the national regulations and international finance institutions' requirements.

## **1.3. SCOPE OF THE STUDY**

The present study was undertaken by the Consultant with the intention of collecting enough and relevant information inherent to ensure the production of an appropriated ESIA document including an Environmental and Social Management Plan (ESMP). The scope of the present study is:

- ✚ consideration of the main environmental problems to be studied, alternatives to the project and ensure that the spatial and temporal scope and extent of the environmental and social assessment is compatible with the size of the project;
- ✚ determination of appropriate ESIA methods relevant to the project's potential environmental and socio-economic impacts;
- ✚ provision of relevant information to communities in areas affected by the project on the environmental problems and alternatives so that they may take part in identification and assessment of the project's environmental and socio-economic impacts.

The scope of this study will be restrained to areas located in Ngoma District of the Eastern Province of Rwanda. It is restricted to the project main components such as construction of water treatment plant, reservoirs, pumping stations, intakes to collect water, installation of pipelines network as well as considering project activities such as design, construction, upgrading, rehabilitation and water distribution.

## **1.4. Developer presentation**

For Mugesera water supply system project, the Client is Water and Sanitation Corporation Ltd (WASAC), a public institution with legal personality, administrative and financial autonomy. WASAC is under the Ministry of Infrastructure (MININFRA), an entity setup to manage the water and sanitation services in Rwanda.

The company was created by the law N° 87/03 of 16/08/2014, in the on-going government reform intended to deliver water and sanitation utility sufficiently focused to deliver new infrastructures; efficient and effective service delivery; build a strong people capability; and meet key national milestones in this sector. Mugesera WSS project is among several other water projects currently under studies and/or implementation level within the country.

## **1.5. Author's presentation**

The assessment was developed by Mr. Franck GASANA SEKA-HEKA Environmental Expert accredited as Lead Expert by Government of Rwanda, REMA and RAPEP, Reg:*N0: RAPEP/EIA/013*. His is authorized to undertake ESIA and Environmental Audit(EA)studies for various projects. Franck GASANA SEKA-HEKA has a long lasting experience in undertaking various study of Environmental Impact assessment and EA studies in Rwanda and has a strong background and knowledge in the area of Environmental Assessment for Development Projects. He has over 16 years of professional experience in the field of environmental audit and 15 years professional experience in Faecal Sludge Management, Water Resources Management, Civil Works, as well as Urban and Regional Planning. He has worked on various projects of the Environmental Assessment as team leader in different sectors such as solid and municipal Faecal Sludge management projects, hydro-power plant, Irrigation projects, building and housing constructions, land filling and Faecal Sludge disposal, mining and quarrying projects, fishing and fish farming projects, road and bridge construction projects, etc... This ESIA report and corresponding Environmental Management Plans (EMP) has been done in collaboration with Mr. HAKIZIMANA Jean de Dieu (Mapping and GIS specialist).

## **CHAPTER II. APPROACH AND METHODOLOGY OF THE STUDY**

This study has followed procedures stipulated in the Law on Environment, the Ministerial order establishing the list of projects that must undergo an ESIA study , compliance with AfDB Environmental and Social safeguards procedures as well as General Guidelines and Procedures for Environment Impact Assessment. The study has adopted the following approach:

- (i) Scoping study/ preliminary assessment;
- (ii) Review of secondary data on baseline information;
- (iii) Review of Policies, Laws and Regulations;
- (iv) Review of previous meetings and consultations with stakeholders;
- (v) Exchanges with key stakeholders, and
- (vi) Field surveys along the entire project sites, to gather information and collect data on various aspects of the project site.

Site locations, land cover, and proposed infrastructures were described fully with clear maps or photographs for a comprehensive understanding of the area and project activities, so that to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts.

### **2.1. Preliminary Assessment/ Scoping study**

A scoping study was done involving consultation with the Client (WASAC), Technical staff, local Authorities, local Communities and potential Project Affected Persons (PAPs) in Ngoma District.

The scoping exercise entailed a preliminary visit to the various sites for the following reasons:

- ✚ Sites reconnaissance to understand the spatial coverage of the project;
- ✚ Identification of the likely stakeholders who will be involved in the public consultations, affected or benefitting from project activities;
- ✚ Preliminary findings of the existing environment (physical, biological and socio-cultural environment);
- ✚ Preliminary predictions of likely positive and adverse impacts;
- ✚ And finally establishing clear boundaries of the study and focus on the relevant issues concerning the study.

The scoping study also involved literature review and an intense deskwork which have resulted on the submission of a report entitled “Preliminaries on environmental, social and safety issues of Sake WSS project).

## 2.2. Consultation with Stakeholders

### *Involvement of Stakeholders*

The study applied different participatory methods, namely: (i) exchange with one-to-one key informant, (ii) focus group discussions and (iii) official meetings with stakeholders as stipulated in the Terms of Reference. The consultation was first conducted with WASAC staff in order to get the details of the proposed project activities. Stakeholders have been informed about components and planned activities of the project, the advantages and potential impacts likely to be encountered and proposed mitigation measures. The Consultant has offered to them an opportunity to express their concerns, raising their opinions and worries through questions. Any issue raised by one individual or a group of people was cross-checked by discussing it with other individuals or groups.

## 2.3. Baseline information gathered on the project

Information on the physical, biological, socio-economic environment, institutional and legal framework were collected from a various sources, namely: concept design of the project, literature review of published and miscellaneous documents, field observations in project's areas, consultations with selected stakeholders and discussions with WASAC technical team for getting expert opinions.

### *Field data / information collection*

The Consultant accompanied by WASAC technical team and some junior officers from local administration have conducted field surveys in order to capture a broad picture of the prevailing situation at the sites. Among the activities performed include:

- ✚ Appraisal of physical and environmental conditions of the project sites and sensitive areas likely to be impacted by project activities. Baseline data on water bodies, climate, topography, soils, drainage/hydrology, flora and fauna etc... have been recorded;
- ✚ Appraisal of land use at adjacent plots to selected areas dedicated to infrastructures construction and assessment of other relevant socio-economic parameters;
- ✚ Understanding the detailed project description through comparison of the field survey and the preliminary technical study;
- ✚ Collecting opinions and point of views of local population about the project, their expectations and concerns in relation to positive and adverse impacts likely to be generated by implementation of the project and on proposed mitigation measures.

## 2.4. Impacts identification and assessment

The environmental and social impacts identification and assessment was done by superimposing project elements onto the existing environmental conditions of the project site. Environmental impacts were then identified, their significance assessed and mitigation/enhancement measures proposed in order to properly eliminate or reduce negative environmental and social impacts, and suggest remedial measures for positive impacts.

The identification and evaluation of impacts was based on qualitative criteria, and thus the importance of each impact was assessed against the following:

√ the degree of sensitivity

√ the occurrence

The degree of sensitivity or intensity of the environmental and social impact corresponds in this case to the relative importance of the disturbance / alteration induced by a project activity on an environmental or social component. The degree of sensitivity of the impact can be Very high, High or Low.

With regard to the occurrence criterion, this is the probability of the occurrence of the impact over the entire period during which the activity is carried out. In this case, the occurrence is considered to be either Very limited, Limited or Permanent for the entire duration of the activity.

The assessment criteria and ratings for determining the impact significance are as following:

- (i) **Nature or status of the impact:** the type of the effect the activity would have on the environment that can be:
  - *Positive:* has a benefit to the holistic environment
  - *Negative:* has a cost to the holistic environment
  - *Neutral:* has no cost or benefit
  
- (ii) **Duration of the impact:** the lifetime of the impact:
  - *Short term:* less than 2 years
  - *Short to medium:* 2 to 5 years
  - *Medium term:* 6 to 25 years
  - *Long term:* 26 to 45 years
  - *Permanent:* 46 years or more

- (iii) **Extent or scale of the impact:** the distance from the source that impacts may be experience:
- *Site specific:* within the site boundary
  - *Local:* affects immediate surroundings areas
  - *Regional:* extends substantially beyond the site boundary
  - *National:* affects country
  - *International:* crosses international borders
- (iv) **Reversibility of the impact:** to what degree its influence on the relevant environment can be negated:
- *Completely reversible:* reverses with minimal rehabilitation and negligible residual effects
  - *Reversible:* requires mitigation and rehabilitation to ensure reversibility
  - *Irreversible:* cannot be rehabilitated completely/ rehabilitation not viable
- (v) **Intensity or magnitude of the impact:** severity of the negative and magnitude of positive impacts:
- *Low:* little effect- negligible disturbance/benefit.
  - *Low to moderate:* effects observable-environmental impacts reversible with time
  - *Moderate:* effects observable-impacts reversible with rehabilitation
  - *Moderate to high:* extensive effects – irreversible alteration to the environment
  - *High:* extensive permanent effects with irreversible alteration
- (vi) **The probability of the impact:** describes the likelihood of the impact actually occurring:
- *Unlikely:* less than 15 % sure of an impact occurring
  - *Possible:* between 15% and 40 % sure of an impact occurring
  - *Probable:* between 40 % and 60 % sure that the impact will occur
  - *Highly probable:* between 60 % and 85 % sure that the impact will occur
  - *Definite:* Over 85 % sure that the impact will occur

## 2.5. Report structure

This report is organized in fourteen chapters. Chapter I gives an Introduction with background of the project and objectives; Chapter II deals with the proposed methodology; Chapter III gives a project description; Chapter IV highlights policy, legal and institutional framework within which the project will operate; Chapter V presents the baseline on physical, biological and socio economical environments.

Furthermore, Chapter VI provides the project mitigation alternatives; Chapter VII presents the identification, evaluation of potential impacts and proposes measures while Chapter VIII deals with the environmental and social management and monitoring Plans. In addition, Chapter IX, X and XI present respectively contingency, community health-safety and security management as well as traffic management plans. Finally, the Chapter XII gives capacity building plan; Chapter XIII deals with stakeholders consultations and Chapter XIV concludes the ESIA report.



# CHAPTER III. PROJECT DESCRIPTION

## 3.1. PROJECT AREA

### 3.1.1. Project location

Mugesera water supply system project will cover all sectors of Ngoma District namely Gashanda, Jarama, Karembo, Kazo, Kibungo, Mugesera, Remera, Rukumberi, Rurenge, Sake,Zaza, Murama, Rukira and Mutenderi (*Source: Project terms of reference*)

Figure 1 Administrative map of project area land cover map



### 3.1.2. Existing features of the project areas

The project is located in Ngoma District. The areas are accessed from the national Road Kigali-Rwamagana-Kayonza and connected to dirty roads for accessing the project sites. The project area is part of lowlands of the Eastern Province, with an average altitude between 1400m and 1700 m above sea level, a region essentially dominated by hills with gentle slopes which allow the water distribution network well reaching many rural users. . The original relief is a plateau strongly dissected by tectonically movements of the quaternary that were progressively gullied by the erosion creating valleys and swamps (*Source: Ngoma District DDP 2013 -2018*).

### 3.1.3. Overall District's developments

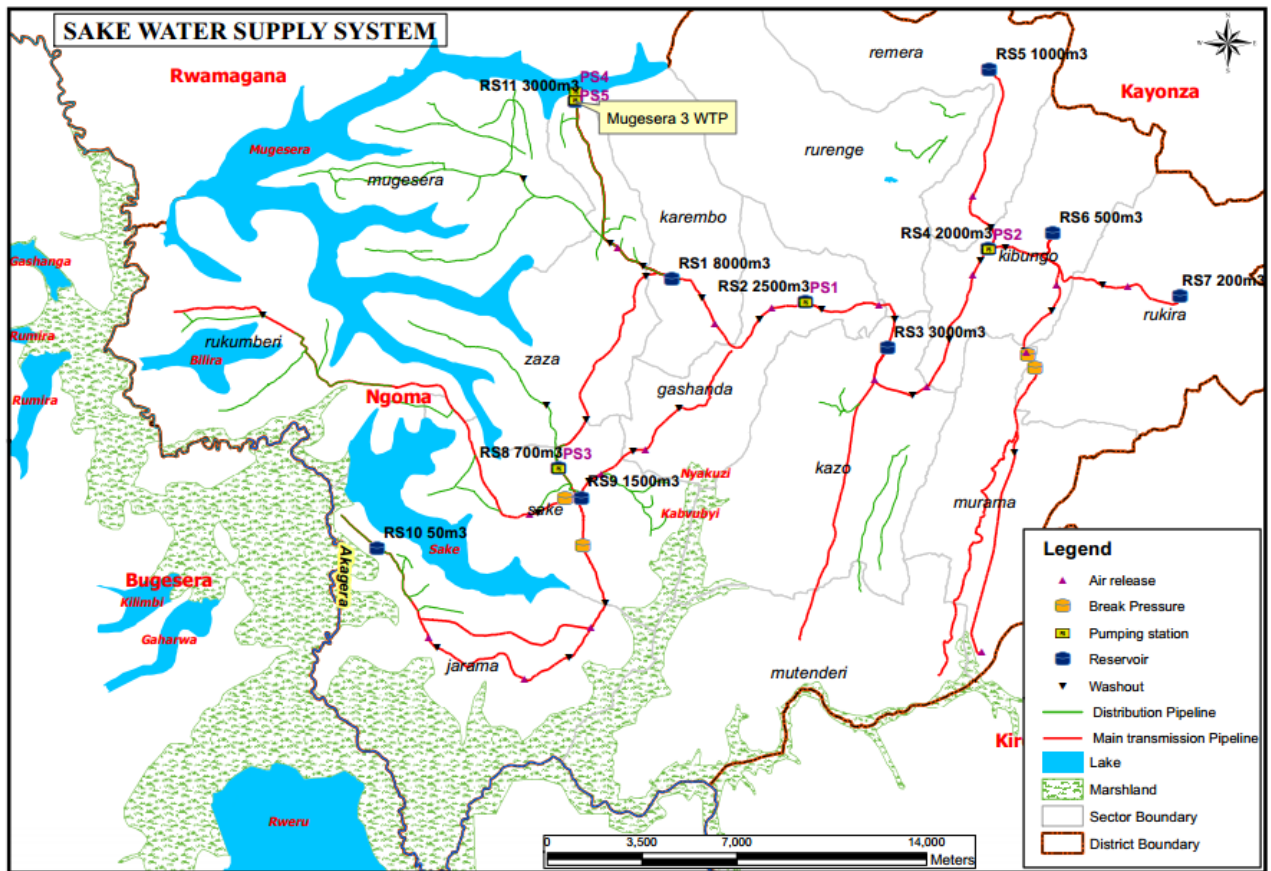
The proposed project sites are located within urban, peri-urban and rural areas of the Eastern province with major development activities such as asphalt road, dirty roads, residential areas, upgraded trade centers with modern markets, schools, hospitals, health centers, local authorities' offices (Cell, Sector offices), churches, banking and Microfinance units, craft making and wrapping paper unit, agricultural and livestock farms with intensive agro-processing businesses. Tourism industry is not well developed in Ngoma District (*Source: Feasibility study, December 2020 by CIRA JV ITEC Engineering*).

## 3.2. PROJECT OBJECTIVES

The principal objective of the project is to achieve 100% access to clean water supply in the targeted area. The proposed project will also contribute to enhanced hygiene and sanitation hence reducing water borne diseases. Specifically, this project will contribute to alleviation poverty within the area through improvement of socio-economic activities generating revenues in rural zones.

## 3.3. General Layout of the project and its main infrastructures

The construction of Mugesera Water Supply System Project in Ngoma District of the Eastern Province comprises six (6) main infrastructures namely: collecting raw water Intake, Water Treatment Plant, storage Reservoirs, Pumping stations, Pressure breakers and Pipelines network.



**Figure 2: Proposed Mugesera Water Supply System selected option Layout**

The retained option for Sake water supply system consists of an intake located at X = 546299.949 m; Y = 4769238.585 m; Z = 1333.996 m in Zaza sector, Nyagasozi cell, and Sugira village. From this intake raw water shall be pumped with the help of 3 horizontal pumps of 500 m<sup>3</sup>/h at a head of 40 m via a single discharge pipe DN630 PN 10 – by gravity intake type shall be constructed at this location.

The pumped raw water from the intake shall be treated at WTP located at X = 546246.948 m; Y = 4768920.369 m; and Z = 1359.000 m in Zaza sector, Nyagasozi cell, and Sugira village. After treatment, the treated water shall be pumped to the main reservoir RS1 (8,000 m<sup>3</sup>) located at X = 549844.693 m; Y= 4762281.438 m; Z= 1551m in Karemba sector, Akaziba cell, and Rwamuhimbura village. Also, two discharge pipes shall parrallely be laid and each pipeline shall have DN varying between 400 mm and 500 mm. Eight pumps shall be installed at the treated water pump station and each pump shall have 173 m<sup>3</sup>/h with a total head of 250 m. One additional pump shall be provided to stand-by. A treated water tank of 3,750 m<sup>3</sup> shall be constructed in THREE compartments of 1,250 m<sup>3</sup> each.

### 3.4. DESCRIPTION OF THE PROJECT'S SUBCOMPONENTS

The works selected for execution in phase I were mainly targeted to supply clean water to the following sectors: Jarama, Rukumberi, Sake, Remera, Mugesera, Zaza, Karemba and Kibungo. These sectors are mostly served by rationing especially during dry seasons. Kibungo sector has been categorized as most vulnerable because it is an urban area and its population grows fast. Detailed below is the description of project's subcomponent and planned works:

#### 3.4.1. Raw water intake

The proposed WSS will have an intake located at  $X = 546299.949$  m;  $Y = 4769238.585$  m;  $Z = 1333.996$  m in Zaza Sector, Nyagasozi Cell and Sugira village. From this intake raw water shall be pumped with the help of 3 horizontal pumps of  $500 \text{ m}^3/\text{h}$  at a head of 50 m via three parallel discharge pipes DN400 PN 10 and flows by gravity.

The Mugesera Water Supply System Project includes the construction of an intake channel, pump house, security booth, and the implementation of external infrastructure such as paving, fencing, landscaping, and drainage works. The supply and installation of electromechanical and hydraulic equipment are crucial for the efficient operation of the system. Through comprehensive testing and commissioning, the raw water intake system will be verified to ensure its effectiveness and reliability in collecting and transferring water for further treatment.

#### 3.4.2. Description of Water treatment plant

The pumped raw water from the intake shall be treated at Water Treatment Plant located at  $X = 546246.948$  m;  $Y = 4768920.369$  m; and  $Z = 1369.000$  m in Zaza sector, Nyagasozi cell, and Sugira village. The WTP shall be constructed with 3 treatment channels.

The water treatment plant project involves the construction of various facilities and infrastructure to ensure the efficient treatment and supply of clean water. The main component of the plant consists of three treatment channels, each capable of treating 11,000 cubic meters of water per day. These channels are designed to go through a cascade process that includes six rapid mixer chambers, twelve slow mixing chambers, six sedimentation units, and nine sand filters. These treatment steps aim to remove impurities and particles from the water.

Apart from the treatment channels, several other structures will be constructed as part of the plant. These include a power house to accommodate generators, a pump house to house the water pumps, and a treated water tank with a capacity of 1,250 cubic meters to store the treated water before

distribution. A laboratory is built for water quality testing and analysis, while a storehouse is provided for storing necessary supplies and equipment.

The administration block serves as the central hub for managing and overseeing the plant's operations, and three-room residential buildings will be constructed to provide accommodation for the plant's staff. A security booth is also built to ensure the safety and control access to the plant premises.

The project also involves external paving and fencing works, as well as landscaping and drainage works to ensure proper infrastructure and aesthetics. The supply and installation of electromechanical equipment and hydraulic equipment, including fittings, will be carried out to ensure the smooth functioning of the plant. The entire system is thoroughly tested and commissioned to ensure its operational readiness.

Additionally, the project includes the construction of three sludge thickeners and three sludge drying beds to handle the treatment byproduct. A sludge drainage system is established to transport the sludge from the treatment chain to the sludge thickeners. Other structures like a chemical building and a chlorine building are constructed to store necessary chemicals for the treatment process.

### 3.4.3. Supply and installation of pipes

As part of the Mugesera Water Supply System Project, pipeline works are a crucial aspect to establish the transmission and distribution networks for the water supply. The transmission network is designed to have a total length of 81.1 kilometers, comprising 13.92 kilometers of ductile iron (DI) pipes and 67.09 kilometers of high-density polyethylene (HDPE) pipes. These pipes are chosen for their durability and ability to withstand the required water pressure.

On the other hand, the distribution network is designed to cover a total length of 259.21 kilometers, exclusively using HDPE pipes. HDPE pipes are selected for their flexibility, corrosion resistance, and ease of installation, making them suitable for the distribution of treated water to various areas within the Mugesera region.

The project also involves crossing obstacles along the pipeline routes. Fifty-seven obstacles have been identified, and their details are provided in the project's drawings and bill of quantities. These obstacles can include rivers, roads, railways, or any other physical obstructions. The necessary

engineering solutions will be implemented to ensure the pipeline works seamlessly pass through these obstacles, considering factors such as depth, elevation, and environmental impact.

#### 3.4.4. Inspection chambers

The Mugesera Water Supply System Project includes the construction of various types of inspection chambers to enhance the functionality and maintenance of the water supply infrastructure. The project entails the construction of 340 air-release chambers, which release air pockets within the pipeline system to optimize water flow. Additionally, 218 washout chambers will be built to provide access points for pipeline flushing and cleaning, ensuring water quality is maintained. Control valve chambers (92 in total) will house valves to regulate water flow and pressure. Five sectioning valve chambers will be constructed to allow for segmenting the system during maintenance or repairs. Furthermore, 201 valve chambers will connect the existing water supply system with the new system, ensuring seamless integration. These inspection chambers contribute to the overall reliability, efficiency, and longevity of the Mugesera Water Supply System, providing sustainable and high-quality water supply to the communities it serves.

#### 3.4.5. Pressure breakers

Only Twenty-Three pressure breakers shall be constructed with details provided in the drawings and bill of quantities.

#### 3.4.6. Distribution water storage reservoirs

The Mugesera Water Supply System Project includes the construction of multiple concrete water storage reservoirs with varying capacities. EIGHT storage reservoirs with a total capacity of 7,750 will be constructed. These reservoirs play a crucial role in ensuring a reliable and sufficient water supply for the communities in the Mugesera area.

The project involves the construction of several reservoirs with different capacities. Starting with RS12, a 50 m<sup>3</sup> reservoir, followed by RS7 and RS11, both with a capacity of 200 m<sup>3</sup>. Additionally, a larger reservoir, RS6, with a capacity of 500 m<sup>3</sup>, is being built to accommodate a higher volume of water.

To meet the increasing water demands, RS8, a 1,000 m<sup>3</sup> reservoir, will be constructed. Furthermore, RS5 and RS9, each with a capacity of 1,500 m<sup>3</sup> will be constructed to provide significant storage capacity.

The project also includes the construction of RS4, a 2,000 m<sup>3</sup> reservoir, to ensure ample water storage. Additionally, RS2, a larger reservoir with a capacity of 2,500 m<sup>3</sup>, will be constructed to cater to the growing water requirements of the area.

To address higher water demands, RS3, a 3,000 m<sup>3</sup> reservoir, will be constructed to provide a substantial storage capacity. Finally, to achieve a total storage capacity of 8,000 m<sup>3</sup>, two reservoirs with a capacity of 4,000 m<sup>3</sup> each, RS1, will be constructed.

These concrete water storage reservoirs are integral to the success of the Mugesera Water Supply System Project. By providing storage for significant volumes of water, they ensure a reliable water supply for the communities served by the system. The construction of reservoirs with varying capacities allows for flexibility and sustainability in the water storage infrastructure, ultimately leading to a consistent and efficient water supply for the Mugesera area.

#### **3.4.7. Booster stations**

In the Mugesera Water Supply System Project, several booster stations are being constructed to enhance water distribution and maintain adequate pressure within the system. Three booster stations are specified in the project: Gashanda, Ngoma, and Sake.

##### **a) Gashanda booster station**

Starting with the Gashanda booster station, the civil works involve the implementation of a suction tank (RS-2) with a compartment capacity of 1,250 m<sup>3</sup>. The electromechanical works include the supply and installation of a transformer (800 KVA), main distribution board, centrifugal pumps, water hammer arrestor tank, air compressor, float sensors, and ultrasonic level transmitter. Hydraulic equipment and fittings are also provided for the pumping station and suction tank, as per the project's drawings and bill of quantities.

##### **b) Ngoma booster station**

Moving on to the Ngoma booster station, the civil works include the construction of a suction tank (RS-4) with a compartment capacity of 1,000 m<sup>3</sup>. The electromechanical works comprise the supply and installation of a transformer (200 KVA), main distribution board, centrifugal pumps, water hammer arrestor tank, air compressor, float sensors, and ultrasonic level transmitter. Similar to Gashanda, hydraulic equipment and fittings are provided for the pumping station and suction tank as specified in the project documentation.

### c) Sake booster station

For the Sake booster station, the **electromechanical** works involve the supply and installation of a transformer (100 KVA), main distribution board, centrifugal pumps, and air compressor. Hydraulic equipment and fittings are provided for the pumping station according to the project's drawings and bill of quantities.

In addition to the booster stations, the project includes the implementation of sixty-seven community water points with double taps for Phase I of the Sake Water Supply System.

In summary, the Mugesera Water Supply System Project includes the construction of booster stations at Gashanda, Ngoma, and Sake. These stations involve civil works, electromechanical works, and the installation of hydraulic equipment and fittings. The booster stations will enhance water distribution and maintain appropriate pressure within the system. Additionally, sixty-seven community water points with double taps will be implemented for Phase I of the Sake Water Supply System, ensuring access to clean water for the community.

## 3.5. Equipment and Machinery

The execution of civil works will require the following equipment

- Bulldozers
- Mechanical shovels
- Graders
- Compactors
- Excavators
- Poker vibrator
- Wheel Loader

Other material includes construction material: stones, sand, cement and gravel

## 3.6. Total Number of Workers:

## 3.7. Construction Materials and Sources:

- Materials such as stones, aggregates (sand and gravel) will be required.
- the required Pipelines are as follow:

**Table 1: Intake pipeline characteristics**

Section	Length (m)	DN & PN & Material
intake - WTP	291.00	HDPE DN630 PN10



**Table 2: Primary pipeline characteristics**

Section	Length(m)	DN & PN & Material
WTP - RS1	8,119.00	HDPE DN500 PN10
	3,118.00	D.I DN400 PN20
	4,964.00	D.I DN400 PN25

**Table 3: Secondary pipeline characteristics**

Section	Unit	Quantity	Section	Unit	Quantity
<b>RS1_RS2</b>			<b>RS8_RS9</b>		
HDPE DN315 PN10	m	7,144.00	HDPE DN250 PN16	m	2,838.00
HDPE DN400 PN10	m	7,144.00	<b>RS3_Mutenderi</b>		
<b>RS2_RS3</b>			HDPE DN125 PN16	m	5,968.00
HDPE DN450 PN10	m	5,848.00	HDPE DN250 PN10	m	5,561.00
D.I DN350 PN20	m	838.00	<b>RS6_RS7</b>		
D.I DN350 PN25	m	3,235.00	D.I DN150 PN40	m	1,763.00
<b>RS3_RS4</b>			D.I DN150 PN25	m	1,168.00
HDPE DN250 PN10	m	9,293.00	HDPE DN200 PN16	m	1,010.00
HDPE DN450 PN10	m	9,293.00	HDPE DN200 PN10	m	2,256.00
<b>RS4_RS5</b>			HDPE DN250 PN10	m	1,219.00
HDPE DN250 PN16	m	13,346.00	<b>R7_RS12</b>		
D.I DN200 PN20	m	1,845.00	HDPE DN75 PN20	m	1,505.00
<b>RS4_RS6</b>			HDPE DN75 PN16	m	2,864.00
HDPE DN250 PN16	m	3,244.00	HDPE DN200 PN16	m	809.00
<b>RS1_RS8</b>			<b>RS6_Murama</b>		
HDPE DN400 PN10	m	1,631.00	HDPE DN125 PN10	m	1,314.00
HDPE DN450 PN10	m	1,631.00	HDPE DN200 PN10	m	4,061.00
HDPE DN250 PN16	m	3,624.00			
D.I DN200 PN25	m	7,976.00			
HDPE DN250 PN10	m	4,654.00			

**Table 4: Distribution pipeline characteristics**

Pipe characteristics	Length(m)	Pipe characteristics	Length(m)
HDPE DN32 PN10	335.00	HDPE DN110 PN16	11,438.00
HDPE DN40 PN16	13,416.00	HDPE DN110 PN10	15,121.00
HDPE DN40 PN10	3,493.00	HDPE DN125 PN16	19,038.00
HDPE DN50 PN16	26,506.00	HDPE DN125 PN10	12,118.00
HDPE DN50 PN10	27,260.00	HDPE DN160 PN16	31,594.00
HDPE DN63 PN16	17,770.00	HDPE DN160 PN10	15,722.00
HDPE DN63 PN10	9,965.00	HDPE DN200 PN16	13,803.00
HDPE DN75 PN16	37,135.00	HDPE DN200 PN10	12,947.00
HDPE DN75 PN10	15,649.00	HDPE DN250 PN16	1,495.00
HDPE DN90 PN16	26,064.00	HDPE DN250 PN10	19,243.00
HDPE DN90 PN10	10,201.00	HDPE DN315 PN16	14,605.00
		HDPE DN315 PN10	3,047.00

### 3.8. Chemicals Used in Water Treatment:

**Chemicals to be used in water treatment are the following:**

- a) Chemicals in water treatment.
- b) Citric Acid.
- c) Chlorine dioxide.
- d) Calcium hydroxide.
- e) Calcium hypochlorite.
- f) PAC (Polyaluminum Chloride )
- g) Sodium chloride.
- h) potassium chloride.

### 3.9. Generated Wastes and its management

**Wastes Generated during Construction Phase :**

- **Construction Debris:** During the construction phase, there will be various types of construction debris, such as concrete, bricks, stones, and wood waste. Proper waste management practices should be implemented to segregate and dispose of these materials appropriately.
- **Excavated Soil:** Depending on the nature of the project, excavation activities may generate large amounts of soil waste. Soil erosion control measures should be implemented to minimize the impact on the surrounding environment.
- **Packaging Waste:** Construction materials, equipment, and supplies are often delivered in packaging that can contribute to waste generation. Efforts should be made to recycle or properly dispose of packaging materials, such as cardboard, plastic, and metal.
- **Chemical Waste:** Construction activities may involve the use of various chemicals, including solvents, paints, adhesives, and lubricants. Proper handling, storage, and disposal of these chemicals are essential to prevent environmental contamination.

**Wastes Generated during Operation Phase :**

- **Effluent Wastewater:** During the operation of the water supply project, there will be wastewater generated from various sources, such as the treatment process, maintenance activities, and office facilities. This wastewater may contain contaminants such as suspended solids, organic matter, and possibly disinfection by-products.
- **Solid Waste:** Operational activities can generate solid waste, including packaging waste, office waste, and maintenance waste. Proper waste management practices, such as recycling

and waste segregation, should be implemented to minimize the amount of solid waste generated and ensure proper disposal.

- **Hazardous Waste:** Certain operations within the water supply project may generate hazardous waste. This can include chemicals used in water treatment processes, such as coagulants, disinfectants, and laboratory reagents. Hazardous waste should be handled, stored, and disposed of following applicable regulations and guidelines to protect human health and the environment

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from excavation activities, scrap wood and metals, and small concrete spills. The excessive generation of inert construction material increases disposal costs and may take up valuable landfill space. With the implementation of good site management and careful planning, the over-ordering of materials and generation of inert construction and material should be minimised. Hazardous solid waste includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil as well as spill cleanup materials from oil and fuel spill

### 3.10. Description of the Distribution Network:

water distribution network will be as follow:

- From RS1 there shall be: (1) a pipeline that will serve by gravity consumers of Mugesera sector and a part of Zaza sector; a pipeline that will discharge, by gravity, into reservoir RS8 of 1000 m<sup>3</sup> located at X =545650 m; Y = 4755275m; Z = 1501 m in Sake sector, Kibonde cell, and Umucyo village and a pipeline that will discharge water by gravity into reservoir RS2 of 2,500 m<sup>3</sup> located at X = 554771.4m, Y = 476118 m and Z = 1502 m in Gashanda sector, Mustindo cell and Kanyinya village. RS1 will also serve by gravity Karembo sector by reinforcing the existing networks;
- From RS8 there shall be a booster pump station (two pumps with 136 m<sup>3</sup>/h each and duty head of 100 m with two discharge pipes of DN250 PN16) that will pump water into reservoir RS9(1,500m<sup>3</sup>) located at X = 546497 m; Y = 4754201m and Z = 1575.0 m in Sake sector, Kibonde cell and Nyagasani village;
- From RS9 of 1,500 m<sup>3</sup> there shall be a pipeline that will serve by gravity Sake, Jarama and Rukumberi Sectors and Part of Zaza sector;
- From RS2 there shall be a booster pump station that will pump water into reservoir RS3 located at X =557794.2m; Y = 4759753m and Z =1670 m in Kazo sector, Karama cell, and

Karenge village. Four pumps shall be installed at the booster pump station and each pump shall have 282 m<sup>3</sup>/h with a head of 215 m. The discharge pipe shall vary between DN350 and DN450;

- From RS3 of 3,000 m<sup>3</sup> there shall be a pipeline that will serve by gravity consumers of Kazo sector and consumers of Mutenderi sector via the existing networks. Also from RS3 there shall be a pipeline that will discharge by gravity into reservoir RS4 located at X = 561524.010 m; Y = 4763399.884 m and Z = 1654 m in Kibungo sector, Cyasemakamba cell, Kiruhura village;
- From RS4 there will be a pipeline that will discharge by pumping (Two pumps with 178.5 m<sup>3</sup>/h each and a head of 160 m with two discharge pipes of DN250) into reservoir RS5 of 1,500 m<sup>3</sup> located at X = 561566 m; Y = 4770034 m and Z = 1707 m in Remera sector, Bugera cell, Gatare village. Consumers of Remera sector shall be served by this reservoir via RS5 of 1,500 m<sup>3</sup> and the existing networks and proposed extensions. Rurenge sector consumers shall be served by gravity from reservoir RS4 as well. Also from RS4 there shall be a pipeline that will discharge by pumping (a single pump with 170 m<sup>3</sup>/h and a head of 125 m with a discharge pipe of DN250) into reservoir RS6 of 500 m<sup>3</sup> located at X = 563906 m; Y = 4763979 m and Z = 1731.06 m in Kibungo sector, Gahima cell, Nyamigina village. A big part of Kibungo sector shall be served by gravity from RS6;
- From RS6 there shall be a pipeline that will discharge by gravity into reservoir RS7 of 200 m<sup>3</sup> located at X = 568572.570 m; Y = 4761621.418 m and Z = 1686 m in Rukira sector, Kibasti cell, Rubagabaga village. A part of consumers of Rukira sector shall be served from RS7 via proposed distribution pipeline and existing networks;
- Also from RS6 there shall be a pipeline that will serve Murama, Mutenderi and Kibungo sectors through 2 pressure breakers and existing networks respectively located at X = 563040.590 m; Y = 4759162.642 m and Z = 1580.969 m and X = 563082.254 m; Y = 4758553.900 m and Z = 1443 m in Murama sector, Mvumba cell, and Kibimba village.

## **CHAPTER IV: RELEVANT POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENT**

### **4.1. INSTITUTIONAL FRAMEWORK**

The institutional framework for environmental management is currently enshrined in the Law N° 48/2018 of 13/08/2018 on Environment, published in the Official Gazette N° Special of 21/09/2018, particularly in its chapter V related to obligations of the state, decentralized entities and local communities with regards to the protection, conservation and promotion of environment.

#### **4.1.1 Ministry of Infrastructure (MININFRA)**

The mission of the Ministry of Infrastructure includes:

- to initiate programs, to develop, rehabilitate and maintain an efficient and integrated national transport infrastructure network, including roads, bridges, airports, railways, and water supply which will contribute towards economic development and regional integration.
- To initiate programs aimed at increasing access to affordable energy, water and sanitation, and transport infrastructure and related services for the population;
- To supervise the implementation of quality standards and norms, cost effectiveness, response to environmental sustainability, safety and cross-cutting issues in infrastructure development;
- To work towards implementation of programs to enhance human resource capacities under the transport, energy, habitat & urbanism, water and sanitation, and meteorology sub-Sectors respectively;
- To supervise activities meant to elaborate, monitor and assess the implementation of national policies and programs on matters relating to habitat and urbanism, transport, energy, water and sanitation.

#### **4.1.2 Water and Sanitation Corporation (WASAC Ltd)**

WASAC Ltd is the entity setup to manage the water and sanitation services in Rwanda and was created by the law N° 87/03 of 16/08/2014. The company was created in the on-going government reform intended to deliver water and sanitation utility sufficiently focused to deliver new infrastructure; efficient and effective service delivery; build a strong people capability; and meet key national milestones. It is expected to reverse the status quo that includes inadequate planning

and investments; inefficient and wasteful operations; inadequate institutional management focus; improve viability and autonomy; and establish a sustainable and customer-centric utility to deliver an important mandate that touches people of all walks of life. The mission of the company is providing quality, reliable and affordable water and sewerage services through continuous innovations and detailed care to customers' needs.

As implementing agency, WASAC Ltd will play a critical role in project implementation but also in the implementation of ESMPs and ARAPs as well as conditions of approval to be issued by Rwanda Development Board. WASAC Ltd is also responsible for monitoring of the implementation of mitigation measures and report back to Rwanda Environment Management Authority and AfDB.

#### 4.1.3 Ministry of Environment (MoE)

The Ministry of Environment is responsible for the development of environmental policies and procedures (including impact assessments), protection of natural resources (water, land, flora, and fauna), environmental legislation, biodiversity, and other environmental aspects. The Chapter V of the Law N° 48/2018 of 13/08/2018 on Environment, Section II and Article 30 clearly specifies that the list of projects that must undergo an environmental impact assessment before they obtain authorization for their implementation is established by an Order of the Minister. This Order also issues instructions and procedures for conducting environmental impact assessment.

MoE is expected to perform the following functions in the ESIA process:

- Participate in screening at the request of Rwanda environment Management Authority (REMA);
- Publish the list of ESIA practitioners;
- At the request of REMA, review Project Briefs so as to advise on Terms of Reference;
- Ensure that their own projects adhere to ESIA requirements;
- Ensure that private-sector projects in fields over which they have jurisdiction comply with ESIA requirements;
- At the request of REMA, review ESIA report;
- Serve on REMA's Technical Committee;
- Serve on REMA's Executive Committee;
- Provide information or advice to developers and ESIA Experts during ESIA process;
- Participate as panelist at public hearings held during the conduct of ESIA;
- Advise developers on the requirement for ESIA (where relevant) before licensing their projects;

- Assist in inspecting and monitoring environmental compliance by ensuring that licensing terms and conditions are met, including those specified by REMA.

#### 4.1.4 Rwanda Environment Management Authority (REMA)

REMA was established in 2004 to act as the implementation agency of environment related policies and laws in Rwanda. Under supervision of the Ministry of Natural Resources, from the Law n°63/2013 of 27/08/2013 determining the mission, organization and functioning of REMA, it has the legal mandate for national environmental protection, conservation, promotion and overall management, including advisory to the government on all matters pertinent to the environment and climate change. Key responsibilities of REMA are as follows:

- 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;
- 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;
- Put in place measures designed to prevent climate change and cope with its impacts;
- Conduct studies, research, investigations and other relevant activities in the field of environment and publish the findings;
- Closely monitor and assess development programs to ensure compliance with the laws on environment during their preparation and implementation;
- Participate in the preparation of activities strategies designed to prevent risks and other phenomena which may cause environmental degradation and propose remedial measures;
- Provide, where it is necessary, advice and technical support to individuals or entities engaged in natural resources management and environmental conservation;
- Prepare, publish and disseminate education materials relating to guidelines and laws relating to environmental management and protection and reduce environmental degradation risks;
- 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. The ESIA review has been delegated to Rwanda Development Board.

#### 4.1.5 Rwanda Water Resources Board (RWB)

The Rwanda Water Resources Board was established under the Law N°06/2017 of 03/02/2017 establishing the Rwanda Water and Forest Authority and determining its mission, organization and functioning. The Authority has the following main mission:

- To implement policies, laws, strategies and Government decisions related to the management of natural water resources;
- To advise Government, monitor and coordinate the implementation of strategies related to the management of natural water resources;
- To assist public and private institutions in charge of management of natural water resources in a bid to fight erosion;
- To prepare appropriate management and support districts in the management of natural water resources;
- To assist in the establishment of standards and regulations relating to the management of natural water resources.

#### 4.1.6 Rwanda Land Management and Use Authority (RLMUA)

RLMUA is responsible for putting in place and operationalizing an efficient system of land administration, use and management that secures land ownership, promotes investment in land for socio-economic development and poverty reduction. Responsibilities of RLMUA are

- Put in place mechanisms which procure security of land tenure for the promotion of investments in land.
- Promote proper allocation of land, and proper use of land resources, according to their potential.
- Avoid the splitting up of plots, and to promote their regrouping in order to bring about optimum production.
- Establish of mechanisms which facilitate an optimum exploitation of land, targeting the social-economic development of the country.
- Orient land management towards a more profitable and sustainable production, by making good choices among methods of land development.
- Develop methods that protect land resources from various types of land degradation.
- Establish institutional frameworks which enable land to become more valuable in the economy or at the market.



- Promote research as well as the education of the public on all aspects concerning land tenure, management, and transactions.
- Establish order and discipline in the allocation of land, as well as in land transactions in order to control the pressure on land, inappropriate development, speculation and trafficking of land.
- Involve and sensitize the public at all levels in order to ensure protection of the environment and good management of the land.
- Ensure the sustainable use of wetlands.

#### 4.1.7 Rwanda Development Board (RDB)

The Law No 46/2013 of 16/06/2013 establishing Rwanda Development Board (RDB) has determined also its mission, organization and functioning. One of the important missions of RDB is fast-tracking development activities and facilitate the Government and Private Sector to undertake an active role. This a one stop institution bringing together several government bodies in Rwanda focused at promoting investment in Rwanda. Initially the responsibility for reviewing and approving ESIA reports was entrusted to REMA, this duty has now been transferred to the newly created Rwanda Development Board (RDB) where a department of ESIA has been created and tasked with review and approvals of all ESIA reports for proposed projects and programs before they are approved for implementation. The key responsibility of ESIA department under One Stop Centre in RDB is to:

- Receive and register ESIA Applications (Project Briefs) submitted by developers;
- Identify relevant Lead Agencies to review Project Briefs and provide necessary input during screening,
- Review Project Briefs and determine project classification at screening stage,
- Transmit Project Briefs to relevant Lead Agencies and concerned Local Governments to provide input on Terms of Reference (ToR),
- Publicize Project Briefs and collect public comments during development of ToR,
- Receive ESIA documents submitted by a developer and verify that they are complete,
- Transmit copy of ESIA Reports to relevant Lead Agencies, Local Governments and Communities to review and make comments,
- Review ESIA reports and make decision on approval, organize and conduct public hearings, appoint an officer from Authority to chair public hearings, receive public comments and compile public hearing reports,
- Appoint the Technical Committee and its representative to the Technical Committee,

- Forward ESIA Documents (ESIA Report, Environment Monitoring Plan and Public Hearing Report) to the Technical Committee,
- Chair the Executive Committee which makes final decision on approval of a project,
- Communicate decision on whether or not a proposed project is approved,
- Issue to developers ESIA Certificate of Authorization if their projects are approved.

#### 4.1.8 Rwanda Standards Board (RSB)

RSB was established by the law N°50/2013 of 28/06/2013. Chapter II of that law gives the main mission of RSB which is very relevant to this project:

- to establish and publish national standard;
- to disseminate information on standards, technical regulations relating to standards and conformity assessment;
- to raise awareness and promote the importance of standards and quality service as tools to improve market access, technology transfer and sustainable development;
- to participate in monitoring standardization at national, regional and international level;
- to provide products and quality service certifications and monitor conformity for issued certifications;
- to provide legal, scientific and industrial metrology services;
- to represent the country at the regional and international standardization organizations;
- to establish laboratories capable of conducting tests and offering testing services;
- to act as reference laboratory in the quality domain;
- to carry out measurement and comparison of proficiency with same level regional and international institutions;
- to organize training programs in the area of standardization, metrology and conformity assessment. Requirements for potable water are presented in standards RS 435:2009.

#### 4.1.9 Rwanda Utility Regulatory Authority (RURA)

Rwanda Utilities Regulatory Authority (RURA) was initially created by the Law n° 39/2001 of 13 September 2001 with the mission to regulate certain public Utilities, namely: telecommunications network and/or Telecommunications services, electricity, water, removal of waste products from residential or business premises, extraction and distribution of gas and transport of goods and persons. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013

establishing Rwanda Utilities Regulatory Authority (RURA) and determining its mission, powers, organization and functioning. This Law gives to RURA the mandate to regulate:

- Sanitation;
- Telecommunications, information technology, broadcasting and converging electronic technologies including the internet and any other audiovisual information and communication technology;
- Postal services;
- Renewable and non-renewable energy, industrial gases, pipelines and storage facilities;
- Water supply including tariffs;
- Transport of persons and goods; and
- Other public utilities, if deemed necessary.

#### 4.1.10 Local Government

Generally, decentralized entities are responsible for the implementation of laws, policies, strategies, objectives and programs relating to protection, conservation and promotion of the environment in Rwanda. Article 61 of environmental law state that in the framework of conservation and protection of the environment, decentralized entities are particularly responsible for:

- ensuring activities related to better management of land, especially controlling soil erosion and tap rain water;
- Afforestation, protection and proper management of forests;
- efficient management of rivers, lakes, sources of water and underground water;
- efficient management and effective use of swamps;
- Protection and proper management of reserved areas, historical sites, endangered animal and plant species.

Under the General Guidelines and Procedure for ESIA Local Governments of all Districts and their respective sectors and cells are tasked to perform the following functions:

- At the request of RDB, review Project Briefs so as to advise on Terms of Reference,
- Provide information or advice to developers and ESIA Experts when consulted during ESIA process,
- At the request of RDB, review ESIA reports and provide comments to RDB,
- Assist RDB in organizing public hearings,

- Host public hearings,
- Host individual consultations,
- Gather written comments from public and transmit them to RDB.
- Facilitate the land acquisition process through land bureau office;
- - Plan and complaints resolutions.

## 4.2. POLICY FRAMEWORK

The National Policies, Plans, Strategies and their relevancy to Mugesera Water Supply project are summarized in the table N° 5 below:

**Table 5: National Policies-Plans and Strategies**

<b>Policy, Plan, Strategy</b>	<b>Objective</b>	<b>Relevance</b>
Rwanda Vision 2050	The main objective of Vision 2050 to ensure high standards of living for all Rwandans. In five main areas of: Quality of Life, Modern Infrastructure and livelihoods, Transformation for prosperity, Values for Vision 2050 and International cooperation and positioning.	The realization of the Sake water supply system project will contribute to realization of the Vision 2050 and its strategy, with emphasis on the distribution of water to the communities in rural and cities. and job opportunities for quality of life, modern infrastructure and transformation for prosperity in the project areas.
National Strategy for Transformation (NST 1) 2017 - 2024	NST 1 is the implementation instrument for the remaining of Vision 2020 and for the first four years of the Vision 2050 to provide the foundation and vehicle towards this new vision through specifically economic and social transformation.	The project implementation will contribute to achieve NST1 objectives by providing high qualified workforce, employment opportunities and development of socio-economic activities, hence contributing to economic and social transformation.
National Environment and Climate Change	The main objective of the National Environment and Climate Change Policy is to make	The water supply project will comply with this policy by ensuring health and safety standard on environment and

<b>Policy, Plan, Strategy</b>	<b>Objective</b>	<b>Relevance</b>
Policy, 2019.	Rwanda a nation that has a clean and healthy environment, resilient to climate variability and change that supports a high quality of life for its society.	climate change; only approved quarries and borrow pits will be used and ensure restoration plan are implemented at the end of the project implementation.
National Land Policy, 2004	The overall objective of the national land policy is to establish a land tenure system that guarantees tenure security for all Rwandans and give guidance to the necessary land reforms with a view to good management and rational use of national land resources.	Basing on this land policy, the project will respect mechanisms which guarantee land tenure security. Where not possible, fair compensation will be provided.
National Health Policy, 2016	One of the objectives of Rwanda Health Sector Policy is to improve the quality of life and demand for services in the control of disease. The policy identifies the most common illnesses as a result of unhealthy living or working environment.	The project will comply with this policy by ensuring health safety and the good working conditions and implement awareness programme on HIV Aids, STD, Malaria and Ebola to workers.
National sanitation policy, 2016	The policy provides for decentralization in line with the national decentralization policy, institutional aspects, integrated watershed management, monitoring and assessment and participatory approach to water and sanitation among other sectoral reforms in Rwanda	The water supply project is in line with this sanitation policy through integrated water supply management, monitoring and assessment and participatory approach to water and sanitation among other sectoral reforms in Rwanda
National Policy	The water policy aims at fair and	The water supply project will comply

Policy, Plan, Strategy	Objective	Relevance
for water resources management, 2011	sustainable access to water, improvement of the management of water resources, etc. through reforestation , water catchments areas and water collection	with this policy improving and upgrading water networks for fir and sustainable access to potable water.
National Biodiversity Strategy and Action Plan, 2016	This strategy defines the objectives and priorities for the conservation and sustainable management of biodiversity. The plan includes hillsides and wetlands and protected areas as some of the areas that need to be conserved.	The project falls under the objectives of this policy for the conservation and sustainable management of biodiversity by avoiding the use of wetlands and other protected areas.
Urbanization and Rural Settlement Sector Strategy 2013-2018	The Urbanization and Rural Settlement Sector encompasses social, economic and environmental activities. It has relevance to both, urban and rural areas. According to policies of Rwanda, access to a decent housing and favourable living conditions is a fundamental right for all citizens.	The project is in line with the action plan as the management of on-going urbanization requires the establishment of infrastructures for development planning, zoning and urban renewal, with the provision of adequate infrastructure facilities such as water supply networks.
Rwanda Biodiversity Policy, 2011	The goal of this Policy is therefore: To conserve Rwanda’s biological diversity, to sustain the integrity, health and productivity of its ecosystems and ecological processes, whilst providing lasting development benefits to the nation through the ecologically sustainable, socially	The project will comply with this policy by avoiding destruction of natural and resources through avoidance of unnecessary vegetation clearance (habitat destruction).

Policy, Plan, Strategy	Objective	Relevance
	equitable, and economically efficient use of biological resources.	
National Urbanization Policy, 2015	One of its objectives is: Improvement of the living conditions of the population in existing precarious neighbourhoods, and restructuration and equipment of those neighbourhood's with basic infrastructure, and secure land tenure status.	The project will improve the living conditions of the population by providing basic water infrastructure.
National Occupational Safety and Health Strategy, 2019	It aims at providing a framework for coordination of OSH activities among public, private, employees organizations and civil society institutions	This policy will govern the project implementation by establishing safety and health standards at workplace and ensure compliance with occupational safety and health standards.
Environmental Health Policy, 2008	The overall objective of the Environmental Health Policy is provision of adequate environmental health services to all Rwandans with their active participation.	The project will comply with this policy by providing good environmental, social, health and safe working conditions to workers and neighbouring residents.
National Strategy for Climate Change and Low Carbon Development, 2011	This Strategy is the first attempt at plotting a climate resilient and low carbon development pathway for Rwanda. It is the start of a continuous process which is described in the Enabling Pillars and it will be implemented through the Programmes of Action	This project will contribute to the achievement of the goals by achieving socio-economic development (water supply) that is resilient to economic, social and environmental shocks related to population growth and climate change.

### 4.3. LEGAL FRAMEWORK

A summary of the national legal framework applicable to Mugesera water supply system project is presented in the table N° 6 below:

**Table 6: National legal framework**

Law/Regulation/ Order	Objective	Relevance
The Constitution of the Republic of Rwanda, 2003 as revised in 2015	The Constitution is clear on the right to property that it will not be encroached upon except in public interest and in accordance with the provisions of the law. The constitution specifies that everyone has the right to live in a clean and healthy environment and everyone has the duty to protect, safeguard and promote the environment.	The water supply project will comply with the Constitution by implementation of applicable laws (Laws on Expropriation, labour, and Environment) and will ensure socio-economic development and comply with environmental laws.
Law on Environment, 2018	This Law determines modalities for protecting, conserving and promoting the environment.	Given the nature of this project and based on this law, the project activities are classified under this project that must undergo an Environmental Impact Assessment before obtaining authorization for its implementation. This reviewed and updated report serves as proof of compliance to the requirements of this law.
Law N°49/2018 of 13/08/2018 determining the use and management of	This Law determines the use and management of water resources in Rwanda. This law governs both natural and artificial water and their boundaries and provides guiding principles.	This project will comply with this law by the protection and rational use of water resources which constitute the obligations of each and every person and project. In addition as stipulated in



<b>Law/Regulation/ Order</b>	<b>Objective</b>	<b>Relevance</b>
water resources in Rwanda		the law, the contractor will avoid dumping, spilling or depositing anything that may pollute water resources.
National Land Law, 2013	This Law determines modalities of allocating, acquisition, transfer, use and management of land in Rwanda. It also establishes the principles applicable to rights recognized over all lands situated on Rwanda's national territory and all rights united or incorporated with land, whether naturally or artificially.	Since the project will affect lands hence compensation, based on this law is relevant to the project. Land in Rwanda is allocated or leased to individual evidenced by a certificate of land registration. The project will ensure rights on lands are considered and observed.
<b>Law on mining and quarry operations No 58/218 du 13/08/2018</b>	This Law governs mining and quarry operations in Rwanda. It applies to activities of exploitation, mining, trading and processing of minerals and quarry. It caters with rights of landowner in a licenced area, activities relating to quarry licence application, transfer of quarry licences, rights and responsibilities of the holder of a quarry licence, relinquishment of a quarry licence area and cancellation of a quarry licence.	Quarries and borrow pits will be required to construct reservoirs and water kiosks and its other components. This law will be enforced during project implementation by ensuring quarries are approved by the Districts and restoration plans are provided and implemented at the end of the project.
Law N° 32/2015 of 11/06/2015 relating to expropriation in	This Law determines procedures relating to expropriation in the public interest.	Since the project is in the public interest, this law will be applied during expropriation and

<b>Law/Regulation/ Order</b>	<b>Objective</b>	<b>Relevance</b>
the public interests		compensation exercise of the people affected by the project where applicable.
Law regulating Labour in Rwanda. No 66/2018 du 30/08/2018	This law regulates labour in Rwanda. It applies employment relations based on employment contract between employee and employer in private and public services, apprentices, interns, self-employed person, informal sector etc., with regards to right of salary, occupational health and safety and the right to form trade unions and employers' associations.	The Mugesera project will abide by good conducive working conditions during the implementation of the project including contracts' agreement. Labour law will be used to ensure good working conditions and wellness. All forms of discrimination will be avoided during recruitment of workers.
Law governing the preservation of air quality and prevention of air pollution in Rwanda, 2016	This Law determines modalities for preservation of air quality and prevention of air pollution in Rwanda.	As per this law, the project will implement measures aimed at the preservation of air quality as well as all elements or activities likely to affect air quality or pollute the atmosphere in the project areas by watering access road and excavated areas in dry season and ensure the use of equipment with low gas emissions.
Law governing biodiversity in Rwanda, 2013	This Law determines modalities for management and conservation of biological diversity within Rwanda.	The management and conservation of biological diversity in the project areas will be considered during the project implementation where necessary by implementing the ESMP and monitoring plan of this report.

<b>Law/Regulation/ Order</b>	<b>Objective</b>	<b>Relevance</b>
Ministerial Order determining the list of prohibited plains to constructions, 2005	This Order determines the list of plains on which construction is prohibited and stipulated that whenever appropriate studies establish the need for other plains not on this list to be protected from construction, the Minister in charge of Environment may order that construction to be prohibited on those plains.	The project will comply with this ministerial order by not approving any construction on the areas provided on the list of prohibited plains to construction. The ESIA scoping did not find any plain in proposed areas.
Ministerial order No 007/2008 of 15/08/2008 establishing the list of protected animal and plant species	The Ministerial order provides a lists of protected animal and plant species and their classifications as mammals, birds, reptiles for animals and corresponding scientific names for both the protected animals and plants	The project will comply by this ministerial order by ensuring not to disturb or kill protected animals and plants and will assess the existence or not of these species in the project areas.
Ministerial Order establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct environmental impact	The order specifies the works, activities and projects that have to undertake an environmental impact assessment. The list of works, activities and projects that must undergo a full environmental impact assessment before being granted authorization for their implementation	Basing on this ministerial order the project activities are classified under project that must undergo an Environmental Impact Assessment before obtaining authorization for its implementation. This report serves to comply with this ministerial order.

Law/Regulation/ Order	Objective	Relevance
assessment, 2019.		
Ministerial Order determining modalities of establishing and functioning of occupational health and safety committees, 2012	This Order determines modalities of establishing and functioning of occupational health and safety committees.	As a good practice, health and safety will be given a priority by ensuring regular toolbox meetings on health and safety during construction. Health and safety committees will be established and governed by this ministerial order during project implementation.
Ministerial Order determining conditions for occupational health and safety, 2012	This Order determine the general and specific rules and regulations relating to health and safety at workplace in order to secure the safety, health and welfare of persons at work and protect them against risks to safety and health arising from work	As a good practice, health and safety will be given a priority by ensure regular toolbox meetings on health and safety during construction. Health and safety committees will be established and governed by this ministerial order during project implementation.
Rwanda building Code version 2019	These building control regulations are hereby introduced to as Rwanda Building Code. The purpose of this Code is to establish the minimum requirements to safeguard public health, safety and general welfare. This is done through regulating, controlling, and monitoring the design, construction, quality of materials, use and occupancy, location, safety, maintenance, sanitation, etc...	The project is classified as a building project of water intake, water treatment plants and reservoirs hence will be in compliance with the Rwanda building code version 2019.

<b>Law/Regulation/ Order</b>	<b>Objective</b>	<b>Relevance</b>
Sector guidelines for EIA for water supply development projects in Rwanda, 2009	These guidelines help in ensuring that the lessons learned from these experiences are integrated into future best practice in relation to EIA for water supply projects.	This ESIA has considered these sector guidelines as compliance during project implementation.
Law n°05/2015 of 30/03/2015 governing the organization of pension schemes	<p>This Law governs the organization of pension schemes. There are two types of pension schemes: a mandatory pension scheme and a voluntary pension scheme.</p> <p>Persons subject to mandatory pension scheme are all employees governed by the Labour law in Rwanda regardless their nationality, type and duration of contract and the amount of wages.</p> <p>Employees governed by the general statutes of public services and civil servants governed by special statutes.</p> <p>Appointed politicians and employees of international organizations, national and international NGOs. Faith based organizations and personal of Embassies accredited in Rwanda.</p>	<p>It is obvious that during Mugesera WSS project implementation, several persons subject to mandatory pension scheme will be recruited, including employees governed by the general statutes of public services and civil servants governed by special statutes.</p> <p>The Employer shall be required to register with the public institution in charge of pension schemes within seven working days from employment of first employee.</p>
Law n°28/2016 of 22/7/2016 on the preservation of cultural heritage and traditional knowledge	<p>This Law determines the preservation of cultural heritage and traditional knowledge. The cultural heritage is composed of the following: (i) Tangible cultural heritage and (ii) Intangible cultural heritage.</p> <p>The tangible cultural heritage is composed of the following: (i) movable and immovable</p>	<p>During Preliminaries and Feasibility study of Mugesera WSS project there was no cultural heritage found on the sites planned for construction of infrastructures or for installation of pipelines network.</p> <p>Nevertheless, as a good practice, once</p>

Law/Regulation/ Order	Objective	Relevance
	<p>heritage, (ii) mixed cultural and natural heritage and (iii) underwater heritage.</p> <p>The intangible cultural heritage is composed of: (i) oral tradition, oral literature, songs, cultural dances, rituals and taboos, intangible art, crafts and folklore, festivals, cultural events, knowledge and practices, (ii) documentary heritage: rare manuscripts, pictures, slideshows and speeches.</p> <p>There are restrictions on the classified cultural heritage. Apart from routine tasks of maintaining cultural heritage, no person shall destroy, move, repair or modify in any way classified cultural heritage without prior written approval of the Minister within sixty (60) days from the date of receipt of the complete file.</p>	<p>cultural heritage will be discovered during project implementation, it will be given a priority to write to the Minister in charge for approval of its move or any other modification. The possibility to seek another site shall be also considered.</p>

#### 4.4. Sustainable Development Goals

The Sustainable Development Goals are a global call to actions for ending poverty, protect the earth's environment and climate, and ensure that people everywhere can enjoy peace and prosperity. The United Nations is implementing 38 key activities across 21 locations in Rwanda.

Concerning water sector, the UN and its partners are supporting 14 activities across 10 locations for Sustainable Development Goal 6 dedicated to ensure availability and sustainable management of water and sanitation for all. These works on clean water and sanitation are linked to two other SDG namely; (i) good health and well-being (Goal 3) and (ii) decent work and economic growth (Goal 8).

The Government of Rwanda has committed to participate in the preparation of the UN Food Systems Summit 2021 which is led by the United Nations Secretary-General. The UN in Rwanda

has expressed its great commitment to support the Government in organizing the Food Systems Summit Dialogues that will shape Rwanda's pathway, intention and commitments to make food systems sustainable, inclusive, efficient and nutritious and healthy in line with the 2030 goals.

## 4.5. AfDB Integrated Safeguards System (ISS)

The African Development Bank (AfDB) has sets of environmental and social assessment procedures that formalize the process to be followed when formulating, designing, constructing and operating programs and projects.

Approved in 2013, the AfDB ISS is designed to promote the sustainability of project outcomes by protecting the environment and people from the potentially adverse impacts of projects. The safeguards aim to:

- ✚ Avoid adverse impacts of projects on the environment and affected people, while maximizing potential development benefits to the extent possible;
- ✚ Minimized, mitigate, and/ or compensate for adverse impacts on the environment and affected people when avoidance is not possible; and help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental, social and safety risks;

The preparation of the present environmental and social impact assessment for the Mugesera WSS project has also followed the AfDB Environmental and Social Assessment Procedure (ESAP).

The ESAP gives the steps to be considered when undertaking an ESIA study including the generic terms of reference, typical contents of an ESIA and the minimum content of an Environmental and Social Management Plan (ESMP). Furthermore, it defines ESIA as an instrument whose purpose is to identify and assess the potential environmental and social impacts of a proposed project, evaluate alternatives, design appropriate mitigation/ enhancement, monitoring, consultative and institutional strengthening measures.

The AfDB Operational Safeguards (OS) under the Integrated Safeguards System are summarized below:

#### 4.5.1. OS1: Environmental and Social Assessment

This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements: the scope of application; categorization; use of the appropriate Environmental and Social Assessment ESA (SESA, ESIA, ESMF, ESMP); climate change vulnerability assessment; public consultation; community impacts; appraisal and treatment of vulnerable groups; and grievance procedures. It updates and consolidates the policy commitments set out in the Bank's policy on the environment.

To the extent possible, the assessment complies with the relevant legislation and standards applicable in the local jurisdiction, bearing in mind the equivalence of standards with those of the Bank, and it takes into consideration national- or regional- level programming documents that are under implementation or in preparation.

#### 4.5.2. OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation

This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements.

In particular, it embraces comprehensive and forward-looking notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasizes the need to maintain social cohesion, community structures, and the social interlinkage that common property provides.

The specific objectives of this OS is to avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative project designs have been explored.

The safeguard retains the requirement to provide compensation at full replacement cost; reiterates the importance of a resettlement that improves standards of living, income- earning capacity, and overall means of livelihood; and emphasizes the need to ensure that social considerations, such as gender, age, and stakes in the project outcome, do not disenfranchise particular project-affected people.

The affected populations are offered a range of different compensation package, resettlement assistance, and livelihood improvement options, as well as options for administering these measures at different levels (e.g., family, household and individual), and the affected persons themselves are given the opportunity to express their preferences.



#### 4.5.3. OS 3: Biodiversity, Renewable Resources and Ecosystem Services

This Operational Safeguard outlines the requirements for borrowers or clients to (i) identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats, and (ii) observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services.

The specific objectives of the OS are to: (i) Conserve biological diversity and ecosystem integrity by avoiding or, if avoidance is not possible, reducing and minimizing potentially harmful impacts on biodiversity; (ii) Endeavour to reinstate or restore biodiversity, including, where some impacts are unavoidable, through implementing biodiversity offsets to achieve “not net loss but net gain” of biodiversity; (iii) Protect natural, modified, and critical habitats; (iv) and Sustain the availability and productivity of priority ecosystem services to maintain benefits to the affected communities and sustain project performance.

#### 4.5.4. OS4: Pollution Prevention and Control, Hazardous Materials and Resource Efficiency

This operational safeguard outlines the main pollution prevention and control requirements for borrowers or clients to achieve high-quality environmental performance, and efficient and sustainable use of natural resources, over the life of a project.

The borrower or client applies pollution prevention and control measures consistent with national legislation and standards, applicable international conventions, and internationally recognized standards and good practice. When national legislation and regulations differ from the standards and measures presented in the EHS Guidelines, borrowers or clients are normally required to achieve whichever is more stringent.

Throughout the different phases of the project’s lifecycle—planning and design, construction, commissioning, operations and decommissioning—the borrower assesses and evaluates resource-efficiency and pollution-prevention techniques and implements them, taking into consideration their technical and financial feasibility and cost-effectiveness.

#### 4.5.5. OS 5: Labor Conditions, Health and Safety

According to the Bank principles, labor is one of a country’s most important assets in the pursuit of poverty reduction and economic growth. The respect of workers’ rights is one of the keystones for developing a strong and productive workforce. This operational safeguard outlines the main requirements for borrowers or clients to protect the rights of workers and provide for their basic needs.

This safeguard further establishes the Bank’s requirements for its borrowers or clients concerning workers’ conditions, rights and protection from abuse or exploitation. It covers working conditions, workers’ organizations, occupational health and safety, and avoidance of child or forced labor.

The AfDB has 5 Environmental and Social Operational Safeguards and these shall be triggered or not by the Mugesera WSS Project as shown in the table below:

**Table 7: AfDB Operational Safeguards triggered or not by Mugesera WSS Project**

<b>Operational Safeguard (OS)</b>	<b>Relevance of Mugesera WSS to the OS</b>	<b>Triggered (Yes or Not)</b>
<b>OS 1:</b> <i>Environmental and Social Assessment</i>	Mugesera WSS project triggers OS 1 because it falls under category 2, hence requires an Environmental and Social Assessment. As an integrated development, the Mugesera WSS’s ESIA will serve as an important tool used to manage the impacts generated through different activities.	<b>Yes</b>
<b>OS 2:</b> <i>Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation.</i>	The Mugesera WSS triggers OS 2 because for the construction of project’s infrastructures, several hectares of individual lands will be acquired, so that fair expropriation/compensation procedures will be followed with reference to the national expropriation/compensation Law 2015.	<b>Yes</b>
<b>OS 3:</b> <i>Biodiversity, Renewable Resources and Ecosystem Services.</i>	The Mugesera WSS project triggers OS 3 because the intake for collecting water from Lake Mugesera will be constructed in a buffer zone, generally recognized as a feeding and breeding area of several bird species and ubiquitous small mammals inhabiting the lakeshores.	<b>Yes</b>
<b>OS 4: Pollution</b>	The Mugesera WSS project will trigger OS 4 because	

<i>Prevention and Control, Hazardous Materials and Resources Efficiency</i>	produced sludge shall be well managed and backwash water from the water treatment plant shall be treated before its releasing to the natural environment. In that line, the elaborated ESMP will provide appropriate mitigation measures for their management.	<b>Yes</b>
<b>OS 5: Labour Conditions, Health and Safety</b>	<p>The Mugesera WSS project will trigger the OS 5 because several hundred of unskilled and skilled workers shall be recruited locally or outside the project areas. With their presence, potential social, safety and health positive and negative impacts are likely to occur.</p> <p>Their management will be in compliance with Occupational Safety and Health Management Plan.</p> <p>Moreover, the ESIA will provide mitigation measures related to abuse of workers' rights, social exclusion, and gender based violence etc...</p>	<b>Yes</b>

#### 4.6. Relevant international conventions applicable to the project

- The international Convention on Biological diversity and its habitat signed in Rio de Janeiro in Brazil on 5 June 1992, as approved by Presidential Order No 017/01 of 18 March 1995;
- The CARTAGENA protocol on biodiversity to the Convention on Biological biodiversity signed in NAIROBI from May 15, to 26, 2000 and in NEW YORK from June 5, 2000 to June 4, 2001 as authorized to be ratified by Law No 38/2003 of 29 December 2003;
- The United Nations framework Convention on Climate Change, signed in RIO DE JANEIRO in BRASIL on 5 June 1992, as approved by Presidential Order No 021/01 of 30 May 1995;
- The KYOTO Protocol to the framework on climate change adopted at KYOTO on March 6, 1998 as authorized to be ratified by Law No 36/2003 of December 2003;
- The RAMSAR International Convention of February 2, 1971 on Wetlands of International importance, especially as water flows habitats as authorized to be ratified by Law No 37/2003 of 29 December 2003;

- The STOCKHOLM Convention on persistent organic pollutants, signed in STOCKHOLM on 22 May 2001, as approved by Presidential Order No 78/01 of 8 July 2002;
- The ROTTERDAM International Convention on the establishment of the international procedures agreed by states on commercial transactions of agricultural pesticides and other poisonous products, signed in ROTTERDAM on 11 September 1998 and in New York from 12 November 1998 to 10 September 1999 as approved by Presidential Order No 28/01 of August 2003 approving the membership of Rwanda;
- The MONTREAL International Conventional on Substances that deplete the Ozone layer, signed in LONDON (1990), COPENHAGEN (1992), Montreal (1997), BEIJING (1999), especially in its article 2 of LONDON amendments and Article 3 of COPENHAGEN, MONTREAL and BEIJING amendments as approved by Presidential Order no 30/01 of 24 August 2003 related to the membership of Rwanda;
- The BONN Convention opened for signature on June 23, 1979 on conservation of migratory species of wild animals as authorized to be ratified by Law No 35/2003 of 29 December 2003;
- The Washington agreement of March 3, 1973 on International trade in endangered species of Wild Flora and Fauna as authorized to be ratified by presidential Order No 211 of 25 June 1980

## CHAPTER V: BASELINE CONDITIONS

### 5.1. Geographic presentation

Ngoma District is one of the seven districts that make up the Eastern Province. It is subdivided into fourteen (14) sectors, sixty-four (64) cells and four hundred and seventy-three (473) villages (Imidugudu). The district covers an area of eight hundred sixty-seven-point seventy-four square kilometres (867.74 Km<sup>2</sup>). It is limited by Rwamagana District in the North-West, by Kayonza District in the North-East, by Bugesera district in the West, by Kirehe District in the East and by the Republic of Burundi in the South.

The District of Ngoma is part of lowlands of the East, a region essentially dominated by hills with low slopes, with an average altitude between 1400 m and 1700 m above sea level. The original relief is a plateau strongly dissected by tectonic movements of the quaternary that were progressively gullied by the erosion creating valleys and swamps.

The climate is temperate especially in low altitudes. The annual average temperature is around 20°C. Ngoma, like other regions of the country, enjoys four seasons of which two are rainy and other two are dry: A short rainy season starts in October and ends in December, a short dry season runs from January to February, a long rainy season runs from mid-February to mid-May, a long dry season runs from mid-May to early October.

Generally, the dry season begins earlier and ends later compared to other regions of the country. The resulting pluviometric deficit adversely impacts agricultural and pastoral productions. The volume of annual precipitations on the whole of the district lies between 900 mm and 1400 mm.

As regard to soil and hydrography, Ngoma soil is favourable for agricultural activities due to the presence of little sandy – clay soil mixture. The District of Ngoma has three lakes namely Bilira, Mugesera and Sake which provides the region with a beautiful landscape that may attract tourists if developed and advocated for.

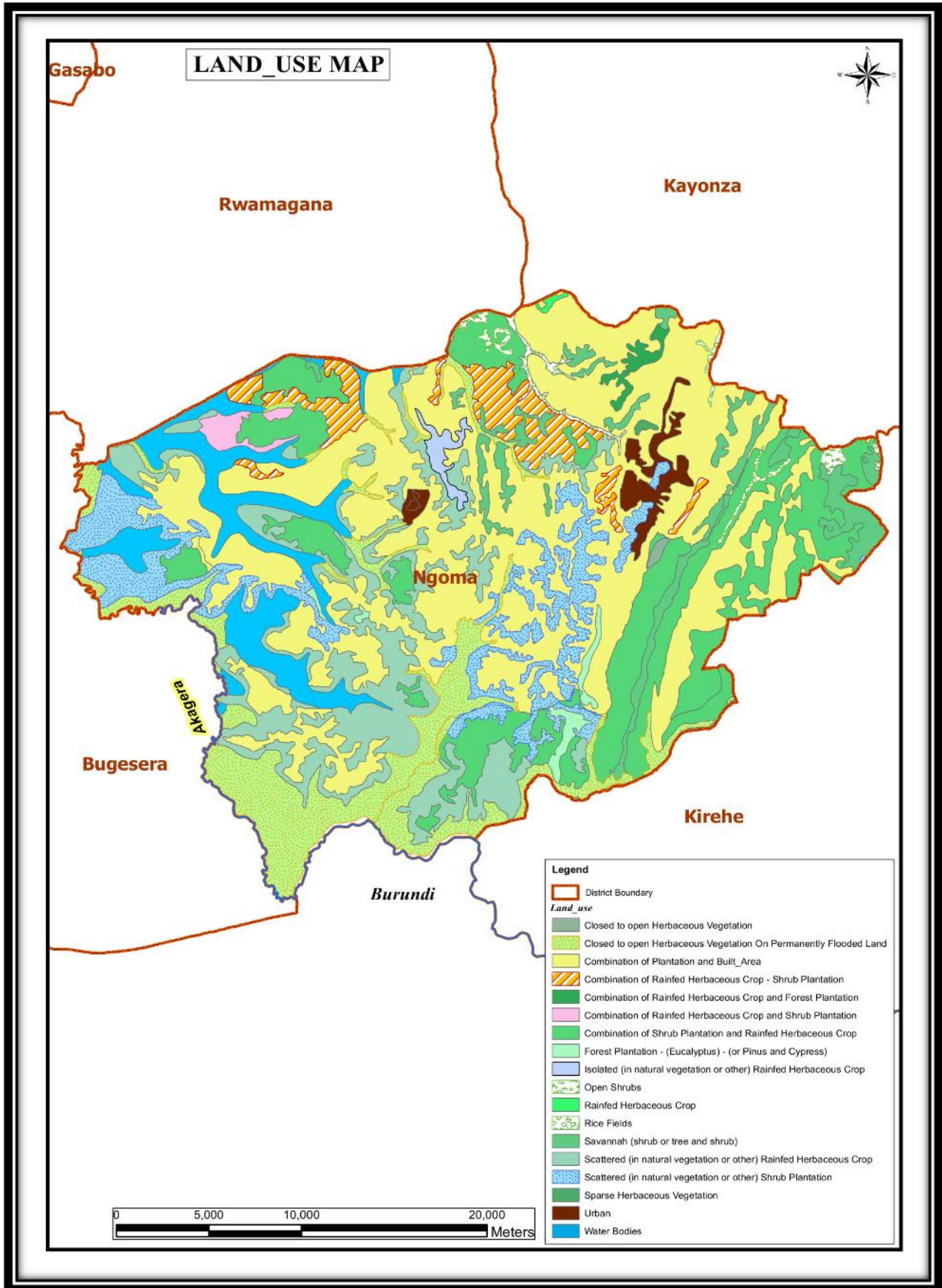
In terms of flora and fauna, the natural vegetation of the district of Ngoma is dominated by savanna landscapes. It is a typical vegetation of the east African basin, with vast lands of grass with scattered shrubs. The western part of the district is made up of vast wetlands constituted by depressions of fluvio-lakes of the Akagera River that offers a typical landscape of lakes and swamps. The district knows large banana plantations with combination of avocado trees, mangoes trees, sweet potatoes, cassava, etc. The majority of the current afforested area consists of Eucalyptus and Pinus. Wildlife no longer exists in the region for a long time except some birds, small mammals and reptiles encountered in the less frequented places (*Ngoma district DDP 2013 -2018*).

The current project for feasibility study, detailed designs and supervision of works for the construction of sake water supply system (phase I) will cover all 14 sectors of the district namely Gashanda, Jarama, Karembo, Kazo, Kibungo, Mugesera, Remera, Rukumberi, Rurenge, Sake,Zaza, Murama, Rukira and Mutenderi (*Project terms of reference*).

**Figure 3**  
**MAP OF**  
**PROJE**  
**CT**  
**AREA**



**Figure 4**Project area land cover map





## 5.2. Physical Environment

Physical environmental survey involves understanding the actual status of the area, in regard to; Climate (temperature, rainfall), topography, hydrography, land use, soil and geology. Physical parameters of the project areas are discussed hereafter.

### 5.2.1 Climate

The general climatic conditions of the area are those of a sub-equatorial region with moderate altitude comprised between 1,300 and 2,000 m amsl and 3 to 4 months of dry season. The climate of the area is characterized by two wet seasons and two dry seasons:

- a small rainy season that extends from mid-September to mid-December,
- a small dry season that runs from mid-December to mid-February,
- a great rainy season from mid-February to late May,
- a long dry season from June to mid-September.

The temperature varies between 15°C and 26°C for the region of Lake Mugesera and Sake catchment as shown by **Table** below.

**Table 8:** Average climatic conditions of Mugesera and Sake catchments (Source: computed from Meteo Rwanda data)

Parameters	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C)	Min	14.9	15.1	15.3	15.7	15.5	14.6	14.4	15.3	15.1	15.2	15.0	14.9	15.1
	Mean	20.3	20.5	20.2	19.9	20.1	20.5	20.8	21.5	21.0	20.4	19.6	19.9	20.4
	Max	27.8	28.2	28.0	27.0	26.8	25.5	24.9	24.6	24.2	24.8	26.4	27.4	26.3
Relative humidity (%)	Mean	72	73	74	76	76	68	61	61	67	71	72	74	70
Effective insolation (W/m <sup>2</sup> )		170	151	159	149	163	211	211	194	180	172	146	161	172
Wind velocity (km/h)	day	74	70	57	54	60	64	74	83	84	75	71	71	70
	Night	22	29	13	12	20	25	17	24	32	31	22	21	22

### 5.2.2 Hydrography

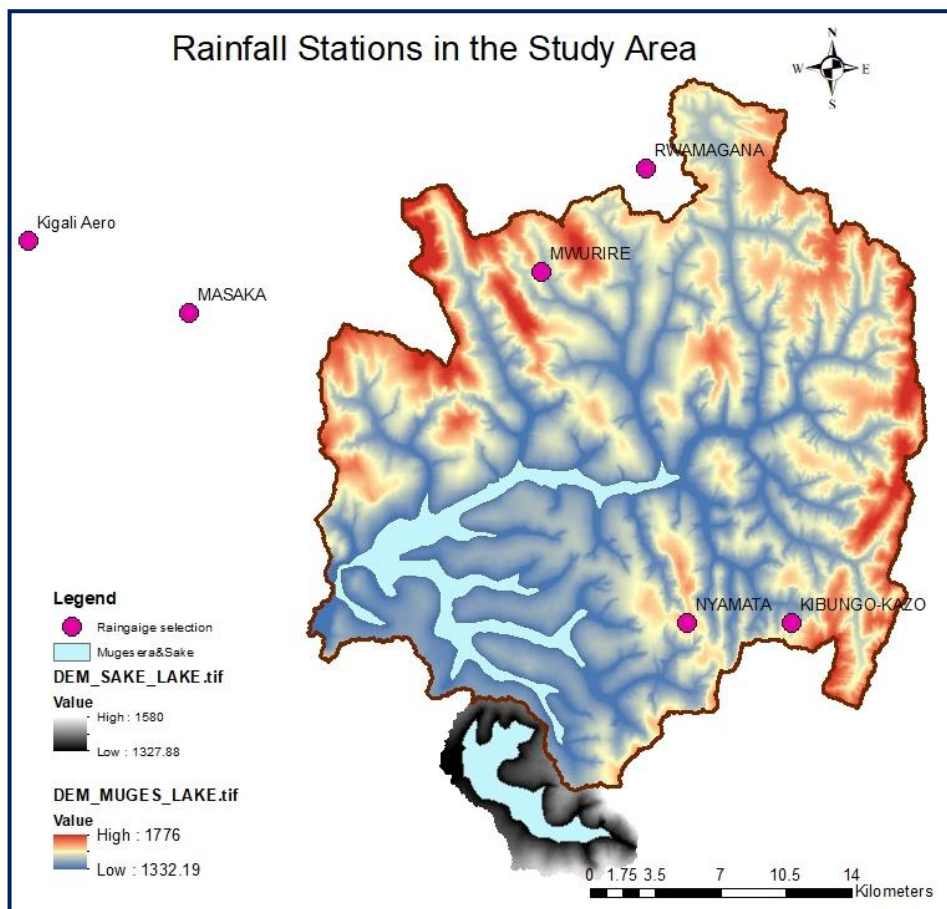
#### 5.2.2.1. Rainfall

The catchment area of Mugesera and Sake are comprised between the isohyetal curves of 900 mm and 1,100 mm of annual rainfall. For the analysis of rainfall within the catchment of Lake Mugesera and Sake, six (6) meteorological gauging stations have been utilized as reference for rainfall data: Kigali Airport, Masaka, Rwamagana, Mwurire, Nyamata and Kibungo. The summary of characteristics of the used reference gauging stations is given in Table below.

**Table 9: Rainfall stations around and in the study area**

Gauging station	Type	Geographic Coordinates		Relative distance from the Centre of catchment (km)	Number of years of observation
		Latitude (degrees)	Longitude (degrees)		
Kigali Airport	Meteorological	-1.96	30.13	35	38
Masaka	Rainfall	-2.00	30.21	25	38
Rwamagana	Rainfall	-1.93	30.43	12	38
Muurire	Rainfall	-1.98	30.38	8	38
Nyamata	Rainfall	-2.15	30.50	8	38
Kibungo	Rainfall	-2.15	30.45	11	38

The considered rainfall stations have been plotted in **Figure below**: Rainfall stations in the study area below.



**Figure 5: Rainfall stations in the study area**

### 5.2.2.2. Monthly Rainfall

The main factor that controls the rainy seasons in Rwanda is characterized by the establishment of the Inter-Tropical Convergence Zone (ITCZ). This is characterized by low pressures, maximum moisture and convergence of winds. It crosses Rwanda twice a year and determines two rainy periods as mentioned above.

The average monthly rainfall has been calculated from the available meteorological data series. The monthly rainfall for the dry year rainfall has been assumed as 80% of the monthly average rainfall for the whole period. 37 years of daily data were collected from Meteo-Rwanda, processed and average monthly rainfall was presented in the Table below.

**Table 10:** Monthly rainfall in the study area (computed from Meteo data)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	ANNUAL
Mwure	69.88	69.23	116.36	139.41	97.92	15.54	15.15	41.33	75.08	146.18	154.85	134.00	1,074.93
Masaka	75.23	90.49	108.90	140.79	76.85	59.56	8.64	27.10	85.31	115.59	159.08	78.54	1,026.07
Kigali	74.00	97.13	100.31	126.54	82.15	15.03	4.44	38.10	62.69	77.31	115.26	75.82	868.77
Rwamagana	61.88	79.90	102.15	138.31	109.36	16.77	10.90	40.82	82.23	118.13	130.13	84.23	974.80
Kibungo	67.20	82.72	149.79	169.15	108.77	13.54	12.44	30.26	59.77	106.38	176.97	94.56	1,071.56
Nyamata	68.98	78.41	126.18	138.08	66.26	16.97	10.03	32.28	60.03	87.05	124.79	75.46	884.51
Average	69.53	82.98	117.28	142.05	90.22	22.90	10.26	34.98	70.85	108.44	143.51	90.44	983.44

### 5.2.2.3. Monthly Evaporation from the Lake

Average monthly evaporation of the lake Evaporation is a broad term used to name a process by which water particles are transferred from the earth's surface to the atmosphere. The evaporation considered here is from the free water surface only, i.e. the lake. The evaporation has been computed by averaging daily pan evaporation for Kigali station. 27 years of evaporation data (1991 to 2018) from Kigali airport have been averaged to have the following table.

**Table 11:** Monthly Evaporation from the lake

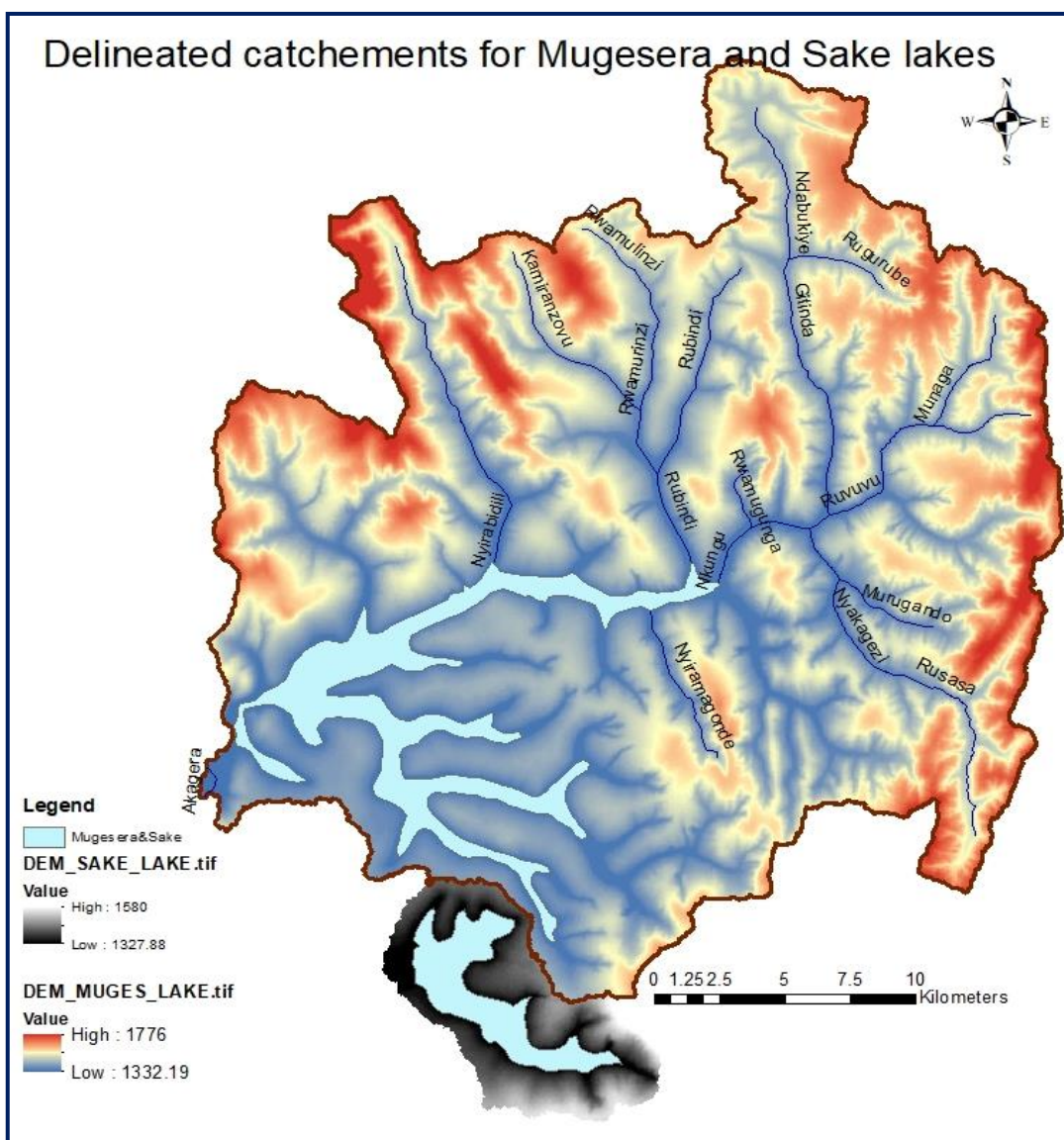
Month	Average (mm/day)	Total (mm/month)
Jan	3.22	99.82
Feb	3.53	102.23
Mar	2.85	88.40
Apr	2.49	74.66
May	2.92	90.48
Jun	4.42	132.62
Jul	5.71	176.86
Aug	5.83	180.75
Sep	4.85	145.40
Oct	3.66	113.48
Nov	2.86	85.81
Dec	3.14	97.38

### 5.2.2.4. Hydrology

Lake Mugesera discharges into Akagera River through an impenetrable wet zone full of papyrus. With a surface area of 43.46 km<sup>2</sup>, Lake Mugesera is supplied by waters from 4 main sub-catchments as shown in **Figure** below. The largest among those sub-catchments is Nkungu, followed by Rubindi, then Nyirabidili and Niramagonde being the smallest. For the rest of sub-catchments, the surface runoff is not relatively important and most of streams are seen only in high rainy seasons because the time of concentration is very limited as the catchment becomes narrow on

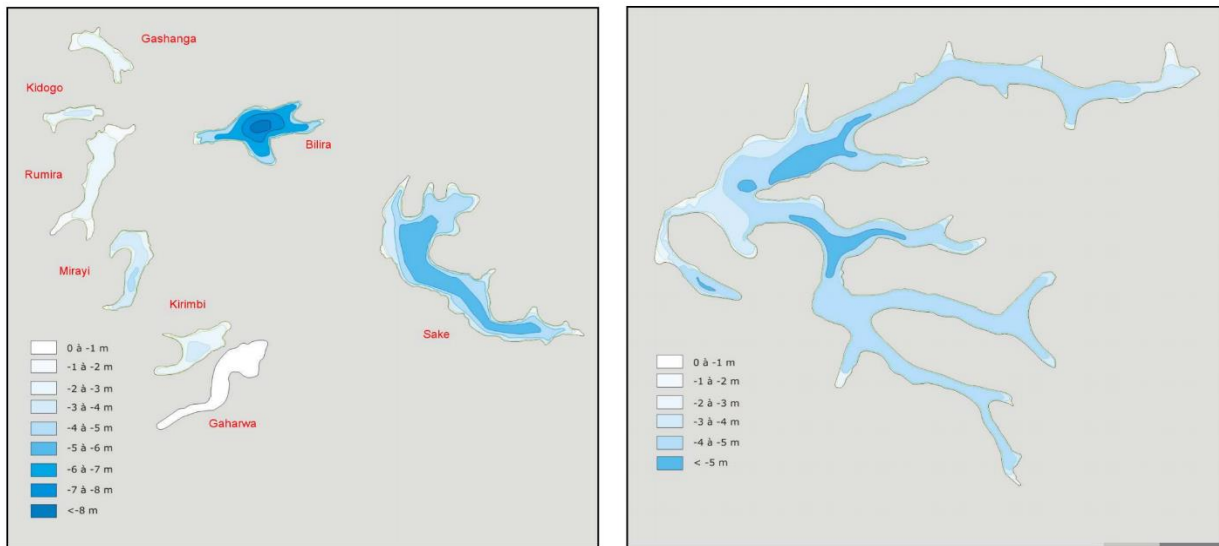
that side. The longest drainage length is Gitinda River, from discharges into Nkungu before entering the lake. The flows will travel around 43.6 km from the farthest upstream point to the catchment outlet as shown by **Figure in section 5.2.2.1**. Lake Mugesera has quite good perennial and seasonal rivers from its catchment of 808.73 km<sup>2</sup>, almost 20 times the size of the lake. This shows a good supply of water from the catchment to the lake. Given the proximity to the Akagera river downstream and to the fragility of the buffer zone, it is assumed that there is a possibility of back flow water from the river Akagera during some seasons of the year. There is no confirmation for this hypothesis.

As far as Sake Lake is concerned, the lake has a surface area of 15.71 km<sup>2</sup> with only 57.61 km<sup>2</sup> catchment. The lake has no single river or stream contributing to it. It gets water from the small runoffs during rainfall events. A quick observation of the size of the catchment which is only 3.5 times the surface of the lake reveals an external contribution of water to the lake, otherwise, the lake could have dried-up long ago.



**5.2.2.5. BATHYMETRY OF THE LAKES**

A bathymetric study was conducted on Lake Mugesera and Sake in 2008 by “Projet d’Etudes d’Elaboration des Plans d’Aménagement Intégré et de Gestion pour 17 Lacs Intérieurs au Rwanda” (PAIGELAC, 2008). The variation of water level was negligible in that period. Depths measured using an Echo-sounder, revealing the maximum depth above 5m in the center of the lake. The surface area of Mugesera lake was reported as 43.46 km<sup>2</sup>.



**Figure 6: Mugesera and Sake Lakes (sources BCEOM/PAIGELAC, 2008)**

The stored volume of water in Mugesera Lake varies from 150 million m<sup>3</sup> to 210 million m<sup>3</sup>. It is the source of domestic water to Kigali city through Karengye water treatment plant. Mugesera Lake is having enough resources to cover the needs for the proposed water supply project for Ngoma district and its neighborhood. In addition, the lake has a direct exchange of water with Akagera river. There is a constant supply of water from Akagera to Mugesera and vice versa. This statement is confirmed by the plot of both water bodies using Kanzenze station of Akagera river a bit upstream of the lake. Sake lake is quite small with a surface area of 15.7 km<sup>2</sup> and volume between 62,8 and 88,5 million m<sup>3</sup>.

**5.2.2.6. WATER BALANCE ANALYSIS**

The water balance has been computed in Table 9 and Table 10 for the two lakes isolated. However, it was found beyond reasonable doubt that both water bodies are directly connected to Akagera river. The proposed Sake water supply project can install the intake at any of the lakes because the actual water abstracted is taken from the whole system and not from a particular lake. For the sake

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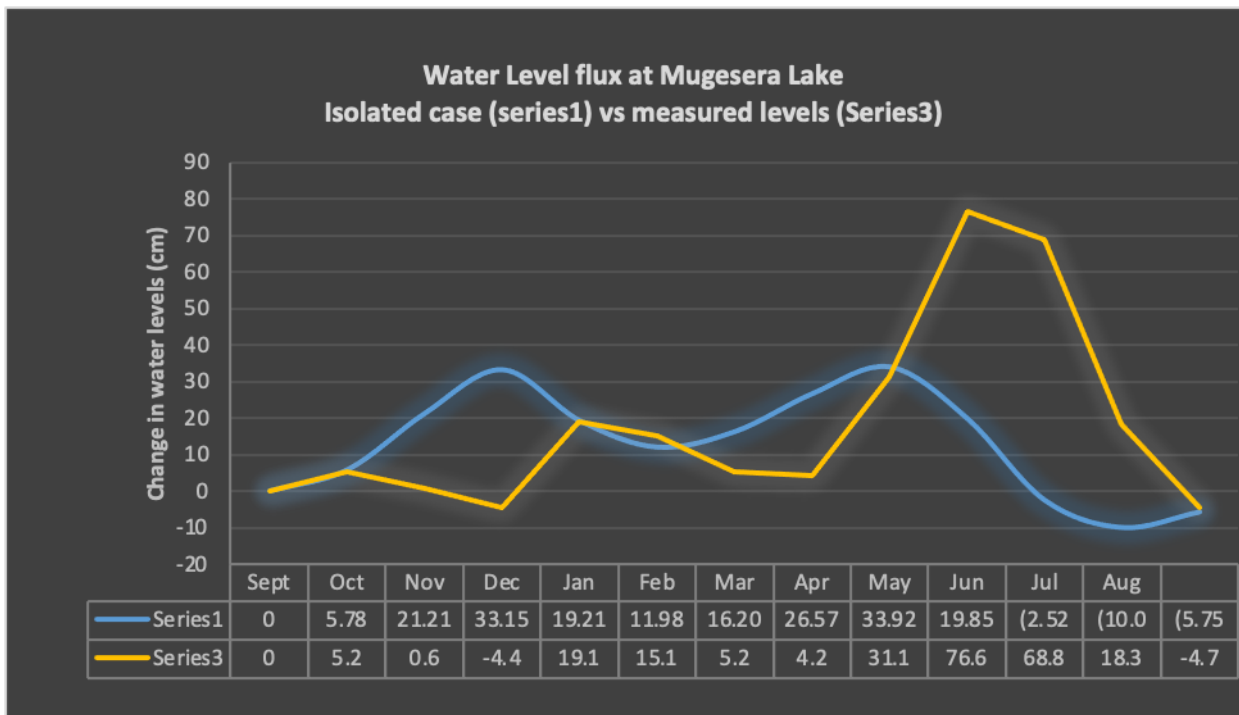
of this project, Mugesera lake is recommended to be used as it has a positive water balance on its own.

In addition to previously mentioned proof that both lakes are connected to Akagera river, a final analysis was done to confirm the interaction among these two lakes and akagera river. 18 years of daily water levels at lake Mugesera were analyzed to come up with averaged monthly data (water levels). The monthly water levels were plotted against expected changes in water levels due to inputs in the lake (baseflow, runoff, rainfall over the lake).

**Table 12:** Monthly changes in water levels in lake Mugesera

		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Series 1	Isolated Lake water levels (cm)	5.78	21.21	33.15	19.21	11.98	16.20	26.57	33.92	19.85	(2.52)	(10.01)	(5.75)
Series 2	Actual Levels (Recorded) in cm	45.2	40.6	35.6	59.1	55.1	45.2	44.2	71.1	116.6	108.8	58.3	35.3
Series 3	Reduced WL (recorded) in cm	5.2	0.6	-4.4	19.1	15.1	5.2	4.2	31.1	76.6	68.8	18.3	-4.7

The table was translated into a graph as follows, for a better visualization:



**Figure 7:** Representation of the changes in water levels in Lake Mugesera

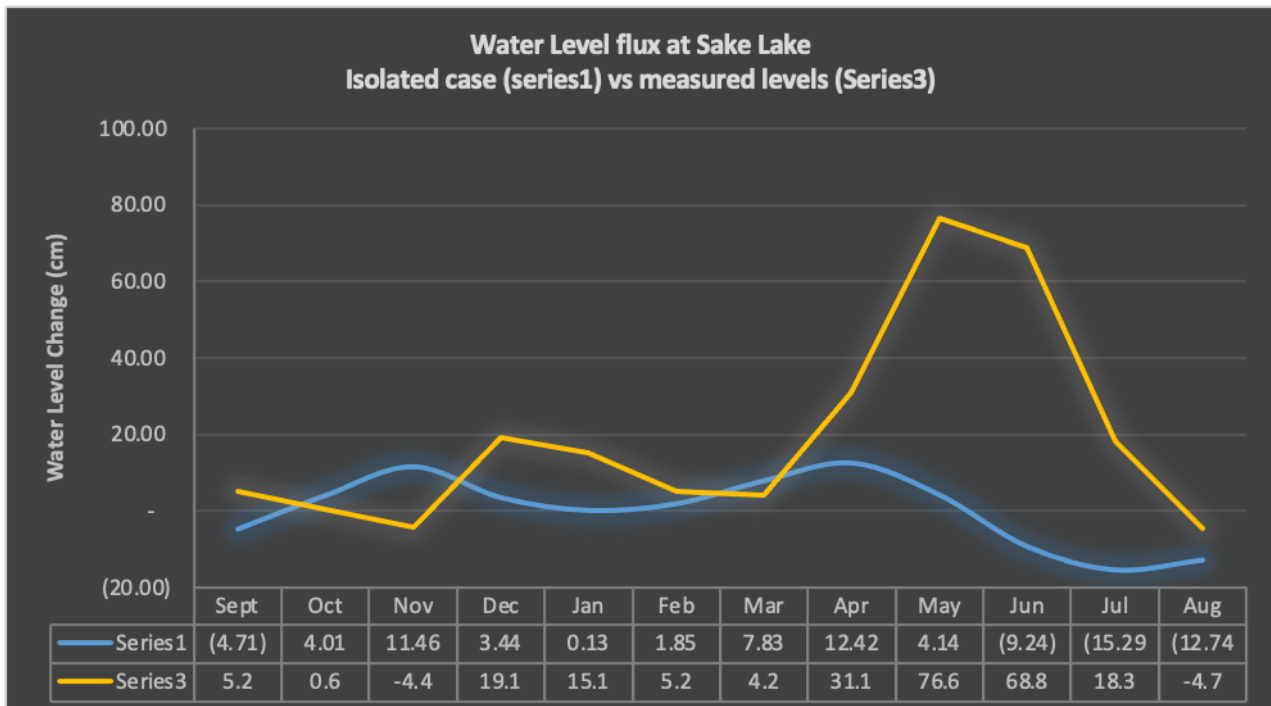
The figure above displays discrepancies between the change in water levels in Mugesera lake as an isolated watershed versus actual changes of water levels as recorded from historical data. This confirms that Mugesera lake is not an isolated watershed rather highly dependent on Akagera river.

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Starting from September (the 1st month of the hydrological year in Rwanda), Mugesera catchment receives water from its watershed, the water level was supposed to go up till November. To our surprise, the level does not go up, instead it goes down till a minimum in November following the Akagera river pattern. Based on the monthly contributions into the lake the maximum changes (fluctuation) expected is 43 cm as opposed to an observed flux of 85 cm.

**Table 13:** Sake water level flux

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Inflow - outflow	-0.74	0.63	1.8	0.54	0.02	0.29	1.23	1.95	0.65	-1.45	-2.4	-2
Sake Surface (km <sup>2</sup> )	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Change in level, Isolated Lake (series 1)	(4.71)	4.01	11.46	3.44	0.13	1.85	7.83	12.42	4.14	(9.24)	(15.29)	(12.74)
Recorded Reduced WL (series 3)	5.2	0.6	-4.4	19.1	15.1	5.2	4.2	31.1	76.6	68.8	18.3	-4.7



The graph was also plotted for a better visualization.

**Figure 8:** Sake water level flux (source: computed by the consultant)

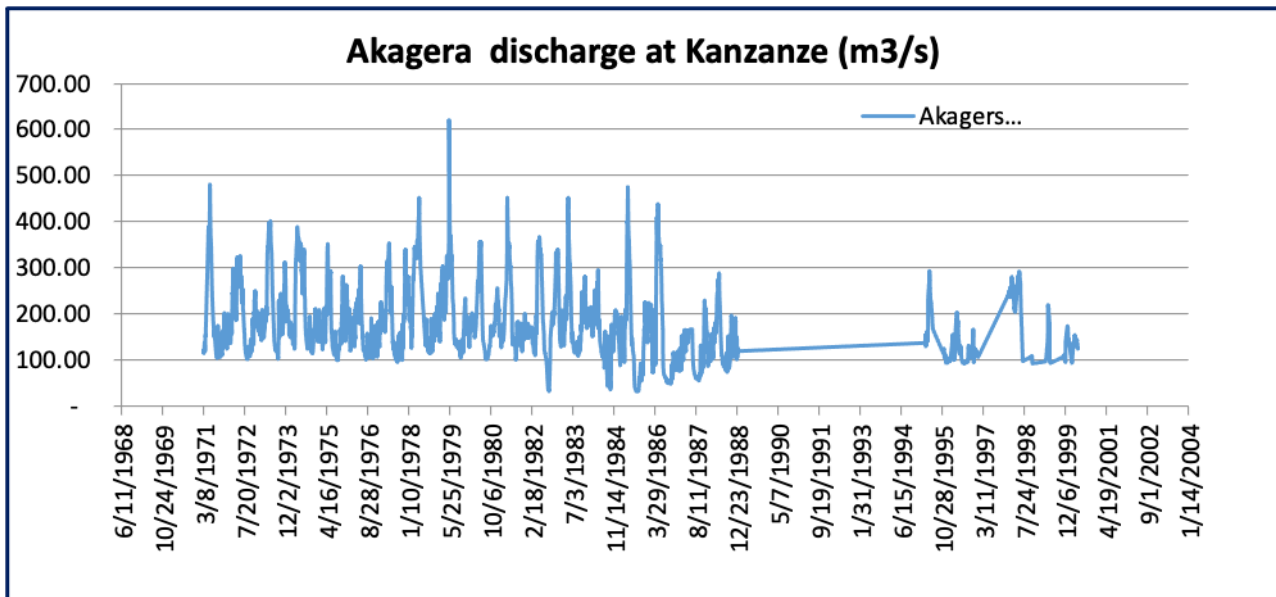
The figure above displays discrepancies between the change in water levels in Sake lake as an isolated watershed versus actual changes of water levels as recorded from historical data. This confirms that Sake lake is not an isolated watershed rather highly dependent on Akagera river.

Based on the monthly contributions into the lake the maximum changes (fluctuation) expected is 24 cm in Sake as opposed to an observed flux of 85 cm. this confirms the influence of Akagera river.

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The project recommends construction of the intake at Mugesera Lake. The lake has enough water in itself and from Akagera river. The lake will play a role of cleaning the Akagera water through its buffer wetland (about 175 has of buffer zone). Akagera has enough water to sustain any kind of water supply project in Rwanda.

When we try to look at discharges of Akagera River at Kanzenze station, just after the confluence between Akanyaru and Nyabarongo, we realize that the average minimum is around 100 m<sup>3</sup>/s with very few exceptional events below 50 m<sup>3</sup>/s this shows that there is enough water resources to cover



our water supply project which is estimated at less than 0.5 m<sup>3</sup>/s for design horizon.\*

**Figure 9:** Akagera discharge time series at Kanzenze: Source AQUARIUM-RNRA

In recent years, higher temperatures, prolonged droughts, and elevated rates of evapotranspiration have led to disturbances in the hydrologic cycle and altered river flows and lakes. Climate change-associated temperature increases and precipitation variability may exacerbate negative impacts on lakes, rivers, and other important sources of water. This can have implications on the availability of water for various users.

Severe weather events, particularly droughts, have historically imposed heavy costs in Rwanda. There is a need to include mainstreaming adaptation into all the activities that are planned along with Sake water supply project. Accomplishing these challenges requires overcoming and addressing existing barriers regarding data availability and accessibility, as well as the limited capacity to conduct meteorological and hydrological analysis and forecasting.

As far as the proposed project (water resources development) is concerned, key conclusions were suggested by global climate models:



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- ◆ Observations indicate a rise in average annual temperatures of about 0.7-0.9°C since 1950 (MINITERE), 2006. National Adaptation Programme of Action to Climate Change. SEI, 2009. Economics of Climate Change in Rwanda).
- ◆ Shifts in the timing of precipitation, which have important implications for water availability,
- ◆ Extreme events associated with El Niño and La Niña episodes have intensified,
- ◆ Greater average annual rainfall, with seasonal variability,
- ◆ Droughts in eastern and southern regions have resulted in a series of severe famines.
- ◆ Heavy rainfall in northern and western regions has led to erosion, flooding, and landslides.

To deal with climate change possible threat, the designs of Sake WS project need to take into consideration the following elements

- (i) Designing a floating intake (if possible) to accommodate the high change in water levels
- (ii) There is a need to a protection of the buffer zone between the two lakes and Akagera river. This can be assured once the buffer zone is kept intact
- (iii) There is a need for a full protection of Akagera flood plain and avoid draining the flood plain which acts as water reservoir and filtration area

The SAKE water supply project seems stable as it is connected to a bigger and stable source of water which is Akagera River.

### **5.2.3 Topography**

The District of Ngoma is part of lowlands of the East, a region essentially dominated by hills with low slopes, with an average altitude between 1400 m and 1700 m above sea level. The original relief is a plateau strongly dissected by tectonical movements of the quaternary that were progressively gullied by the erosion creating valleys and swamps.

### **5.2.4 Geology and Soils**

As regard to soil, Ngoma soils are favorable for agriculture activities due to the presence of little sandy clay soil mixture. The soils in the Lake Mugesera vicinities are predominantly oxisols to the north of the Lake, and ultisols on the south. Along the lakeshore on the north and south sides, the soils are inceptisols, with a band of histosols on the west side (*Source: Ngoma district DDP 2013 - 2018; CPCS-ITEC, 2012*).

**Figure 10 Types of soil in upland (left side) and in lowland around Mugesera (right side)**



### 5.2.5 Land use and Settlement

The main land use in Ngoma District, especially in Sectors Jarama, Rukumberi and Sake constitute agriculture, livestock raising and human settlement. The hundred meters from water bodies of Mugesera lakes is usually a vibrant agricultural area with the main crops including pineapples, bananas, cassava, maize, beans and other subsistence crops. The coffee farming was there, but on a smaller scale. Pineapple is actually the key agro-based, non-subsistence economic activity in the study area, producing 12 tons per hectare. In Sake Sector, 135 hectares were under pineapple production (*Source: Ngoma district DDP 2013 -2018; CPCS-ITEC, 2012*).

The 50m buffer zone has been secured; the zone is under natural vegetation of short shrubs and marshy areas. There are plans to plant trees around the lakes as part of plans to discourage invaders and encroachment, prevent soil erosion and siltation, and avoid pollution of the lakes.

**Figure 11 Illustrative photographs showing the current land use for reservoir in banana plantation and in pineapples for the construction of WTP**



### 5.3. BASELINE ON CALCULATION OF ENVIRONMENTAL FLOWS

Before calculating the minimum environmental flows, consultant conducted a feasibility study on the water balance of the intake. The water balance is determined by considering water inflows and water demand. The study on the water balance helps consultant: to determine water demand, to Determine the quantity of water that will be abstracted; to Assess the minimum Environmental Flows (EF) required to ensure that the water abstraction does not compromise EF and biodiversity/ecological functions and to Evaluate the impacts of abstracting water on the hydrological regime and the associated habitat/ecosystem dependent on the water.

#### 5.3.1. Quantity of water that will be abstracted

As shown in the table below, the planned project is 30,000 m<sup>3</sup> per day equivalent to 11Mm<sup>3</sup> per year and 0.35m<sup>3</sup> per sec.

**Table 14: Key water users from Lake Mugesera**

DEMAND	m <sup>3</sup> /day	Mm <sup>3</sup> /year	m <sup>3</sup> /s
<b>Irrigation water demand</b>		18.3	0.58
<b>Karengye Water Supply</b>	15,000.00	5.48	0.17
<b>Karengye Extension</b>	15,000.00	5.48	0.17
<b>Kanyonyomba Water Supply</b>	4,000.00	1.46	0.05
<b>Planned Water Supply</b>	30,000.00	10.95	0.35
<b>Others</b>	3,000.00	1.10	0.03
<b>TOTAL</b>		<b>42.75</b>	<b>1.36</b>

#### 5.3.2. Water demand balance

The table 15 shows that water demand is up to 42.75 Mm<sup>3</sup> against the renewable water resources of 73.7 Mm<sup>3</sup> per year. The demand is therefore estimated at 58% of the renewable resources leaving all the 42% as available flow. This can include 20% as the ecological flow with a balance of 21% exploitable by other users.

**Table 15: Water balance for Mugesera Lake (average year)**

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Ann
	t													ual
<b>Net area of the catchment</b>	km <sup>2</sup>	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	
<b>Lake surface area</b>	km <sup>2</sup>	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	
<b>Average rainfall</b>	m	70.85	108.44	143.51	90.44	69.53	82.98	117.28	142.05	90.22	22.96	10.26	34.98	983.44

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Runoff coefficient	%	0.06	0.08	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.05	0.05	0.05	
Runoff volume	(M) m <sup>3</sup>	3.25	6.64	8.79	5.54	3.72	5.08	7.18	8.70	5.52	0.88	0.39	1.34	57.03
Rainfall on lake	(M) m <sup>3</sup>	3.08	4.71	6.24	3.93	3.02	3.61	5.10	6.17	3.92	1.00	0.45	1.52	42.74
Base flow	l/s/ km <sup>2</sup>	1.26	1.41	1.57	1.57	1.41	1.41	1.57	1.57	1.57	1.41	1.26	1.26	
Base flow volume	(M) m <sup>3</sup>	2.50	2.80	3.11	3.11	2.80	2.80	3.11	3.11	3.11	2.80	2.50	2.50	34.26
TOTAL INFLOW	(M) m <sup>3</sup>	8.83	14.15	18.14	12.58	9.54	11.48	15.39	17.98	12.56	4.67	3.34	5.36	134.02
Monthly evaporation	m m	145.4	113.48	85.81	97.38	99.82	102.23	88.4	74.66	90.48	132.62	176.86	180.75	1,387.89
Lake surface area	km <sup>2</sup>	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	
TOTAL OUTFLOW	m <sup>3</sup>	6.32	4.93	3.73	4.23	4.34	4.44	3.84	3.24	3.93	5.76	7.69	7.86	60.32
TOTAL AVAILABLE	(M) m <sup>3</sup>	2.51	9.22	14.41	8.35	5.21	7.04	11.55	14.74	8.63	(1.10)	(4.35)	(2.50)	73.71
Change in Water Level	cm	5.78	21.21	33.15	19.21	11.98	16.20	26.57	33.92	19.85	(2.52)	(10.01)	(5.75)	

The below 16 shows that in the case of dry year, the demand is 42.75 Mm<sup>3</sup> against the renewable resources of 53.75 Mm<sup>3</sup> (**Error! Reference source not found.** per year. The demand is therefore estimated at 80% of the renewable resources leaving behind 20% as environmental flow.

**Table 16: Water balance Mugesera Lake (dry year)**

Net area of the catchment	km <sup>2</sup>	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	765.27	
Lake surface area	km <sup>2</sup>	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	43.46	
Average rainfall	m m	70.85	108.44	143.51	90.44	69.53	82.98	117.28	142.05	90.22	22.96	10.26	34.98	983.44
Effective rainfall (80%)	m m	56.88	86.75	114.80	72.35	55.62	66.38	93.82	113.67	72.17	18.32	8.20	27.98	786.752
Runoff coefficient	%	0.06	0.08	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.05	0.05	0.05	
Runoff volume	M m <sup>3</sup>	2.60	5.31	7.03	4.43	2.98	4.06	5.74	6.96	4.42	0.70	0.31	1.07	45.62
Rainfall on lake	M m <sup>3</sup>	2.46	3.77	4.99	3.14	2.42	2.89	4.08	4.94	3.14	0.80	0.36	1.22	34.19
Base flow	l/s /k m <sup>2</sup>	1.26	1.41	1.57	1.57	1.41	1.41	1.57	1.57	1.57	1.41	1.26	1.26	

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<b>Base flow volume</b>	M m <sup>3</sup>	2. 50	2. 80	3. 11	3. 11	2. 80	2. 80	3. 11	3. 11	3. 11	2. 80	2. 50	2. 50	34. 26
<b>TOTAL INFLOW</b>	M m <sup>3</sup>	7. 57	11 .8 8	15 .1 3	10 .6 9	8. 19	9. 75	12 .9 4	15 .0 1	10 .6 7	4. 29	3. 17	4. 79	114 .07
<b>Monthly evaporation</b>	m m	14 5. 4	11 3. 48	85 .8 1	97 .3 8	99 .8 2	10 2. 23	88 .4	74 .6 6	90 .4 8	13 2. 62	17 6. 86	18 0. 75	1,3 87. 89
<b>Lake surface area</b>	km <sup>2</sup>	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	43 .4 6	
<b>TOTAL OUTFLOW</b>	m <sup>3</sup>	6. 32	4. 93	3. 73	4. 23	4. 34	4. 44	3. 84	3. 24	3. 93	5. 76	7. 69	7. 86	60. 32
<b>TOTAL AVAILABLE</b>	M m <sup>3</sup>	1. 25	6. 95	11 .4 0	6. 46	3. 86	5. 30	9. 09	11 .7 7	6. 74	(1. 47	(4. 52	(3. 07	53. 75

**5.3.3. Minimum Environmental Flows (EF):**

- a) Table 15 summarizes water demand up to 42.75 Mm<sup>3</sup> against the renewable water resources of 73.7 Mm<sup>3</sup> per year. The demand is therefore estimated at 58% of the renewable resources, leaving 42% as available flow. This can include 20% as the ecological flow, with a balance of 22% exploitable by other users.
- b) Mugesera Lake has enough water to sustain key existing and planned projects when considered in isolation. A total flow of 1.59 m<sup>3</sup>/s can easily be supplied from the lake without harming the ecological life of the lake. However, monthly variations can be severe in dry months for this isolated case.
- c) From numbering a) and b) this means that 20% of the renewable flow has been reserved for ecological flow ecological purposes.
- d) Fortunately, Lake Mugesera is not an isolated water body. It is hydraulically connected to the Akagera River, and all the consumed water will practically come from the Akagera River, which has sufficient water resources at the lake. The minimum flow is around 100 m<sup>3</sup>/s, with exceptional events at 50 m<sup>3</sup>/s.
- e) Sake water supply project (intake at lake Mugesera) can therefore be implemented because there is enough water to sustain the project

**5.3.4. Determine impacts of abstracting water on the hydrological regime and associated habitat/ecosystem dependent on the water.**

The abstraction of water for the planned water supply project, which involves an annual abstraction of 11 Mm<sup>3</sup>, does not have any negative impact on the hydrological regime of Mugesera Lake and

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the surrounding catchment. In fact, the lake has sufficient water resources to sustain both existing and planned projects even when considering the total inflows into the lake from the catchment, which amount to 134 Mm<sup>3</sup>. This demonstrates that the planned abstraction volume is relatively small in comparison to the renewable water resources available in the lake. Therefore, the implementation of the water supply project will not cause any harm to the ecological life of the lake or significantly disrupt the hydrological regime of the area. It is important to note that monthly variations can be more pronounced during dry months, given the isolated nature of the lake. However, with careful planning and management, these variations can be effectively addressed to ensure sustainable water usage and protect the associated habitat and ecosystems dependent on the water.

## 5.4 BIOLOGICAL ENVIRONMENT

### 5.4.1 Flora

Concerning flora, the natural vegetation of Ngoma District is dominated by savanna landscapes. It is a typical vegetation of the east African basin, composed of vast lands of grass with scattered shrubs of the natural vegetation dominated by savanna landscapes. In uplands of the District, natural ecosystems have disappeared, leaving room for crops and artificial forests which mainly consist of large banana plantations with the combination of avocado, mangoes, sweet potatoes, cassava, etc. The majority of the current afforested area consists of *Eucalyptus* and *Pinus*.

The western part of the District is shaped of vast wetlands constituted by depressions of fluvio-lakes of the Akagera system that offer a typical landscape of lakes and swamps. Lakeshores and encrusted wetlands in mountains have rich plant diversity.

The vegetation within the lakeshores of Lake Mugesera in Nyagasozi and cell is composed by *Cyperus papyrus*, *Vossia cuspidata*, *Phragmites mauritianus* followed by *Calliandra calothyrsus* and *Jacaranda mimosifolia*. In buffer zone of solid lands there is dense vegetation composed by native species such as *Erythrina abyssinica*, *Ficus thonningii*, *Acacia hockii*, *Markhamia lutea* as well as a predominant exotic species *Mangifera indica*. There was no plant species which appears at the IUCN red list in littoral zone of Lake Mugesera and vicinities.

**Figure 12: Photos Nos 5 & 6: Illustrative photos showing plant diversity around Mugesera Lake.**



The whole site is underscored by a large variety of herbs strewn with shrubs and constitutes a

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preferred breeding area for terrestrial and semi-aquatic fauna species.

Some parts of the buffer zone looks arid and characterized by the presence of poacea, shrubs and few Acacia trees and different habitats implies the rich diversity of flora and fauna species. All these complex habitats form an important buffer zone protecting the lake against any sort of pollution and constitute appropriate breeding area for several birds' species (*Technical report, REMA, 2020: Lakeshores ecologically sensitive areas*).

#### **5.4.2. Fauna composition**

In uplands of rural areas, wildlife no longer exists since long time except for tropical birds, small rodents and reptiles encountered in the less frequented places. Concerning fauna biodiversity, most of wild species are found in wetlands areas and buffer zones surrounding the lakes (*DDP Ngoma 2013-2018*)

In lakeshore sites of Nyagasozi zaza where the Raw Water intake will be constructed, small mammals including *Chlorocebus aethiops*, *Genetta genetta* and *Civettictus civetta*, plus birds' species including aquatic ones *Bostrychia hagedash*, *Gypohierax angolensis*, *Ardea cinerea*, *Acrocephalus schoenobaenus* and a water bird *Numida meleagris* (helmeted guinea fowl) were recorded in the sites.

Furthermore, from lakeshores ecologically sensitive areas study (REMA, 2020) eight fish species have been recorded within Ngoma and Nyagasozi bays of Lake Mugesera, namely *Caecomastacembelus frenatus*, *Oreochromis niloticus*, *Haplochromis vittatus*, *Clarias gariepinus*, *Protopterus aethiopicus*, *Haplochromis sp*, *Labeo victorianus* and *Alestes jacksonii*. Finally, reptiles species including *Chameleon ellioti* and *Varanus niloticus* were also recorded in the areas (*Technical report, REMA, 2020: Lakeshores ecologically sensitive areas*).

**Figure 13: Photos showing some bird and reptile species found around Mugesera Lake**





Considering species conservation status, one reptile namely *Varanus niloticus* is threatened while *Chamaeleo Elliotti* and one fish species *Caecocomastacembelus frenatus* were listed least concern in reference to IUCN red listing status.

## 5.5. SOCIO-ECONOMIC PROFILE

### 5.5.1 Population

Ngoma District is subdivided into fourteen (14) Sectors, sixty four (64) Cells and four hundred and seventy three (473) Villages (Imidugudu). The district covers an area of eight hundred sixty seven point seventy four square kilometers (867.74 Km<sup>2</sup>).

The total population of Ngoma District is 338,562 inhabitants among which 162,388 are males and 176,174 are females (NISR, 2012; [www.ngoma.gov.org](http://www.ngoma.gov.org)). From the same source, the administrative Sectors of Kibungo and Remera are the most populated: 662 and 549 inhabitants per km<sup>2</sup> respectively while Sectors of Mutenderi and Jarama are less populated: 280 and 262 inhabitants per km<sup>2</sup> respectively.

The Eastern Province annual average of population growth rate is 4.3%, while Ngoma District had 3.7%. The population density is 393 persons per km<sup>2</sup> against 416 at national level. The sex composition of the Ngoma District population, as measured by the sex ratio, indicates that there were 92 men per 100 women in 2012 which is the same at national level (DDP Ngoma, 2013).

### 5.5.2. Population in Ngoma District per Sector

From the population of Ngoma District censused per Sector in 2012, a projection of total population in 2020 has been done. It appeared that it was expected an increasing rate of almost 30% of the total population in 2020.

**Table 17: Population of Ngoma Sectors in 2012 and 2020**

N <sup>o</sup>	Sector	Population 2012	Population 2020
1	Gashanda	16,322	22,150
2	Jarama	23,873	29,152
3	Karembo	15,158	19,492
4	Kazo	27,476	37,285
5	Kibungo	28,688	33,309
6	Mugesera	25,680	32,389
7	Remera	27,682	40,002
8	Rukumberi	28,579	37,286
9	Rurenge	28,522	37,279
10	Sake	23,795	31,444

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11	Zaza	23,907	30,942
12	Murama	22,406	28,007
13	Mutenderi	21,027	27,971
14	Rukira	25,447	33,020
<b>Total</b>		<b>338,562</b>	<b>439,728</b>

**Source:** Projected population data of 2012, NIS national population census of 2012

Based on a horizon of 15 years, the project area population was projected to the year 2035 through intermediate horizons 2025 and 2030. The following mathematical exponential model was adopted. This model was adopted because it describes the top limit compared to linear or geometric models.

**$P_n = P_o \times (1 + GR)^n$**  where,

- ◆  $P_n$  = the projected population after  $n^{th}$  year from initial year;
- ◆  $P_o$  = the population in the initial year of the period concerned determined on the basis of statistical data;
- ◆  $GR$  = the average growth rate between the 2 periods and;
- ◆  $n$  = number of years between the  $P_o$  and  $P_n$ .

The population growth rates adopted are the sector level growth rates adjusted to the national level urban and rural growth rates as appear in the report of the fourth population and housing census, Rwanda, 2012. The results of population projection of each sector are provided in the following table:

**Table 18: Project area projected population**

N°	Sector	Population 2025	Population 2030	Population 2035
1	Gashanda	26,572	31,522	36,703
2	Jarama	32,838	36,719	40,557
3	Karembo	22,865	26,560	30,350
4	Kazo	44,311	52,045	60,255
5	Kibungo	36,572	39,914	43,173
6	Mugesera	37,149	42,249	47,377
7	Remera	49,135	59,516	70,867
8	Rukumberi	43,689	50,696	57,876
9	Rurenge	43,681	50,686	57,864
10	Sake	37,032	43,161	49,526
11	Zaza	36,460	42,531	48,783
12	Murama	31,958	36,170	40,391
13	Mutenderi	33,255	39,120	45,209
14	Rukira	38,692	44,895	51,266
<b>Total</b>		<b>514,209</b>	<b>595,784</b>	<b>680,197</b>

**Source:** Projected population data of 2012, NIS national population census of 2012

### 5.5.3 Socio-cultural characteristics of the population

Selection (genetic and cultural) and environmental variations are the principal mechanisms determining patterns of demographic change in human populations. Conditions exist under which

the nature and intensity of these forces can be inferred from temporal trends in the demographic variables. These conditions, which can be expressed in terms of relations between the Malthusian parameter and population entropy, provide a means for evaluating the effect of selective and nonselective factors on demographic trends in human populations.

The project area demographic evolution is mainly influenced by the following factors: culture, employment and unemployment rates, poverty and extreme poverty, youth, education and health status.

#### 5.5.3.1. Culture

The population of the project area still think, like in many other parts of the country, that children are workforce and source of honour. This pushes them to giving birth to many children without, however, sufficient means to assure their well-being. The government started to mobilize the population to give birth to few children depending on the financial capacity of the households. This makes the annual population growth rate which is currently 3.2 % drop to 2.5% by the year 2035 (*Source: NISR national population census of 2012*).

#### 5.5.3.2. Employment and unemployment

Reference made to EICV5 the employment and unemployment rates are as follows:

- ◆ 88.8% of the district population is employed;
- ◆ 11.2 % of the district population is not employed;
- ◆ 17.5% of the district population gets paid by working in farms;
- ◆ 13.0% of the district population work in services;
- ◆ 64.2% of the district population is independent farmers;
- ◆ 5.3 % of the district population is self-employed in other services.

#### 5.5.3.3. Poverty and Extreme Poverty

EICV5 states that 37.8% of Ngoma population live in poverty whereas 14.0% live in extreme poverty.

#### 5.5.3.4. Youth

EICV5 indicates that:

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- ◆ 8.6% of Ngoma district population is aged between 16 and 20;
- ◆ 7.3% of Ngoma district population is aged between 21 and 25;
- ◆ 7.1% of Ngoma district population is aged between 26 and 30;
- ◆ 77 % of Ngoma district population is aged above 30;
- ◆ 83.5% of Ngoma district aged 16 to 30 is literate.

#### **5.5.3.5. Health**

From Ngoma District Health Strategic Plan (2012-2018), the following are the causes of diseases in hospitals of Ngoma District: Teeth and gum infections (18%), Eye problems (13%), Acute respiratory infections (10), Urinary tract infections (8%), Intestinal parasites (8), Gastritis and duodenum (7), Physical traumas other than fractures (7), Pneumonia (6%), Fractures (5%), Diarrhea with no dehydration (5%)

The most frequent disease is child pneumonia and diarrhea diseases occupying 39% and 32.1% respectively. The top 5 causes of morbidity in District (5 years and plus) are: Acute respiratory infections (39.6), Intestinal parasites (13.2), Gastritis and duodenum (10.4), Malaria (6%) and Physical traumas other than fractures (5.8).

According to EICV4, the health situation is as follows:

- ◆ 78.1% of the Households in Ngoma District have at least one member with health insurance;
- ◆ 58% of the Households do not visit health facilities when they are sick due to limited financial means;
- ◆ 31.7% do not visit health facilities because the facilities are located too far;
- ◆ Prevalence of malaria among children is 7.7%;
- ◆ Prevalence of HIV in the District is 1.7 %. It was 3% in EICV3;
- ◆ The district counts 1 hospital, 12 health centres, and 19 health posts.

#### **5.5.3.6. Education**

Reference to Feasibility report of Mugesera WSS project (CIRA JV ITEC Engineering, 2020), the identified non-domestic water consumers and their average daily water demands for the year 2020 included schools operating in the District. The average daily water demand for schools totalizes 635

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m<sup>3</sup>. Among schools which are connected to clean water distribution include: Petit Seminaire de Zaza, Lycee de Zaza, Teachers Training Center of Zaza, Groupe Scolaire de Zaza, Ecole Technique Nazareth, Ecole Primaire de Zaza. The most other schools harvest rainy water from the roofs which are stored in reservoirs and utilized for toilets and cleaning works of school infrastructures.

From the consultant's survey of November 2020:

- ◆ 0.59% of the district population have never been to school;
- ◆ 2.9% of the district population abandoned primary education;
- ◆ 69.8% of the district population completed primary education;
- ◆ 7.1% of the district population completed pre-primary vocational;
- ◆ 8.6% of the district population completed post-primary vocational;
- ◆ 10.3% of the district population completed secondary education;
- ◆ 0.71 % of the district population completed university education.

#### **5.5.4. Existing and Future Development Projects**

##### **5.5.4.1. Existing Development Projects**

The Consultant has identified projects that have a direct impact on water consumption. Such existing projects are provided in the table below.

**Table 19: Existing development projects in Ngoma**

<b>N°</b>	<b>Project</b>	<b>Number</b>
1	Hospitals	1
2	Health Centres	12
3	Health posts	19
4	Schools	81
5	Administrative offices	79
6	Police stations	11
7	Military camps	10
8	Factories and coffee washing stations	17
9	Stadium	1
10	Bus stations	1
11	Markets	9
12	Selling points	3
14	Hotels, Guest Houses and Lodges	10
15	Restaurants	8
16	Prisons	2
17	Churches	48

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18	Youth centres	1
19	Courts	1

**Source:** Ngoma District, Department of Planning and Monitoring, updated data, September 2020

**5.5.4.2. Future development projects in Ngoma**

The future development projects that have a direct impact on water consumption are provided in the table below.

**Table 20: Project area planned projects**

<b>N°</b>	<b>Project</b>	<b>Number</b>
1	Main Conference Hall	2
2	Agriculture Buildings	1
3	Police Buildings	2
4	One Stop Center Buildings	1
5	NEC Office	1
6	Yego Centre (Dushishoze)	1
7	Recreation Buildings	5
8	Police Station	3
10	Umwalimu Sacco	1
11	Residential Apartment	3
12	Police Hostels	1
14	Police Buildings	1
15	Main Conference Hall	1
16	Zaza Transit Centre	1
17	Residential Apartment	1
18	Police Buildings	1
19	Construction of capacity building centre	1
20	VTC construction	14
21	Gisaka Museum construction	2
22	Modern beaches construction	2
23	Bus station construction	2
24	Juice and Jam factories construction	2
25	Police Hostels	1
26	Police Hostels	1
27	Police Buildings	1
28	Residential Apartment	1
29	Residential Apartment	3
30	Main Conference Hall	1
31	Police Buildings	1
32	Police Hostels	1
33	Post Harvest Collection Centre	1
34	Residential Buildings	1

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35	Police Hostels	1
36	Police Hostels	1
37	Police Hostels	1

**Source:** *Ngoma District, Department of Planning and Monitoring, updated data, September 2020*

#### 5.5.5. Socio-Economic Situation

The consultant has conducted a household survey in order to determine the actual socio-economic situation of the project area. The main objectives of the household survey were to determine details on the following points: Habitat, Gender issues, Access to basic infrastructures, Family income situation, Family income generating activities, Population will to pay for water supply services, Possibility of beneficiaries' participation (men and women) to the planning, the investment, the execution of the works and the operation of the drinking water systems.

##### 5.5.5.1. Gender Issues

Gender is an important variable in a given society which is variably affected by any social or economic phenomenon; globalisation is not an exception to it.

Referring to the Department of Planning and Monitoring in Ngoma District, the population of Ngoma District is predominantly female; 198,385 are female corresponding to 50.29 percent of the total population and 196,114 are Male which represents 49.71 percent of all population of Ngoma District.

Females are predominant in all sectors of the district except in Kibungo, Mutenderi and Remera Sectors. Rurenge, Rukumberi, Remera and Kazo are the most populated Sectors, respectively with 34,312, 34,021, 32,378 and 31,343 inhabitants.

Two less populated sectors are Karembo and Gashanda sectors with 4,368 and 4,788 inhabitants respectively.

A number of Households (383 Households) contacted during the household survey 100 percent have successfully responded to the questionnaires.

Of the 383 sample respondents to whom the social survey questionnaires were administered, 58.6 percent (224) respondents were male while 41.4 percent (159) respondents were female. Since the study targeted the heads of households, findings show that there are more male headed (58.6 percent) than female headed households (41.4 percent). However, the findings further show that female headed households are on the increase especially in Kibungo and Gashanda Sectors. This was also evident in the Focal Groups Discussions (FGDs) and interviews.

### **5.5.5.2. Habitat**

According to EICV5, 88.1 % of the population in Ngoma District live in planned settlements (Imidugudu) compared to 49.2 % at national Level.

### **5.5.5.3. Access to Basic Infrastructure**

**Energy:** A disquieting 6.20 percent of all 383 households said firewood was their main energy source compared to 3.7 percent at national level. Most of survey households (40.35 percent) use torch/phone as main source of lighting compared to 43.4 percent at national level with another 14 percent using electricity compared to 27.1 percent at national level according to EICV 5.

A few households (0.8 percent) also mentioned using candle as main source of lighting compared to 6.1 percent at national level, or solar panels (1 case: 0.26 percent) in combination with either wood or charcoal. The long distance to the electrical grid line is a constraint to the access and use of electricity inside the dwellings. The electrical grid line is in range of 15 meters to 30 meters.

**Water:** Water is essential to life and health. It is required in considerable quantities for drinking, washing, cooking and personal hygiene. Despite its importance, water is not always available in quantities and qualities required yet the need for it is such that people tend to use any water that is readily available to them, whether it is polluted or not. Access to water is an important determinant of health.

Polluted waters when used for drinking and bathing and cleaning, constitute one of the principal modes for infections. For any meaningful gains to be realized in improvement of health status of the people at household level and thus enhance the general productivity of the population, measures must be taken to ensure that people have access to safe water. The source of water should as much as possible supply a quantity of safe water that is adequate for the needs of the community.

EICV5 shows the progress observed in the use of improved drinking water source (87 percent compared to 85 percent in EICV4) over the period of three years at national level. Usage rates are higher in urban areas (96%) compared to rural areas (85 percent). The use of improved water source may be related to type of habitat since; households living in Imidugudu are mostly using improved water sources.

The survey shows that 99.22 percent of survey households use water from surface water, protected spring, unprotected shared well and rain water. The dependency on protected spring is very high.

Percentage of households accessing improved drinking water in the Project area is 94 percent while the target for 2018 was 100%. The national average is 87.4 percent according to EICV5 report. On



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the other hand, less than half of the interviewed population has access to an improved water resource (their own stand pipe or borehole), with 54.31 percent of the households using a shared well, borehole or stand pipe compared to 35.4 percent at national level.

**Figure 14: Local population making queues at water point and others fetching water from Mugesera Lake**



According to National Water Supply Policy, the distance used for defining EDPRS 2 targets<sup>1</sup> is 500 meters distance and 200 meters from an improved water source in rural and urban areas respectively to attain universal access within a very short period of time.

The survey sought to find out the mode of transportation from the source to the household, the distances involved in fetching water from the main source to the household and time taken to fetch water. Walking distance to basic services can be considered as an indicator of both provision and coverage of such services and the remoteness of households' dwellings. One of the main interests of the study was to know the distances households travel to fetch water both during the rainy and dry seasons.

In Project zone, when water is not piped to the dwellings, the burden of fetching it falls disproportionately on women and children, especially girls and the time to fetch water depends on the sector. According to EICV5, at national level, people walk 504.9 meters (mean distance) to search for water to the nearest improved drinking water source compared to 600 meters in Ngoma District.

Of the households surveyed, 83.6 percent fetch water from a water source that is outside the vicinity of their home. The study revealed that, typically, respondents travelled an average of 659 meters to

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fetch water, especially in Mugesera Sector. About 32 percent of the households in the study area had to travel more than 500 meters to fetch water. The average time it takes for the respondent to fetch water (round trip) was *25 minutes*; 74.7 percent reported that it takes them less than 25 minutes and 31 percent said it takes them 30 minutes.

Another indicator assessed is the reliability of water services or availability of water especially for those households who are connected or who get water from public taps. This was assessed through frequency of water availability over one month. Results reveal that 28.6% of interviewed households faced water fluctuation during the last 7 days preceding the survey.

#### **Sanitation:**

In Ngoma District, the most widespread form of water contamination results from disease-bearing human wastes. This waste poses great health risks for people who are compelled to drink and wash in untreated water.

**Latrines:** Improved sanitation refers to a latrine/toilet/facility that hygienically separates human wastes from human contact; flush toilet; connection to a piped sewer system; connection to a septic system; flush/pour-flush to a pit latrine; ventilated improved pit (VIP) latrine; and composting toilet. While this definition categorizes latrines as “improved,” to be effective, the latrines must also be properly constructed and maintained.

Basic sanitation means that every household has its own toilet and does not share with another household. These toilets should also keep human waste out of contact with people. In order to find out the proportion of the households with access to sanitary facilities, the survey sought to know the types of toilets owned by household in the Project zone. The majority (94.3 percent) of the households in Ngoma District have access to improved sanitation compared to 86.2 percent at national level (EICV5).

The findings show that 0.5 percent of survey Households have access to Flush Toilet compared to 1.9 percent at national level; 77.8 percent have access to Pit Latrine with solid slab compared to 84.3 percent at national level. For unimproved sanitation, 21.7 percent of survey households use Pit Latrine without slab.

**Status of Hand Washing:** In respect to Hygiene, availability of clean water and soap enables and encourages people to wash their hands especially at critical times, and as a result, it reduces the likelihood of disease transmission. Drinking safe water can prevent the spread of waterborne diseases among the population. The survey revealed that only 45.9 percent of households wash hands with water and soap at recommended 5 times.

**Wastes Management:** Waste management remains a problem where 17.5% of Households throw their domestic wastes in bushes or field and only 78.0% have composts. This is relatively lower than national level where respectively 31.1% throw their wastes in bushes and 59.4% of Households use compost (*Source: Ngoma district, DDP 2013 - 2018*).

#### **5.5.5.4. Household Income Situation**

The annual household income for 383 households varies between 350,000 Rwf and 650.00 Rwf with an average of 351,697 Rwf (median 425,000 Rwf). Dividing the household income by all household members, the average annual per capita income is 87,924 Rwf (median 120,000 Rwf). The main breadwinner in almost 90 percent of the cases is a man and in all the other cases a woman. Less than one quarters of the interviewed household declared receiving additional income from other sources, including transfers from relatives abroad; tontine (ikimina) or; credit from a bank and gifts, such as lands or domestic animals.

**Sources of income:** Questionnaire was asked to state the source of revenue for each economically active household member. Even though family members worked on the same farm, income from their 'own' agriculture and livestock has been noted separately. However, it is difficult to distinguish for each family member working on the same farm a specific 'income'. For this reason, one household income was calculated for all economically active household members. The majority of interviewees mentioned several sources of revenue for one economically active household member. 299 households have at least two economically active household members; 61 households have up to three economically active household members; 23 households have up to four economically active members; and ten households have up to five economically active household members.

The majority of all economically active household members in the sample cultivates their own crops (60.5 percent) and has their own livestock (12.27 percent). Some government employees (5.48 percent) and privately employed persons (2.4 percent) are also included. It must be stated that these persons are also likely to have to cultivate their own crops and raise livestock, and therefore appear in both categories. The self-employed, which includes shop and other business owners accounted for 9.4 percent of the respondents. Only single cases are seasonal workers or paid farm labourers. Only one respondent receives assistance from the government. As stated earlier, the majority of farmers both cultivate crops and raise livestock. The number of farmers practicing only one of these activities is very low. Only four households do not have any economically active household member. We have to assume that these households either refused to answer this question or practice subsistence farming and do not consider the self-consumed yields as an income. Other

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than these four households, all the other households (383) have at least one economically active household member.

Household income is calculated on the basis of revenue from the sale of crops, livestock and other farming products, and the other paid economic activities that have been mentioned. These numbers must be treated with caution, as individuals tend to give unrealistic estimates that are intended to reflect favourably on the project. We therefore understand the given numbers and further calculations based on those figures represent estimates rather than exact and fully reliable data.

**Household Assets:** The survey revealed that 73.9 percent of households possess a radio compared to 73.9 percent at national level. Most (87.9 percent) also own a mobile phone compared to 64.3 percent at national level. More than half of the households surveyed responded that the houses are theirs. *(source: CIRA JVITEC Engineering, November 2020)*

#### **5.5.5.5. Existing drinking Water Supply System Management**

In general, the management structure of the existing water supply systems is the one recommended by the national policy on water and sanitation (2016) which is the management contracts with the district in the form of Public-Private-Partnerships *(Source: Ngoma district, November 2020 and WASAC Rural MIS data)*.

The existing water supply systems in Ngoma District are classified as rural and urban water supply systems. Rural water supply system is under the management of private operator named WATRESCO Ltd and under management contracts with the district in the form of Public-Private-Partnerships. The urban water supply system is under the management of WASAC Ltd *(Source: Ngoma district, November 2020 and WASAC MIS data)*.

## **CHAPTER VI: PROJECT ALTERNATIVES**

The alternatives to the project are different ways to achieve the same purpose and needs that the proposed project will achieve. ESIA requires looking into alternatives to the proposed project in order to make prudent decisions. In the present ESIA report, three alternatives will be analyzed namely: (i) Alternative site location utilized, (ii) Alternative construction techniques and (iii) Alternative zero or no-project in order to make prudent decisions and ensure District's sustainable development.

### **6.1. SITE LOCATION**

The proposed project will be located within Ngoma District in the Eastern Province of Rwanda. Under this alternative, the Government of Rwanda through Water and Sanitation Corporation Ltd could consider purchasing or leasing lands at different sites and execute Mugesera WSS project.

Considering the hydrological situation of the region, apart from the Nyabarongo River and the three lakes Bilira, Mugesera and Sake, there are no other important sources of water which could be captured to have sufficient distributed water to supply the population of Ngoma District.

Fortunately, Ngoma District has two closer important water bodies in its constituency including Lakes Sake and Mugesera. The second one is more connected with Akagera River system and there is a sustainable recharge of water to the lake through marshlands areas.

While, for Lake Sake, the water balance is almost negative. It exhibits deficits in the months of January and February as well as in June, July, August and September (*Hydrology report, 2020*). Therefore, Lake Mugesera has been recommended to be used as it has a positive water balance on its own (*Hydrology report, 2020*)

Finally, the presence of these two important water bodies in the Sectors of Jarama and Zaza with enough raw water to be captured, treated and distributed among local population is conducive to the development of the Mugesera Water Supply project at this location.

### **6.2 ALTERNATIVE CONSTRUCTION TECHNIQUES**

In most of the areas of Ngoma District, especially in the parts closer to the lakeshores, it will be extremely important to minimize construction impacts and water applications so as to guard against the risk of lake water pollution, groundwater rising through leakage and infiltration as well as secondary salinization.

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An appropriate water treatment system, drying sludge eliminated and recycling backwashed water, storage water in reservoirs versus maintaining continuous flow from intake and canals, installation of pipelines network for water recharge in reservoirs versus construction of concrete channels, all these constitute excellent techniques for managing water efficiently in Ngoma District.

Therefore, the detailed design for infrastructures construction and techniques which will be used for water treatment, its distribution and wastes management would be based on international standards for the smooth running of the Mugesera WSS project, within well-sound environmental and social conditions.

### **6.3. NO-PROJECT ALTERNATIVE**

In Ngoma District, the survey has shown that 99.22 percent of surveyed households use water from surface water, protected spring, unprotected shared well and rain water. The expectation to depend on protected spring is very high.

On the other hand, less than half of the interviewed population has access to an improved water resource (their own stand pipe or borehole), with 54.31 percent of the households using a shared well, borehole or stand pipe compared to 35.4 percent at national level.

**Figure 15: People fetching water in Lake Mugesera and at water point**



Of the households surveyed, 83.6 percent fetch water from a water source that is outside the vicinity of their home. The study revealed that, typically, respondents travelled an average of 659 meters to fetch water, especially in Mugesera Sector. About 32 percent of the households in the study area had to travel more than 500 meters to fetch water. The average time it takes for the respondent to fetch water (round trip) was 25 minutes; 74.7 percent reported that it takes them less than 25

minutes and 31 percent said it takes them 30 minutes.

On the other hand, considering no project option means all socioeconomic benefits from the project execution in Ngoma District such as offer of several employment opportunities, distribution of cleaned water to population and decrease of waterborne diseases, increasing of public revenues and tax incomes which should contribute to the development of national economy would be definitively lost.

Therefore, as the potential adverse impacts susceptible to be generated by the project execution would be minimized and/or eliminated through implementation of proposed mitigation measures, this alternative of no-project is considered not acceptable on grounds of losing out many project's positive socio-economic and environmental benefits.

#### **6.4. Alternative sources of energy during operation for pump stations**

Two alternative sources of energy be used to power pump stations are

**Solar Power:**

Solar energy is a popular choice for powering pump stations. Photovoltaic (PV) panels can be installed on the roof or in the vicinity of the pump station to convert sunlight into electricity. This energy can be used to power the pumps directly or charge batteries for later use.

**Energy Storage Systems:** Implementing energy storage systems, such as batteries, can help store excess energy generated from intermittent sources like solar or wind power. These stored energy reserves can be used during periods of low generation or high demand, ensuring a consistent power supply for the pump station.

**Grid Connection and Net Metering:** Pump stations can also benefit from grid connections and take advantage of renewable energy sources supplied by the local power grid. Depending on the location and availability, the pump station can draw power from the grid or even contribute excess energy back to it through net metering arrangements.

**Hydroelectric Power:**

Hydroelectric power from REG will be utilized.

## **CHAPTER VII: ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES**

### **7.1. INTRODUCTION**

The objective of the identification and assessment of impacts is to provide accurate information on the effects of activity execution to human beings and environment in general, which will allow the competent authority to take decision as whether the activity will be authorized subject to mitigate proposed measures or rejected.

In this sense, impacts are defined as the changes in an environmental parameter that result from undertaking an activity. These changes are the difference between effects on an environmental parameter where the activity is undertaken compared to that where the activity is not undertaken, and occur over a specific period and within a defined area.

This section entails assessment of impacts of the Mugesera water supply project. Obviously, the proposed project has potential to cause positive as well as adverse impacts on the biophysical and socio-economic environment. The magnitude of potential impacts will vary between the phases of project implementation.

The assessment of the project impacts given below is for the proposed Mugesera interventions which comprise the construction of main infrastructures namely: collecting raw water Intake, Water Treatment Plant, storage Reservoirs, Pumping stations, Pressure breakers and Pipelines installation network.

The proposed WSS project will have an intake located in Zaza Sector, Nyagasozi Cell and Sugira village. From this intake raw water shall be pumped with the help of 3 horizontal pumps from Mugesera lake, so that monitoring of hydrological regime of this water body and avoidance of its siltation shall be considered.

The Water Treatment Plant with 3 channels shall be constructed in Zaza Sector, Nyagasozi Cell, and Sugira Village. For this activity, three categories of environment and social receptors are: local population for acquired lands dedicated to WTP construction, lake Mugesera with risk of siltation and individual fertile agriculture lands with risk to be covered by excavated earth materials.

Treated water will be kept in 12 Reservoirs which will be located in different Sectors before its distribution. The construction of these reservoirs will require individual lands acquisition plus destruction of agriculture crops as well as natural habitats and their biodiversity.



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Six booster pump stations will be installed with six pumps as well as pressure breakers. For this activity, two categories of environment and social receptors are: local population for acquired lands dedicated to pump stations construction, lost of their assets and natural environment destruction.

Installation of Pipelines network for treated water distribution. Local population will temporarily loose their lands and destruction of natural habitats and their biodiversity.

During all phases of the project, the representatives of the developer of Mugesera WSS in Ngoma District (WASAC) in collaboration with the contractors shall implement all measures necessary to avoid undesirable adverse environmental and social impacts wherever possible, restore work sites to acceptable standards, and abide by any environmental performance requirements specified in the Environmental and Social Management Plan. More specifically, the contractors shall ensure that the negative impacts are minimized, mitigated or avoided.

## **7.2. TYPES OF IMPACTS**

Different types of impacts may occur from the implementation of this type of project, which may be positive or negative, and can be categorized as being either direct (primary), indirect (secondary) or cumulative.

Direct impacts are impacts that caused directly by the activity and generally occur at the same time and at the place of the activity (for example, dust generation excavation activities). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Indirect impacts are induced changes that may occur as a result of the activity (for example the use of water from a natural source at the activity will reduce the capacity for supply to other users). These types of impacts include all the potential impacts that either does not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity (*Jain et al, 1993; Fuggle and Rabie, 1994*).

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (for example, removal of vegetation may cause soil erosion, leading to excessive sediments in receiving stream, leading to reduced sunlight penetrating the water and thus reducing dissolved oxygen in the water and adversely affecting aquatic life and water quality). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts (*Jain et al, 1993*).

### **7.3. POTENTIAL IMPACTS IDENTIFICATION AND ASSESSMENT**

Potential impacts associated with the project were identified based on the qualitative information and data on cause-and-effect relationship. The identification considers the sources of impacts and relates them to the environmental or social characteristics and conditions; hence concluding if the source of impact affect or not the specific environmental or social components of the project activities. The impacts identification considers the all stages of the project: design and planning, pre-construction, construction, operational and decommissioning phases.

The methodology used for impacts assessment in this report is related to risk assessment : (i) whereby certain impacts to the environment are identified, (ii) risk evaluation (by using a stipulated assessment criteria whereby impacts are given a rating or weighting and obtaining an overall rating or significance of an impact) and (iii) risk management (relating directly to applicable mitigation measures to be implemented to manage a risk of an impact in the best interest of the project beneficiaries and surrounding communities. The assessment criteria and ratings for determining the impact significance (*see Chapter of Methodology utilized*).

### **7.4. POSITIVE IMPACT DURING CONSTRUCTION PHASE**

The Mugesera WSS Project implementation will result in many social-economic benefits for the beneficiaries and surrounding communities of the project. In general, it is expected that the project will result in better access to safe drinking water and sanitation facilities leading to improved standards of living in terms of reduction of diseases, creation of temporary employment during construction, economic development etc..

The following section highlights the potential positive socioeconomic impacts likely to be generated by the project.

#### **7.4.1. Job creation for local residents**

The implementation of this project will provide employment opportunities for the local residents in areas. The following activities will create employment in Ngoma District as result of Mugesera WSS project implementation: (i) recruitment of workforce as man power for different constructions, (ii) supply of construction materials including sand aggregates, stones, steel bars, timber, cement, (iii) small businesses for income generation, (iv) security guards and cleaners, (v) green areas creation all around water infrastructures.

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The use of local laborers and skilled workers will improve the skill resource base in Rwanda through the implementation of training and development programs. These are both positive outcomes of the project and for the local population. However, there will be an influx of people looking for work in general. If not carefully managed, this strain would be a negative impact. During the public consultation all the persons met have solicited to get job opportunity during project implementation.

#### **7.4.2. Improvement of life quality of local population**

Revenues generated will be distributed through the creation of temporary or permanent job for the local personnel or the supplying material at different sources together with the compensation which will be distributed. Referring to concrete impact, the mass of money which will be distributed within the zone of the project will contribute to the improvement of the quality of life, the accessibility to health treatments and to opportunities of trade.

#### **7.4.3. Services for local Contractors**

During project implementation, there will be a need for multiple diverse services to support the workforce. Services can be expected to include the catering, cleaning, guards, transport, repair work, provision construction materials and goods etc. The provision of services will be given, by preference, to the existing local companies or companies from outside the area.

#### **7.4.4. Access to reliable potable water supply**

Once completed, this water supply project will result in better access to safe drinking water. The improvement and expansion of water supply system will enable greater responsiveness to the water demand, increasing also the reliability of the operating system. The reliability of the system will allow adequate planning for water supplies.

The upgrading and extension of water supply system will create conditions for improving the lives in Ngoma District by providing more efficient access to water supply services. The availability of quality water will help in reducing the incidence of waterborne diseases, increasing the welfare of local people. This will be a positive impact of the project and great motivation for its implementation.

#### **7.4.5. Compatibility with the scale of economic development**

This water supply project as a whole will have positive impacts due to the increased availability of potable water, which will create opportunities to open up other development projects that require regular water supply in their operation such as processing small scale enterprises.

#### **7.4.6. Potential creation of synergies with other sectors**

The water supply project will create synergies with the health and education sectors due to its influence in reducing the incidence of waterborne diseases that result from the availability of quality water by increasing the welfare of local people. Children who spend part of their day in fetching water will have more time to study if there is water availability, as does the productive population that will have more time for other productive activities thereby improving their living standards.

#### **7.4.7. Knowledge transfer**

Technical and planning skills will be gained by the Rwandese people that will be employed by the project and this is likely to contribute to the capacity building in management, engineering, environmental, health and safety.

#### **7.4.8. Local socio-economic diversification and improvement**

It is expected that all works related to the project will provide a positive increase to the local and national economy in general this will contribute to the socio economic benefits within and around the project area. The economic expansion will enable alternative businesses and economic activities to develop. Also, increased earnings by staff will most likely be spent locally further supporting already established businesses in the area, as well as potential new businesses that may emerge.

#### **7.4.9. Gender balance enhancement**

It is expected that during the project implementation women will equally benefit as men in terms of employment benefits. In Rwandan culture, it is the responsibility of a woman to collect water and during water shortages, women and girls use most of their time for fetching water.

In the Sectors covering the project, women and young girls form a high percentage of population, but are inadequately participating in development activities due to the burden of fetching water. Increased availability of water will relieve them and thereby give them an opportunity to engage in development activities.

**7.4.10. Access to healthcare**

Projects’ employees and their immediate families will be provided with basic healthcare. This will benefit the overall health of the local population. HIV/AIDS, STDs and COVID-19 information will be dispersed to employees to prevent the spread of the disease amongst the project employees and their families.

**7.4.11. Saving possibilities**

The increase of the project’s employee’s revenue from salaries will lead to the possibility of savings in local banks and micro-finances and hence, may easily access to small credit to invest in other activities such as construction of houses or in agriculture or livestock activities.

**7.4.12. Increase of public revenues and taxes**

The implementation of the project will increase revenue and taxes for both the central (Rwanda Revenue Authority) and local authorities. The project will fully participate in increased payments of taxes from suppliers of the clean water in the project areas of Ngoma District.

**7.4.13. Improving food security and nutrition**

Through diversification of farming activities of high yield using small scale irrigation, as well as expansion of farming can increase agriculture production and by the way boosting food security.

**7.4.14. High job expectation**

There is within the local population, exaggerated expectations about jobs creation. During the public consultation, the issues raised were related to employment. Indeed, although the project will create employment opportunities, the jobs will be limited and it is therefore important that the procurement processes should be clear and fair. It is expected that creation of not enough jobs will create frustration on part of the local people and conflicts can occur or be generated in relation to the project.

<b>Impact characterization/Significance</b>						
Direct	Negative	Short term	Local	Irreversible	Moderate	Highly Probable

**Mitigation measures**

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For each position, must be disclosed the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work;

- The hiring requirements must be clear, properly publicized before the start of the recruitment process and respected by the designated contractor. For a better impact on the communities this process should be conducted with the involvement of local leaders;
- The necessary skills for the positions must be provided or, in cases where it is not applicable, must be clearly indicated that no special qualifications are required;
- In the event there are local expectations for employment that cannot be met by the project, the limited availability of places should be made known to the interested parties through local authority
- The principles and procedures for hiring should, as far as possible, give priority to the hiring of skilled local workers

#### 4.5. NEGATIVE IMPACTS DURING CONSTRUCTION PHASE

##### 7.5.1. Expectation of short term water supply solution

The presence of a new water project can create very high expectations in the population as the immediate solution of all problems in the water supply sector. However, it is known that the solutions will be gradual and there are initiatives taken in the short term and others long-term due to limitations in the existing water sources and the costs involved with the alternatives identified.

Impact Characterization /Significance						
Direct	Negative	Short term	Local	Irreversible	Moderate	Probable

##### Mitigation measures

Dissemination to local communities of the extent of measures that will be taken in the short term to prevent false expectations and ensuring the credibility of the project among the communities;

Coordinate with local authorities the process of disclosure of the timing and targets of project implementation

**7.5.2. Expropriation and compensation**

Some individual properties/assets in or close to the location of the project infrastructures sites will be demolished or affected and the affected people will claim for expropriation/compensation. This shall have a negative impact due to physical and economic displacement of the affected people. Some other properties such as trees and crops shall be affected causing loss in revenue to the Project Affected Persons.

<b>Impact Characterization /Significance</b>						
Dire ct	Negativ e	Long term	Loca l	Irreversib le	High	Definite

**Mitigation measures**

WASAC in collaboration with local authorities and contractors will have to proceed to the expropriation/compensation of all affected population as per the National Expropriation/Compensation Law. The affected persons should have priority of job during the recruitment in the beginning of project activities.

**7.5.3. High expectation of higher compensation**

It is high likely that the affected people by the project who will stand to lose land, infrastructure or business, trees and crops due to the project will have very high expectations of compensation to their losses and create speculation during the compensation exercise.

<b>Impact Characterization /Significance</b>						
Dire ct	Negativ e	Short term	Loca l	Reversibl e	Moderat e	Probable

**Mitigation measures**

Expropriation and compensation mechanisms should be implemented in all justifiable cases, based on clear criteria for eligibility and Rwanda expropriation law. It is believed that the involvement of the local authorities will contribute to the minimization of attempted opportunism.

**7.5.4. Impact on lands acquisition and their utilization**

The intake structure construction, water lifting channel, water treatment plant, storage reservoirs and excavation for pipelines network installation will require acquisition of several hectares of lands, with destruction of agriculture crops as well as other individual properties (houses, fences,

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toilets, planted forests, etc). The magnitude and importance of the potential impact on the lands acquisition and use will depend on the overall surface areas required for the execution of project’s activities.

<b>Impact Characterization /Significance</b>						
Dire ct	Negativ e	Long term	Loca l	Irreversib le	High	Highly Probable

**Mitigation measures**

Utilize necessary construction areas and expropriate/compensate PAPs in reference to National compensation/ expropriation Law accordingly.

Backfilling non utilized area and cover with deposited arable fertile soil, establishment of green zones and planting pre-existing flora species in the area.

**7.5.5. Conflict among workers and local population**

Projects involving major works include, often, the potential for the occurrence of social conflicts between workers who temporarily settle in the local and community residents. Such behaviors are generally related to socially unacceptable behavior according to local social standards and can be seen, for example, cases of drunkenness and disregard/lack of respect for local customs. This impact should be considered even though an important part of the manpower to be recruited locally.

<b>Impact Characterization /Significance</b>						
Indirect	Negative	Short term	Local	Reversible	Moderate	Probable

**Mitigation measures**

Implement a set of rules for the workplace, including the Code of Conduct. The standards should include, inter alia, the entry of persons outside the service. Explain to workers about the importance of keeping a good relationship with local communities.

**7.5.6. Economic and Social disturbance**

The project is likely to impact on the assets (households, persons, private and public entities), including housing infrastructure, commercial infrastructure and sales business, farming plots, crops and trees. The losses of field crops and fruit trees could lead to situations of greater vulnerability and food insecurity for the affected families. It is also important to note that the substitute land



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available, may present different conditions of the lost lands, thus leading to a change in the type of crops and methods employed in farming, which may require a long period of adaptation on the part of affected families.

Impact Characterization /Significance						
Direct	Negative	Medium	Local	Irreversible	Moderate	Probable

**Mitigation measures**

Minimize the affected population by occasional changes in the route of pipelines. Where the contractor accidentally interferes with populations’ structures and assets, he should make the due compensation in coordination with local authorities and project proponent;

Where the contractor needs to develop activities around homes and farms, preference should be given to manual means. Selection of temporary sites for work camps and laydown yards along the pipeline corridor in order to avoid any interference with population structures and assets.

It possible, avoid use of agriculture lands

**7.5.7. Risk of accident and injuries to workers**

The most common injuries or accident result from manual handling are musculoskeletal disorders in various parts of the body (back, neck, shoulders, or other) and include from sprains and strains to damage to muscles, joints and vessels. Other injuries include cuts, bruises, lacerations and fractures due to unexpected events such as accidents caused by manual handling or lack of proper Personal Protective Equipment (PPE).

Impact Characterization /Significance						
Direct	Negative	Short term	Site specific	Reversible	Moderate	Probable

**Mitigation measures**

Provide induction training to all workers on tasks and the use of equipment and correct handling techniques. Workers must be instructed during toolbox meetings about the risks a certain manual handling could have;

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Manual work must be carried out by workers having the physical conditions to undertake the tasks without any risks to their health (consider experience and familiarity with the job, age and historical of injuries);

Sufficient breaks must be implemented and organized to ensure the possibility for having a rest from repetitive tasks or heavy manual handling, especially under hot ambient conditions. The arrangements for breaks must be communicated to all concerned workers;

Suitable and appropriate PPE must be provided to each worker at no cost; and Ensure that they are worn;

Ensure first Aid Kits are available on site and a permanent safety officer is recruited.

**7.5.8. Risks of HIV/AIDS, STD and COVID 19 transmission**

Due to the increase of people from outside of the project zone and the interaction with the local communities, there is a risk of increase of HIV/AIDS and other sexual transmitted diseases and propagation of COVID 19 if proper measures are not taken.

<b>Impact Characterization /Significance</b>						
Indirect	Negative	Long term	Regional	Irreversible	High	Possible

**Mitigation measures**

Carry out awareness program for HIV/AIDS, STD and COVID 19, prevention and voluntary testing

Provide free condoms and place them at discrete but accessible areas,

Ensure all workers have medical insurance Mutuelle de Santé” or other insurance

Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers

Promoting collaboration with local authorities to enhance access of workers’ families and the community to public health services and promote immunization.

In particular, for COVID 19

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- (i) Wash Hands: frequently wash hands with soap and clean water for at least 20 seconds or an alcohol-based hand sanitizer
- (ii) Avoid Handshakes: Greet people with a wave, bow, or nod
- (iii) Sneeze Or Cough: Cover mouth and nose with flexed elbow or tissue, throw tissue away and immediately wash hands
- (iv) Avoid Close Contact: If experiencing fever, cough, sneezing avoid contact with others and stay home when sick
- v) Clean And Disinfect: Clean and disinfect surfaces around your home and work

**7.5.9. Disruption of public utilities**

The project area encounters small domestic water supply pipe lines and electricity and communication cables were observed. Due to nature of the water supply project activities during construction, these infrastructures are likely to be affected by the construction activities and create disruption of water, electricity and internet services to local residents and neighboring communities.

Impact Characterization /Significance						
Direct	Negative	Short term	Local	Reversible	High	Possible

**Mitigation measures**

The contractor in collaboration with WASAC will be required to: (i) plan for immediate attendance by the service providers for any damages to utilities during construction; (ii) replace (or compensate for) public and private physical structures damaged due to construction and (iii) provide prior public information about the likely disruption of services.

Coordination with relevant authorities to identify and map the location of existing underground utilities such as electricity and communication cables.

In consultation and with support from WASAC, the contractor will provide alternate arrangements for water supply in the event of disruption beyond reasonable time.

Where practical, the contractor shall work carefully to avoid damages to the water pipe lines, electricity and communication cables. Roads and pathways cuts should be done without interrupting normal traffic and preferably to be planned during nights.

**7.5.10. Gender based Violence and Child Abuse and Exploitation**

Given the number and diversity of workers under the Mugesera water supply project, there are high risks of Gender Based Violence (GBV) among project workers or with the neighboring communities and risks of Child Abuse / Exploitation (CAE) due to labour influx. Child Labour law violation may also take place if proper mitigation measures are not put in place.

Impact Characterization /Significance						
Indirect	Negative	Short term	Local	Reversible	Low	Highly Possible

**Mitigation measures**

Prepare awareness program to all workers on the avoidance and related risks to GBV and CAE;

The contractor should be aware on labour Law and most importantly the article on the Child Labour;

Female workers should be sensitized on their rights and encouraged to report any gender based violence or threat.

**7.5.11. Limited job creation**

The construction work will require skilled and non-qualified labour, local and regional level. It is expected that construction activities will create opportunities for direct and indirect jobs. These opportunities will accrue in favor of the income of few beneficiary families, improving their living standards.

Impact Characterization /Significance						
Direct	Negative	Short term	Local	Irreversible	Low	Probable

**Mitigation measures**

- Establish clear formal hiring requirements, to be observed by the contractor;
- The hiring requirements must be clear, properly publicized before the start of the recruitment process and respected by the designated contractor. For a better impact on the communities this process should be conducted with the involvement of local authorities;
- The required skills for the positions must be provided or, in cases where it is not applicable, must be clearly indicated that no special qualifications are required;
- For each position, must be disclosed the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work;

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- The principles and procedures for hiring should, as far as possible, give priority to the hiring of skilled local workers;
- Much as possible, training should be given to local people to perform semi-specialized tasks, so as to reduce the number of workers from outside for this purpose;

**7.5.12. Unsafe drinking water provided to workers**

During project implementation, unclean drinking water or washing water not fulfilling the health requirements could result in diseases propagation among workers and indirectly to their family members hence creating illness and most probably fatalities.

Impact Characterization /Significance						
Direct	Negative	Short term	Site specific	Reversible	Moderate	Possible

**Mitigation measures**

- Drinking water must be provided in accordance with the applicable national and WHO recommendations and guidelines;
- The water must be tested once per week if it is served from tanks or containers;
- The drinking water must be stored at a cool and shadowed place.

**7.5.13. Health issues**

Due to excavation and construction of the water pipeline and reservoirs, there is likely the generation of dust and exhaust fumes from the vehicles and machineries. Inhalation of dust, smokes and exhaust fumes can result in possible respiratory irritation, discomfort, or illness to workers if not properly mitigated

Impact Characterization /Significance						
Direct	Negative	Long term	Local	Reversible	Moderate	Highly Probable

**Mitigation measures**

- Use of wet processes (excavated soil stored close to the trench must be regularly watered to prevent the generation of dust);

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- Use of Personal Protective Equipment may be vital, but it should nevertheless be the last resort of protection (PPE should not be a substitute for proper dust control and should be used only where dust control methods are not yet effective or are inadequate).

## 7.5. ADVERSE ENVIRONMENTAL IMPACTS DURING CONSTRUCTION PHASE

### 7.5.1. Increasing accumulation of earth materials leading to sedimentation pollution of lakes

At present, soil erosion resulting from non-ecological agriculture activities and poorly designed dirt roads are carrying heavy sediments into water bodies and cause flooding in cultivated lowlands during heavy rains.

During the construction of water treatment plant, intake structure, reservoirs and pipelines installation there will be excavation of bulk earth materials. The mismanagement of these materials can result in sterility of fertile top soils covered by deposits, increasing erosion phenomenon transporting heavy sedimentation and polluting the water bodies too.

Impact Characterization /Significance						
Direct	Negative	short term	Site Specific	Reversible	Moderate	Possible

#### **Mitigation measures**

- In order to avoid land sterilization, soil excavated should not be dumped on any individual land.
- Re-use it for backfilling or repairing dirt access roads;
- The remaining shall be dumped in designated offsite ground recommended by the authority.

### 7.5.2. Landscape change and aesthetic visual impact

Impacts on the physical environment will consist of landscape transformation causing aesthetic visual impacts. Building of water storage will alter slightly the landscape at some localities. These impacts will remain during operational phase.

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Temporary physical impacts will occur during the construction period at places selected to store construction material and pipes and at accommodation places for workers. However, those sites will be decommissioned after the construction phase; the visual impact is restricted to the construction period.

Impact Characterization /Significance						
Direct	Negative	Permanent	Site specific	Irreversible	Low	Definite

**Mitigation measures**

- Use paint with colours that match the environment to minimize visual impact of the structure;
- Retain a belt of trees/bush around facilities built to minimize visual impact

**7.5.2. Impact of water uptake on lake hydrological regime**

Lake Mugesera is strongly dependant to Akagera hydrological system. The lakes are very shallow (maximum 3.5 m depth), their waters fluctuate during rainy and dry seasons and huge quantity of muddy sediments are accumulated in deeper zones.

Even if the hydrological study has ensured that water uptake will not affect the water balance stability in these lakes, the quantity of water to withdraw in Lake Mugesera may induce changes in

the hydrological regime of the lake and potentially affect lakeshores' biodiversity.

Impact Characterization /Significance						
Direct	Negative	Permanent	Local	Irreversible	Low	Probable

**Mitigation measures**

- Include a strong hydrological monitoring component to check the flows and fluctuations of water levels in the lakes and tributaries in order to preserve natural habitats and management of biodiversity in these lakes.
- Environmental conservation education to all communities living closer to water sources
- Preparation of climate change adaptation measures.

**7.5.3. Potential pollution of lake water by release of mixed sludge and backwash water from WTP**

It is obvious that non proper management of sludge and backwash water from WTP can lead to impacts on water quality alteration, health deterioration of people, loss of aquatic life in lake and the destruction of natural habitat.

<b>Impact Characterization /Significance</b>						
Indirect	Negative	Long term	Regional	Irreversible	High	Possible

**Mitigation measures**

- The produced sludge should be kept in containers or on site temporarily before disposal in landfill or reuse;
- Alternative use of sludge such as use as fertilizer or bricks making;
- Ensure waste water recycled or treated before its release in natural environment;
- Initiate a regular water sampling tests for both bacteriological and physic-chemicals elements, at least twice a year.

**7.5.4. Impact generated by chemicals handling and use**

Water purification process requires the addition of chemicals such as aluminium sulphate (or alum) and chlorine to assist in the removal of particles suspended in water. Improper use of these chemicals may have an impact on human health, water and soil quality.

<b>Impact Characterization /Significance</b>						
Indirect	Negative	Long term	Regional	Irreversible	High	Possible

**Mitigation measures**

- Strictly follow instructions indicated in material safety data sheets, dedicated to chemicals handling and disposal off;
- Awareness creation and training amongst workers on proper handling of chemicals;
- Avoid spreading waste water with chemicals to natural environment.

**7.5.5. Clearing and loss of vegetation and other biodiversity**

Through clearing of vegetation and soil excavation, there is loss of natural habitats and their



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biodiversity clearing the right of way and loss of microhabitats and their biodiversity

Impact Characterization /Significance						
Direct	Negative	Short term	Site Specific	Reversible	Moderate	Probable

**Mitigation measures**

- Where construction materials are exploited, implementation of quarries and borrow pits management plans shall be considered;
- All terraced areas surrounding the WTP shall be backfilled and re-vegetation utilizing pre-existing species or ornamental ones;
- Creation of green belts areas in local environment;
- Regular biodiversity monitoring.

**7.5.6. Disturbance and mortality of fauna biodiversity**

Loss of fauna biodiversity due to habitats destruction for infrastructures construction dedicated to water treatment, keeping stocks and distribution among users.

Loss of fauna biodiversity by destruction of natural habitats for quarry and borrow pits exploitation  
The construction of intake at the lakeshore, within the buffer zone, may have significant degradation of important breeding habitats for fish, birds, reptiles and small wild animals.

Impact Characterization /Significance						
Direct	Negative	Short term	Site specific	Reversible	Moderate	Probable

**Mitigation measures**

- Fauna restoration through habitats regeneration by planting local species of vegetation in the remaining spaces around infrastructures as well as in created green spaces.
- Backfilling for site restoration, reforestation for fauna biodiversity reconstitution.
- Backfilling the non-utilized area and re-vegetation using the pre-existing plant species.
- Avoid utilizing ecological niche of rare, endangered, and threatened species.
- Limiting access ways cross buffer zone in order to protect lakeshores' habitats and their biodiversity.

**7.5.7. Dust and gaseous emissions**

Emissions of dust and exhaust fumes will occur while opening trenches and by the operation of vehicles during the transport of building material and equipment. Clearance of sites and excavation

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will also cause dust emission. In addition, exhausts from trucks and construction machines will also have a certain impact on the air quality

Impact Characterization /Significance						
Direct	Negative	Short term	Local	Reversible	Moderate	Highly Probable

**Mitigation measures**

- Water the soil surface and any non-asphalted roads, especially in the dry season;
- Water the soil before starting excavating and during and after burial of the pipeline;
- The storage and handling of spoil, subsoil, topsoil and materials should be carefully managed to minimize the risk of wind-blown material and dust;
- Burning of any waste on site is prohibited;
- Vehicle engines must not be left running unnecessarily;
- Regular and proper maintenance of vehicles and machinery.

**7.5.8.Pollution due to solid wastes**

Solid wastes from the construction activities and worker’s domestic waste can also have negative impacts on the environment. These wastes include construction debris such as plastics, stones, sand, gravel, timber, iron bar and human wastes and food leftovers.

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from excavation activities, scrap wood and metals, and small concrete spills.

Impact Characterization /Significance						
Direct	Negative	Short term	Local	Reversible	Low to Moderate	Probable

**Mitigation measures**

- In addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans.
- All the solid waste should be collected; the biodegradable organic material composted properly on site for manure production and the non-biodegradable disposed of in a public landfill.

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- A waste collection system will be in operation to handle solid wastes, oily rags, and used fuel and lube oil filters in a leak-proof container that will be stored and disposed off at the landfill site, to ensure effective management of solid wastes at the project site.

**7.5.8. Soil and water pollution by solid and liquid wastes generated during construction and decommissioning phases**

During construction works of project’s infrastructures, various solid and liquid wastes, principally unused earth materials, metal and plastics, workshop wastes including used oil filters, and other various liquid wastes including used oils and solvents, detergents etc. will be accumulated or spread in working area or within command zones.

In any construction activity there is the possibility that the soil be contaminated by used engine oils and the spillage of diesel. Contaminated soil is injurious to the growth of plant and must be removed. Contamination of water is potentially more serious since pollutants may move faster and the receiving environment is highly sensitive (e.g. dwellers fishes, international migratory birds, water used by human and livestock etc...).

<b>Impact Characterization /Significance</b>						
Direct	Negative	Short term	Regional	Reversible	Moderate	Possible

**Mitigation measures**

- Stockpiles from excavation should be minimize and protected from run off and rain especially during rainy season;
- Trenches and drainage should not direct water to nearby streams or rivers to avoid pollution;
- Trees should be planted and re-vegetation provided to avoid bare land which is prone to erosion;
- Regular inspection of machine and truck and provisional of replacement in case of defects.
- Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse
- Cleaning used instruments at appropriate place within construction areas.

**7.5.9.Noise and vibration emissions**

Noise and vibration during construction will be generated by the operation of heavy machines, heavy trucks, right of way preparation, soil stripping, trenching, pipe stringing, welding and laying and backfilling activities.

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Blasting may also be required in certain areas where rocky substrates prevent trenching by other means. These impacts are of temporary nature.

<b>Impact Characterization /Significance</b>						
Direct	Negative	Short term	Local	Reversible	Low	Probable

**Mitigation measures**

- Restrict construction and operation of heavy machines to daylight;
- Ensure noise emissions are kept within the Rwanda standards and inform communities on the noisy activities schedule;
- All vehicles and construction machinery shall have an efficient muffler design in accordance with the manufacturer’s specifications. This also includes high noise generating hand held like power drills, saws, nail guns etc. The mufflers shall be well maintained and regularly tested with the results documented in the maintenance logs;
- Regular and effective equipment maintenance in order to ensure all machinery is in good working order and use does not generate excess noise/vibration.
- All vehicles and trucks should have valid Vehicle Inspection Certificates delivered by the Rwanda National Police.

**7.5.10. Incorrect reservoirs management**

Technically, releases of water from the reservoir should at least match with water demand, taking into account appropriate loss factors relating to the distribution of water in pipelines, plus any required environmental flows.

Inappropriate reservoir management could result in: (i) inadequate water released for daily utilization demand and (ii) excessive water released resulting in inadequate supplies to meet full dry season demand.

<b>Impact Characterization /Significance</b>						
Indirect	Negative	Long term	Local	Reversible	Moderate	Possible

**Mitigation measures**

- Develop and implement Reservoirs Management Plan (RMP).
- Enhance knowledge and skills of technicians necessary to minimize surplus and/or shortage

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of water applications

- Enforce high levels of maintenance of drainage pipelines network till the last water users.

**7.5.11. Impact on the water quality deterioration by oil and detergents**

Lake Mugesera may be polluted by spreading of large volumes of gasoline, lubricant products as well as significant quantities of chemicals (concrete additives, paints, thinners, solvents) which will be stored and handled on the Water Treatment Plant’s storage facilities, with related risk of leakage or accidental spill in the environment.

Impact Characterization /Significance						
Direct	Negative	Long term	Regional	Irreversible	High	Possible

**Mitigation measures**

- Backwashed water shall be treated and recycled before any use or spreading in environment;
- Carrying out regularly water sampling tests for both bacteriological and physic-chemicals elements.

**7.5.12. Environment pollution by domestic liquid waste**

Domestic liquid waste would be produced by staff and workers in camp sites as well as households consuming distributed water. The release of such waste water containing pathogens and coliforms in the river and other natural environment may affect the human beings as well as domestic animals. There is risk of appearance of foul odors following poorly management of liquid waste.

Impact Characterization /Significance						
Indirect	Negative	Long term	Regional	Irreversible	Moderate	Possible

**Mitigation measures**

- Awareness and training local population on the simple best methods for waste water management;
- Regular inspection done by sanitation officers from District and Sectors’ services.

**7.5.13. Labour Influx:**

Impact: The implementation of the water supply system project may lead to a significant influx of labor into the project area. This sudden increase in the local population can place pressure on

infrastructure, services, and resources, potentially causing social, economic, and environmental challenges.

Mitigation measures:

- Conduct a comprehensive labor assessment to estimate the number of workers needed and their potential impacts on local communities.
- Develop a labor management plan that includes measures for managing the influx of workers, such as providing adequate housing, sanitation facilities, and healthcare services.
- Collaborate with local authorities and communities to identify and address potential social and environmental issues arising from the labor influx.
- Implement capacity-building programs to enhance local skills and employment opportunities, promoting the long-term socio-economic development of the area.

#### 7.5.14. Fire Hazards at Treatment Works:

- Impact: The operation of treatment works for water supply systems can pose fire hazards due to the presence of flammable substances, electrical equipment, and potential ignition sources. A fire incident can result in property damage, environmental contamination, and endanger the safety of personnel.

Mitigation measures:

- Develop and implement a comprehensive fire safety plan that complies with relevant fire codes and standards.
- Conduct a thorough fire risk assessment to identify potential hazards and develop appropriate preventive and protective measures.
- Install fire detection and suppression systems, such as smoke detectors, fire alarms, fire extinguishers, and sprinkler systems, in treatment works facilities.
- Establish emergency response procedures and provide training to staff members on fire prevention, evacuation, and firefighting techniques.
- Regularly inspect and maintain electrical systems, equipment, and storage areas to ensure compliance with safety standards and prevent fire incidents.
- Conduct periodic fire drills and exercises to familiarize personnel with emergency protocols and enhance their preparedness.

## **7.6. Potential cumulative impacts of a water supply system project**

Certainly! Here are the potential cumulative impacts of a water supply system project that involves water abstraction from Mugesera Lake, along with some possible mitigation measures for each impact:

### **7.6.1. Alteration of water levels:**

**Impact:** Changes in water levels can disrupt the lake's ecosystem and affect aquatic habitats.

**Mitigation measures:** Implement water management strategies to minimize excessive abstraction, such as setting sustainable water withdrawal limits, monitoring water levels, and maintaining minimum environmental flow requirements to preserve the lake's ecological balance.

### **7.6.2. Disruption of aquatic ecosystems:**

**Impact:** Water abstraction activities can disturb the natural flow patterns and habitats of aquatic organisms, impacting biodiversity.

**Mitigation measures:** Conduct ecological assessments prior to the project and implement measures to protect sensitive areas and critical habitats. This may involve establishing buffer zones, creating artificial habitats, and implementing fish passage structures to minimize the disruption to aquatic species.

### **7.6.3. Decreased water quality:**

**Impact:** Abstraction can lead to changes in water quality, including increased pollution and reduced oxygen levels.

**Mitigation measures:** Implement water treatment processes to ensure the abstraction does not negatively impact water quality. This can include filtration, disinfection, and regular monitoring of water parameters. Implement best management practices to prevent pollution sources from entering the lake, such as controlling runoff from construction sites and promoting responsible waste management practices.

### **7.6.4. Erosion and sedimentation:**

**Impact:** Altered water levels and flow patterns can contribute to erosion and sedimentation within the lake.

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Mitigation measures: Implement erosion control measures such as sediment basins, silt fences, and revegetation of disturbed areas to reduce erosion. Regular dredging and sediment management programs can help maintain the lake's depth and prevent excessive sediment accumulation.

#### **7.6.5. Introduction of invasive species:**

Impact: Water abstraction activities may inadvertently introduce non-native invasive species into the lake.

Mitigation measures: Implement strict biosecurity measures, such as cleaning and inspecting equipment and boats to prevent the transport of invasive species. Develop and enforce regulations to control the introduction and spread of invasive species, including monitoring and early detection programs.

#### **7.6.6. Socioeconomic impacts:**

Impact: Changes in water availability can have socio-economic consequences for local communities and stakeholders.

Mitigation measures: Engage with local communities and stakeholders to understand their water needs and concerns. Implement water allocation plans that prioritize sustainable water use, balancing the needs of different sectors. Promote water conservation and efficiency measures to optimize water usage and minimize potential conflicts over water resources.

The Table N° 16 below highlights identification and evaluation of impacts likely to be generated by the project and proposed mitigation measures accordingly.



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**Table 21: Identification and evaluation of environmental and social potential impacts and proposed mitigation measures**

Activities Phases	Environmental areas and Components to be affected		Potential environmental and social impacts	Sensitivity level of impact	Occurrence of impact	Recommended mitigation measures
<p><b>Construction of infrastructures for project management and cleaned water distribution (camp sites installation, terracing, infrastructures construction and equipment installation, excavation for water pipeline's network installation, backfilling, levelling and finishing artworks)</b></p>	<p><b>Physical environment</b></p>	<p><i>Water component</i></p>	<p>Spreading of oil from parking area of vehicles and engines could infiltrate into water sources and affect people's health and physical environment.</p>	<p>Low</p>	<p>Limited</p>	<p>-Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse</p>
			<p>There will be alteration of water quality due to heavy sediments carried by erosion from sites where intake, WTP, pumping stations and pipelines are under construction.</p>	<p>High</p>	<p>Limited</p>	<p>-Accurate supervision of construction works, -Collection and deposit of unused soil in dumping site selected and approved by local authority.</p>
			<p>Mugesera water body is likely to be polluted by solid and liquid wastes from areas under construction</p>	<p>High</p>	<p>Limited</p>	<p>-Proper collection and disposal of wastes. Sorting solid waste and deposit this in transit zone, then to the selected landfill;  -Collection and pre-treatment of liquid waste before leasing in environment.</p>

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			Mugesera water quality degradation during fixation of pipes' supports for pumping raw water towards water treatment plant	High	Very limited	Utilization of floating platform with balloons to support pipes. As possible avoid use of corrosive materials for piping and construction of floating platform.
			Mugesera lake water to be polluted by detergents, soaps and remaining colors of all kind when people are washing bodies and/or cleaning the used instruments	High	Limited	-Prepare a resting and washing place for workers; -Cleaning used instruments at appropriate place within construction areas.
		<i>Soil component</i>	Soil structure modification by stripping topsoil layers, change of topography and natural drainage modification	High	Permanent during earth works	-Soil backfilling and compacting for stabilization in order to remediate soil structure; -Planting soil support grasses and shrubs where necessary.

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			<p>During civil works, there will be excavation and scrapping works leading to accumulation of bulk earth materials.</p> <p>Improper disposal of these can result in sterilization of productive lands, creation of erosion, sedimentation pollution and lack of esthetical view.</p>	High	Limited	<p>In order to avoid land sterilization, soil excavated should not be dumped on any individual land. Re-use it for backfilling or repairing dirt access roads, the remaining shall be dumped in designated offsite ground recommended by the authority.</p>
			<p>Land excavation during pipelines installation will lead to loss of arable fertile soil used for agriculture development.</p>	High	Permanent during pipelines installation	<p>Backfilling and cover the utilized area with arable soil and continue agriculture activities.</p>
			<p>Soil contamination by waste from construction materials (cement, stone, rubble, trellis, etc.)</p>	High	Permanent during works	<ul style="list-style-type: none"> <li>- Regularly check and clean construction sites</li> <li>-Evacuate construction material waste and transfer it to appropriate landfills.</li> </ul>
			<p>Soil structure modification and erosion phenomenon during quarries and borrow pits exploitation for getting construction materials.</p>	Very high	Permanent during construction works	<p>-Sites rehabilitation through utilization of excavated earth materials and re-vegetation.</p>

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			Soil polluted by oil leakage from working machines, parking of cars as well as small metal waste from construction areas.	Low	Limited	-Waste oil should be properly collected and stored in clearly labelled metallic drums with lids for reuse -Iron parts should be stored in lockable stores to avoid accidents and leakages into the soils.
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Activities phases	Environmental areas and Components to be affected		Potential environmental and social impacts	Sensitivity level of impact	Occurrence of impact	Recommended mitigation measures
<p>Construction du réseau AEP et distribution de l'eau potable (installation des chantiers, terrassement, édifications des équipements de stockage et de pompage, excavation, pose de conduites d'eau, remblaiement, et finissage des ouvrages d'art)</p>	<p>Human environment</p>	<p><i>Economical component</i></p>	<p>Temporary employment opportunities for many people and increased household income.</p> <p>Recruitment of unskilled and skilled employees as well as hiring services of local private companies.</p>	<p>Very high</p> <p>“</p>	<p>Permanent during project implementation</p>	<p>- Positive impact –No mitigation measure</p> <p>- Positive impact –No mitigation measure</p>
		<p><i>Social component</i></p>	<p>Several hectares of land will be acquired for intake, water treatment plant, reservoirs, pumping stations and pipeline network constructions</p> <p>Portions of individual lands acquired for creation of new roads and/or extension of existing roads towards planned infrastructures.</p>	<p>Very high</p>	<p>Limited</p>	<p>Fair compensation on the basis of full value of the land temporarily occupied.</p> <p>Procedures for expropriation /compensation of project affected persons will be followed with reference to National compensation/ expropriation Law.</p>

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			<p>Individual land acquisition for project camp site installation including offices, workshops, stores, vehicles parking etc...</p> <p>Other land will be needed temporarily for aggregate processing.</p>	Very high	Limited	<p>Expropriate/compensate PAPs in reference to National compensation/expropriation Law.</p> <p>Establish a mandatory entitlement related to temporary land loss and compensation for lost crops</p>
			<p>Pumping and delivery of enough water to people and therefore mitigate against the potential impacts of waterborne diseases transmission</p>	Very high	Permanent	<p>Positive impact-no mitigation measure</p>
			<p>Exposure of electric cables, telephone and underground water supply pipes</p>	Very high	Very Limited	<p>Placement of cables and pipes in secure ducts crossing the places of pipes.</p>
			<p>Relocation of electric poles due to project's works</p>	High	Very limited	<p>In sensitive areas, provide for a temporary supply of electricity and plan a reconnection as soon as possible</p>
			<p>Destruction of public assets particularly along pipeline route</p>	Very high	Very limited	<p>Reconstitution of the same asset elsewhere or provide fair compensation</p>

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**Tableau (continued).**

Activities phases	Environmental areas and Components to be affected		Potential environmental and social impacts	Sensitivity level of impact	Occurrence of the impact	Recommended mitigation measures
Exploitation and maintenance of the cleaned water supply system	Physical environment	<i>Water component</i>	Change of lake hydrology, fluctuations of water levels leading to loss of littoral habitats and their biodiversity.	Very High	Limited	<ul style="list-style-type: none"> <li>-Avoid sedimentation pollution of lake waters.</li> <li>-Initiate a sustainable hydrological monitoring component to check the fluctuations of water levels in lake water and tributaries.</li> </ul>



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			<p>It is obvious that non proper management of sludge and backwash water from WTP can lead to impacts on water quality alteration, health deterioration of people, loss of aquatic life in lake and the destruction of natural habitat.</p>	Very high	Limited	<p>-The produced sludge should be kept in containers or on site temporarily before disposal in landfill or reuse.</p> <p>-Alternative use of sludge such as use as fertilizer or bricks making.</p> <p>-Ensure waste water recycled or treated before its release in natural environment;</p> <p>Initiate a regular water sampling tests for both bacteriological and physic-chemicals elements, at least twice a year.</p>
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			Water purification process requires the addition of chemicals such as Aluminium sulphate and Chlorine to assist in the removal of particles suspended in water. Improper use of these chemicals may have an impact on water and soil quality.	Very high	Limited	<p>-Strictly follow instructions indicated in material safety data sheets, dedicated to chemicals handling and disposal off.</p> <p>-Awareness creation and training amongst workers on proper handling of chemicals;</p> <p>-Avoid spreading waste water with chemicals directly in natural environment without proper treatment.</p>
			Risk of groundwater pollution by liquid waste from households	Very high	Permanent during exploitation	<p>-Increase awareness among water users for waste water management</p> <p>-Training people on simple method for waste water treatment.</p>
			Reduction in the exploitation of natural sources by the population receiving cleaned water distributed	-----	-----	- Positive impact- No mitigation

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		<i>Soil component</i>	- Risk of soil pollution by waste liquid from households of water users	Very high	Permanent during exploitation phase	-Increase awareness among water users for waste water management -Training people on simple method for waste water treatment
			Risk of soil erosion by inappropriate use of public watering points	High	Permanent during exploitation phase	-Sensitize the beneficiary population on the rational use of water -Maintain public supply points
		<i>Air component</i>	Risk of air pollution by volatile compounds from waste water	Very high	Permanent during exploitation phase	- Collect and ensure waste water treatment before any release in environment.

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Activities phases	Environmental areas and Components to be affected		Potential environmental and social Impacts	Sensitivity level of impact	Occurrence of impact	Recommended mitigation measures
Exploitation and maintenance of the cleaned water supply system	Biological environment	<i>Flora component</i>	Increasing green spaces around pumping stations, WTP, reservoirs through sodding and tree plantation	---	---	-Positive impact- No mitigation measure
			Increase green gardens all around human settlements with possibility of irrigation.	---	---	-Positive impact- No mitigation measure
		<i>Fauna component</i>	Reappearance of fauna biodiversity especially avian and arthropods around pumping stations, WTP, reservoirs etc...	---	---	-Positive impact- No mitigation measure
	Human environment	<i>Population component</i>	-Esthetical perturbance by landscape modification due to presence of WTP, Reservoirs, Pumping stations etc...	Low	Permanent during exploitation phase	Plant trees around WTP, Reservoirs and pumping stations for infrastructures camouflage
			Risk of excessive concentration or lack of water treatment chemicals.	Very high	Limited	-To ensure regular water quality monitoring by WASAC technicians

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			Risk of accidents within Water Treatment Plant, storage and pumping equipment	High	Permanent during exploitation phase	Prevent, educate and inform the local population about the straying of animals and the risk of drowning children; -Provide lighting for the sites; -Build security fences at site level; -Placement of sign-posts and bulletin boards; - Make arrangements for emergency care and make site employees aware of compliance with safety rules at work.
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Table (continued)

Activities phases	Environmental areas and Components to be affected	Potential environmental and social impacts	Sensitivity level of impact	Occurrence of impact	Recommended mitigation measures	
Exploitation and maintenance of the cleaned water supply system	Human environment	<i>Economical component</i>	- Job opportunities for local people in water treatment plant and pumping stations which will increase their households' revenues.	---	---	-Positive impact-No mitigation measures
			Payment of drinking water consumption by users.	High	Permanent during exploitation phase	Make the beneficiary population aware of the advantages inherent to the consumption of cleaned water
		<i>Social component</i>	Water mismanagement at level of storage reservoirs and inadequate distribution could result in misuse of high quantity delivered or shortage of water in delivered entities.	Very high	Limited	-Enhance knowledge and skills of technicians necessary to minimize surplus and/or shortage of water applications. -Enforce high levels of maintenance of drainage pipelines network till the last water users.
			Risk of outbreaks of disease vectors all around public supply points	Very high	Permanent during exploitation phase	Regularly maintain clean the surroundings of public water taps.

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			-Reduction of waterborne diseases due to cleaned water consumption by local population	---	---	- Positive impact- No mitigation measure
			Risk of the appearance of foul odors following poorly management of liquid waste.	High	Limited	-Collection and appropriate management of waste water
			Risk of a lack of good maintenance of the whole system (water treatment and pumping units, storage tanks and pipes etc..)	Very high	Limited	-Ensure regular maintenance of the system ; -Sensitize the population on respecting the Water distribution infrastructures and ensure their support in the maintenance.

## **CHAPTER VIII: ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLANS (ESMP)**

### **8.1. Environmental and Social Management Plan (ESMP)**

The Environmental and Social Management Plan aims to make this project conform with the applicable environmental legal requirements and also to help all stakeholders to find their role and responsibility in the environmental preservation during the implementation of the present project.

This Environmental and Social Management Plan completes the information given for the environmental impacts and the specific mitigation measures proposed in the previous sections. It proposes the institutional responsibilities for the implementation of the mitigation measures, the timing and indicates the source of implementation cost of proposed mitigation measures.

The contractor shall be responsible for overall implementation of the ESMP during preconstruction and construction phases. A project Environmental and Social Officer shall be designated to make day to day follow up (e.g. follow up of ESMP implementation and liaise with stakeholders).

The ESMP is a document reflecting the obligation of the Contractors. It will be reviewed during the life cycle of the project in order to ensure that it remains fit for purpose and continues to meet policies, laws and regulatory requirements. The Contractor is obliged to implement all proposed mitigation measures and will also work together with the regulatory agencies and communities especially WASAC to ensure that the development of the project acceptable to all stakeholders.

However, any changes in the construction methodology or activities undertaken on the site will be followed by the change of ESMP in terms of social and environmental requirements of the project. At the same time, any changes to the ESMP content will need to be updated and approved by the Supervision Engineer.



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**Table 22: Environmental and Social Management Plan (ESMP)**

<b>Project Activities</b>	<b>Potential Impacts</b>	<b>Recommended mitigation measures</b>	<b>Timing</b>	<b>Institutional Responsibilities</b>	<b>Source of Cost/Budget</b>
<b>Pre-construction Phase</b>					
Project camp site installation, construction and/or upgrading access roads towards planned areas for infrastructures edification	<p>Individual land acquisition for project camp site installation including offices, workshops, stores, vehicles parking etc...</p> <p>Portions of individual lands acquired for creation of new roads and/or extension of existing roads towards planned infrastructures.</p> <p>Other land will be needed temporarily for aggregate processing.</p>	<p>Fair expropriation/compensation of Project Affected Persons (PAPs) in reference to National Expropriation/Compensation Law 2015</p> <p>Establish a mandatory entitlement related to temporary land loss and compensation for lost crops</p>	<p>Before commencement of works</p> <p>During construction works</p>	WASAC and Project Construction Enterprise (PCE)	Included in Project budget
	<p>Loss of natural habitat and flora biodiversity by felling trees and clearing vegetation on the construction sites</p>	<p>After dismantling of the camp, site restoration by earth filling, trees planting and re-vegetation will be necessary.</p> <p>Planting trees and vegetation all along road embankments</p>	<p>Before and during construction works</p>	<p>Project Construction Enterprise (PCE) &amp; Community Based</p>	Included in Project budget

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				Organizations (CBO)	
	Increasing in traffic movement of vehicles, machines (e.g. excavators, cars, equipment...) and manpower.	Ensure effective security of the sites. Noise minimized by limiting operating times to daylight hours and/or locating site establishment away from sensitive receptors like settlements, schools, health centers etc.	Before and during construction works	WASAC and Project Construction Enterprise (PCE)	Included in Project budget
	Ambient air quality deterioration due to dust spreading and gaseous pollutants like SO <sub>2</sub> , NO <sub>x</sub> , and CO to sites peripheries,	Restricting traffic speed and regular watering of the exposed areas terraced; Monthly inspection of machines and worthy vehicles used, producing minimal exhaust fumes	Before and during construction works	Project Construction Enterprise (PCE)	Included in the Project budget
	High noise level increasing in ambient air which raise disturbance suffered by local residents and workers.	Reduce noise to the minimum by using soundproof equipment.	Before and during construction works	Project Construction Enterprise (PCE)	“
	Soil structure modification by stripping topsoil layers.	Soil backfilling and compacting to remediate soil structure after camp dismantling.	After Project completion	Project Construction Enterprise (PCE)	“

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	Excavated earth accumulation which will affect esthetical view of the area	Soil excavated should not be dumped on any individual land. Re-use it or dumping any waste soil in designated offsite ground recommended by the authority.	Before and during construction works	Project Construction Enterprise (PCE)	“
	Risk of accidents to workers during camp site installation and access roads upgrading	Avail project protective safety equipment specific to the working environment shall be delivered to the workers. First Aid Box and emergency medical coverage will be provided to workers.	During pre-construction phase	Project Construction Enterprise (PCE)	“
	Spreading of oil from parking area of vehicles and engines, machines 'parts could infiltrate into water sources and land to affect people's health and physical environment.	Waste oil should be stored in clearly labeled metallic drums with lids.  -Machine parts should be stored in lockable stores with concrete floored.	Before and during construction phases	Project Construction Enterprise (PCE)	Included in Project budget
	Recruitment of unskilled and skilled employees as well as hiring services of local private companies.	Positive impact, no mitigation measures	During pre and construction phases	Project Construction Enterprise (PCE)	“
<b>During Construction Phase</b>					
Following construction works of:	For construction of different infrastructures, several hectares of	Procedures for expropriation /compensation of project affected persons will be	During construction	WASAC and Project Construction	Included in project

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<p>-construction of intake unit and its stability, -construction of Water Treatment Plant and operational services; -connection of intake to the pumping tank by pipes; -construction and installation of pumping station and de-silting basins; -construction of storage reservoirs for water; -excavation for installation of pipelines network.</p>	<p>individual lands will be acquired and their valuation conducted for expropriation/compensation exercises.</p>	<p>followed with reference to National compensation/expropriation Law 2015</p>	<p>phase</p>	<p>Enterprise (PCE)</p>	<p>budget</p>
	<p>During civil works, there will be excavation and scrapping works leading to accumulation of bulk earth materials.  Unmanaged disposal of these can result in sterilization of productive lands, creation of erosion, sedimentation pollution and lack of esthetical view.</p>	<p>Soil excavated should not be dumped on any individual land. Re-use it or dumping any waste soil in designated offsite ground recommended by the authority.</p>	<p>“</p>	<p>Project Construction Enterprise (PCE)</p>	<p>Included in project budget</p>
	<p>Local ambient air quality degradation due to dust emission from roads upgrading works as well as machines and vehicles travelling on unpaved feeder roads.</p>	<p>Restricting traffic speed of machines and vehicles as well as regular watering of the exposed areas terraced.</p>	<p>During construction phase</p>	<p>Project Construction Enterprise (PCE)</p>	<p>“</p>
	<p>Risk of accidents to workers, road users,</p>	<p>Strict application of Occupational safety and Health (OSH) plan taking</p>			<p>Included in project</p>

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	neighbor community and their cattle.	into account: -availability of protective safety equipment specific to the working environment; -availability of First Aid Box and emergency medical coverage dedicated to workers and staff.	“	“	budget
	Recruitment of unskilled and skilled employees as well as hiring services of local private companies.	Positive impact, no mitigation measures	During construction phase	Project Construction Enterprise (PCE)	“
	Installation of pumping network to collect water in Mugesera will lead to water quality degradation during fixation of pipes' supports.	Utilization of floating platform with balloons to support pipes.  As possible avoid use of corrosive materials for piping and construction of floating platform.	“	“	“
	The construction of intake at the lakeshore, within the buffer zone, may have significant degradation of important breeding habitats for fish, birds, reptiles and small animals.	Use of strictly limited area for intake construction.  Backfilling the non-utilized area and re-vegetation using the pre-existing plant species.  Avoid to utilized the habitat/ecological niche of rare, endangered, threatened	During construction phase	PCE, REMA technical service at Sector level and Local authority	Included in Project budget & Sector's functioning budget

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		and important commercial species if any; Limiting access ways to intake and other routes crossing buffer zone in order to protect lakeshores' habitats and their biodiversity.			
	There may be alteration of water quality through deposit of sediments from earthworks.	Accurate supervision of construction works, collection and deposit unused soil in dumping site selected and approved by local administrative authority.	During construction works	Project Construction Enterprise (PCE)	Included in project budget
	Lake water body polluted by solid and liquid wastes from intake construction works	Proper collection and disposal of wastes. Sorting solid waste and deposit this in transit zone, then to the selected landfill; Collection and pre-treatment of liquid waste before leasing in environment.	During construction works	Project Construction Enterprise (PCE)	Included in Project budget
	Through clearing of vegetation and soil excavation, there is loss of natural habitats and their biodiversity	Where construction materials are exploited, implementation of quarries and borrow pits management plans shall be considered.  All terraced areas surrounding the WTP shall	During construction and operational phases	Project Construction Enterprise (PCE) & Community Based Organizations	Included in Project budget & Sector's functioning budget

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		<p>be backfilled and re-vegetation utilizing pre-existing species or ornamental ones;</p> <p>Creation of green belts areas in local environment;</p> <p>Regular biodiversity monitoring.</p>		(CBO)	
	<p>Spreading of solid and liquid wastes generated during construction activities in local environment and lake water body.</p>	<p>Proper execution of waste management plan including:</p> <ul style="list-style-type: none"> <li>-sorting solid waste and deposit this in transit zone, then to selected landfill;</li> <li>-Avail proper toilets with septic tanks for liquid waste management</li> </ul> <p>Construction of temporary drainage channels to direct dispersal of rainy waters;</p> <p>Storage and stockpiling of materials on the site done away from drainage channels.</p>	<p>During construction and operational phases</p>	<p>Project Construction Enterprise (PCE) &amp; Local Private Company collecting wastes</p>	<p>Included in project budget and District functioning budget</p>
	<p>Discharge of polluting substances into soil and lake water including washed water from</p>	<p>Well supervision of construction works;</p> <p>Keep in appropriate containers oil, leakage and</p>	<p>During construction works</p>	<p>Project Construction Enterprise (PCE)</p>	<p>Included in project budget</p>

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	construction areas, oil, accidental spills etc...	good management of waste water before releasing in natural environment;  Plan for good management of hazardous substances, if any.			
	Air pollution by emission of dust during construction which may affect human respiratory system.	Management of dust emission through water spreading in construction areas; Management of road traffic and access to working area.	During construction phase	Project Construction Enterprise (PCE) & Local traffic control police	Included in project budget & Local police functioning budget
	The construction process will create noise, unusually movements of human and vehicles throughout the lakeshores. These activities may disturb sensitive biodiversity species.	Noise minimized by limiting operating times to daylight hours  Reduce as possible the vehicles' speed and movement of people;  Physically identify sensitive habitats and ensure biodiversity protection.	During construction phase	Project Construction Enterprise (PCE) & REMA technical Service in Sector	Functioning budget of Sector and Police
	Induced services to local companies which will offer jobs opportunity to several	Contractor to apply recruitment policy and procedure.	During construction works	Project Construction Enterprise (PCE)	-----



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	people.	Priority for hiring local companies as sub-contractors			
	Increased prevalence and transmission of HIV/AIDS and other STDs due to influx of workers migrating to worksites seeking jobs or already recruited.	Application of public health management plan; Increasing awareness and campaigns against transmitted diseases among workers and local population.	During construction works	Project Construction Enterprise (PCE) & Technical Health Service of Sector	Include in project budget and Health functioning budget
	Occurrence of hazards, number of accidents and injuries among workforce	Application of workforce health and safety plan; Check-up workers for effective diseases control measures. Avail First Aid Box tools as well as trained Nurse and a safety officer.	During construction phase	Project Construction Enterprise (PCE)	Included in project budget
	Loss of arable fertile soil during excavation works and decreasing of agriculture products.	Backfilling non utilized area, covering with deposited arable fertile soil and continue agriculture development	“	Project Construction Enterprise (PCE) & local population	“
	Destruction of natural habitats and loss of biodiversity	Delimitation of green zones and planting pre-existing flora species in the area.			
	High noise levels will be	Ensure that all vehicles and	During	Project	Include in

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	produced during transport of materials using heavy trucks and construction activities.	<p>machineries are properly maintained and if possible having silencers;</p> <p>Limit works to the hours of daylight;</p>	construction phase	Construction Enterprise (PCE)	project budget
	Clearing the right of way and loss of microhabitats and their biodiversity	<p>Clearing of just needed surfaces for pipelines installation</p> <p>After backfilling the excavated area using removed soil, compacting, levelling and re-vegetation by pre-existing species.</p>	During construction and operational phases	Project Construction Enterprise (PCE) & Community Based Organizations (CBO)	“
<b>Operational Phase</b>					
Pumping water in Mugesera lake to feed water treatment plant.	Change of lake hydrology, fluctuations of water levels leading to loss of habitats and their biodiversity.	<p>Avoid sedimentation pollution of water.</p> <p>Initiate a sustainable hydrological monitoring component to check the fluctuations of water levels in lake water and tributaries.</p>	During operational phase	Technical Services of Water in District and Sector levels & Rwanda Water Board (RWB)	Functioning budgets of Services
	Pumping and delivery of enough water to people and therefore mitigate against	Positive impact-no mitigation	During operational phase	WASAC Services	WASAC functioning budget

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	the potential impacts of waterborne diseases transmission and climate change.				
Management of Water Treatment Plant and its residual effluents	It is obvious that non proper management of sludge and backwash water from WTP can lead to impacts on water quality alteration, health deterioration of people, loss of aquatic life in lake and the destruction of natural habitat.	The produced sludge should be kept in containers or on site temporarily before disposal.  Ensure waste water treatment before its release in natural environment;  Alternative use of sludge such as use as fertilizer or bricks making.	During operational phase	WTP Management Authority and its Technical team & WASAC services	WASAC functioning budget
	Backwashed water which will be produced in WTP will contain high concentrations of particulate material.  Once directed into the lake or in nearby natural environment without treatment, this can have serious impacts on water quality, soil composition and loss of aquatic life as	Backwashed water from the WTP shall be recycled or treated with an appropriate waste water treatment plant before any use or spreading in environment.  Initiate a regular water sampling tests for both bacteriological and physic-chemicals elements, at least twice a year.	During operational phase	WTP Management Authority and its Technical team & WASAC services	“

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	well as human living conditions.				
	Water purification process requires the addition of chemicals Aluminium sulphate and Chlorine to assist in the removal of particles suspended in water. Improper use of these chemicals may have an impact on water and soil quality.	Strictly follow instructions indicated in material safety data sheets, dedicated to chemicals handling and disposal off.  Awareness creation and training amongst workers on proper handling of chemicals;  Avoid spreading waste water with chemicals directly in natural environment without treatment.	During operational phase	WTP Management Authority and its Technical team & WASAC services	“
	Management of pipes and ponds for storing water before treatment against siltation and logging.	Avoid stop for long time flush out the water in piping system c;  Regular inspection of ponds to reduce siltation.	During operational phase	WASAC technical services at District and Sector levels	Institutional functioning budget
Management of reservoirs for water supplying in the system	Water mismanagement at storage reservoirs level and inadequate distribution could result in misuse of high quantity delivered or shortage of water in delivered entities.	Enhance knowledge and skills of technicians necessary to minimize surplus and/or shortage of water applications  Enforce high levels of maintenance of drainage pipelines network till the last	During operational phase	WASAC Ltd and Rwanda Water Board (RWB)	Institutional functioning budget

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		water users.			
Management of pumping stations and accessories.	Spread of washed waste and oil leachate in lake water situated nearby will be harmful to fish and other biodiversity.	Regular maintenance of pumping machines and other equipment used; Proper treatment of waste water from WTP and pumping stations.	During operational phase	WASAC technical services at District and Sector levels	WASAC functioning budget at District and Sector levels
Maintenance of safe and cleaned environment within and around constructed infrastructures.	Vandalism and gradual deterioration of constructed infrastructures will lead a water supply failed project.	Ensure security of constructed infrastructures within 24 hours' basis shall be considered;  Ensure proper cleaning of infrastructures and maintenance of green gardens with ornamental flowers will raise favourable environmental working sites and esthetical view.		WASAC technical services at District and Sector levels	“

## 8.2. ENVIRONMENTAL MONITORING PLAN (EMP)

Monitoring refers to the systematic collection of data through a series of repetitive measurements over a long period of time to provide information on characteristics and functioning of environmental and social variables in specific areas over time.

Environmental monitoring is an essential component of project implementation. A general monitoring plan should be implemented on site. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measures. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time. In this chapter a monitoring plan is proposed and is provided in the following table N° 16.

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**Table 23: Environmental and Social Monitoring Plan of the Mugesera WSS Project**

<b>Project Activities</b>	<b>Potential Impacts</b>	<b>Recommended mitigation measures</b>	<b>Monitoring indicators</b>	<b>Monitoring Responsibilities</b>	<b>Estimated cost (USD'000)</b>
<b>Pre-construction Phase</b>					
Project camp site installation, construction and/or upgrading access roads towards planned areas for infrastructures edification	Individual land acquisition for project camp site installation including offices, workshops, stores, vehicles parking etc...  Portions of individual lands acquired for creation of new roads and/or extension of existing roads towards planned infrastructures.  Other land will be needed temporarily for aggregate processing.	Fair expropriation/ compensation of Project Affected Persons (PAPs) in reference to National Expropriation/ Compensation Law 2015  Establish a mandatory entitlement related to temporary land loss and compensation for lost crops	-Reports on compensation and/or expropriation procedures done	WASAC, Ngoma District & Supervision Company (SC)	Included in Project budget (50,000)
	Loss of natural habitat and flora biodiversity by felling trees and clearing vegetation on the construction sites	After dismantling of the camp, site restoration by earth filling, trees planting and re-vegetation will be necessary.  Planting trees and vegetation all along road	-Absence of camp, trees effectively planted and green vegetation reappeared	REMA and Technical Services (TS) of the District and Sectors &	Included in Project budget (1,500)

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		embankments		SC	
	Increasing in traffic movement of vehicles, machines (e.g. excavators, cars, equipment...) and manpower.	Ensure effective security of the sites.  Noise minimized by limiting operating times to daylight hours and/or locating site establishment away from sensitive receptors like settlements, schools, health centers etc.	-Special signboard provided to caution the road traffic.  -Report related to operations of machinery and traffic at the evening and late night  Minute of the meeting on site location agreement	WASAC, SC and TS of District and Sectors	Included in Project budget (5,000)
	Ambient air quality deterioration due to dust spreading and gaseous pollutants like SO <sub>2</sub> , NO <sub>x</sub> , and CO to sites peripheries,	Restricting traffic speed and regular watering of the exposed areas terraced;  Monthly inspection of machines and worthy vehicles used, producing minimal exhaust fumes	-Water has been regular sprinkled and dust emission ceased  -Monthly report on vehicles and equipment maintenance;  -Workers are really utilizing personal	WASAC, SC and TS of District and Sectors	Included in the Project budget (15,000)



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			protective equipment during working hours		
	High noise level increasing in ambient air which raise disturbance suffered by local residents and workers.	Reduce noise to the minimum by using soundproof equipment.	“	“	“
	Soil structure modification by stripping topsoil layers.	Soil backfilling and compacting to remediate soil structure after camp dismantling.	PCE’s report on water equipment’s construction advanced works	WASAC, SC and TS of District and Sectors	Budget 5,000
	Excavated earth accumulation which will affect esthetical view of the area	Soil excavated should not be dumped on any individual land. Re-use it or dumping any waste soil in designated offsite ground recommended by the authority.	-Report on site visit to see where is located the earth dumping site	WASAC, SC and TS of District and Sector	Budget 6,000
	Risk of accidents to workers during camp site installation and access roads upgrading	Avail project protective safety equipment specific to the working environment shall be delivered to the workers. First Aid Box and emergency medical coverage will be provided to	-Visit on site shall confirm that workers are really equipped and utilizing safety equipment. First	Supervision Company & TS of District/Sector	Budget (10,000)

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		workers.	aid medical box available		
	Spreading of oil from parking area of vehicles and engines, machines parts could infiltrate into water sources and land to affect people's health and physical environment.	Waste oil should be stored in clearly labeled metallic drums with lids. -Machine parts should be stored in lockable stores with concrete floored.	-Visit report on the site by environmental Officer to verify oil leakage	REMA, Supervision Company (SC) and TS of District and sectors	Budget (1,000)
	Recruitment of unskilled and skilled employees as well as hiring services of local private companies.	Positive impact, no mitigation measures	-Report on recruited personnel and their provenance; -Number of jobs created for local workers	Sectors concerned and Ministry of Public Labor (MPL)	-----
<b>During Construction Phase</b>					
Following construction works of: -construction of intake unit and its stability, -construction of Water Treatment Plant and operational services; -connection of intake to	For construction of different infrastructures, several hectares of individual lands will be acquired and their valuation conducted for expropriation/compensation exercises.	Procedures for expropriation /compensation of project affected persons will be followed with reference to National compensation/ expropriation Law 2015	-Report on compensation and/or expropriation procedures done  Reports on awareness and education of people	WASAC, Supervision Company and Ngoma District & Sectors	Budget (RAP Budget)

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<p>the pumping tank by pipes;</p> <p>-construction and installation of pumping station and de-silting basins;</p> <p>-construction of storage reservoirs for water;</p> <p>-excavation for installation of pipelines network.</p>	<p>During civil works, there will be excavation and scrapping works leading to accumulation of bulk earth materials.</p> <p>Unmanaged disposal of these can result in sterilization of productive lands, creation of erosion, sedimentation pollution and lack of esthetical view.</p>	<p>Soil excavated should not be dumped on any individual land. Re-use it or dumping any waste soil in designated offsite ground recommended by the authority.</p>	<p>-No remaining excavated materials visible on the site -</p> <p>Dumping site available and has been monitored</p> <p>-Report on solid waste disposal methods which have been applied</p>	<p>REMA, SC and TS of District and Sectors</p>	<p>Budget (2,500)</p>
	<p>Local ambient air quality degradation due to dust emission from roads upgrading works as well as machines and vehicles travelling on unpaved feeder roads.</p>	<p>Restricting traffic speed of machines and vehicles as well as regular watering of the exposed areas terraced.</p>	<p>-Water has been regular sprinkled and dust emission ceased</p> <p>-Monthly report on vehicles over speed recorded</p>	<p>WASAC, SC and TS of District</p>	<p>Budget (10,000)</p>
	<p>Risk of accidents to workers, road users, neighbor community and their cattle.</p>	<p>Strict application of Occupational safety and Health (OSH) plan taking into account:</p> <p>-availability of protective safety equipment specific to the working environment;</p> <p>-availability of First Aid Box</p>	<p>-Visit on site shall confirm that workers are equipped with safety materials. First aid medical box available</p> <p>Accidents records</p>	<p>SC and TS of District and Sectors</p>	<p>Budget (7,000)</p>

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		and emergency medical coverage dedicated to workers and staff.			
	Recruitment of unskilled and skilled employees as well as hiring services of local private companies.	Positive impact, no mitigation measures	-Report on recruited personnel and their provenance; -Number of jobs created for local workers	Concerned Sectors and Ministry of Public Labour (MPL)	-----
	Installation of pumping network to collect water in Mugesera will lead to water quality degradation during fixation of pipes' supports.	Utilization of floating platform with balloons to support pipes.  As possible avoid use of corrosive materials for piping and construction of floating platform.	Report on water quality parameters measured	REMA, SC and TS from District and Sectors	Budget (3,000)
	The construction of intake at the lakeshore, within the buffer zone, may have significant degradation of important breeding habitats for fish, birds, reptiles and small animals.	Use of strictly limited area for intake construction.  Backfilling the non-utilized area and re-vegetation using the pre-existing plant species.  Avoid to utilized the habitat/ecological niche of rare, endangered, threatened and important commercial species if any;  Limiting access ways to	Report of the environmental Officer on the conservation of sites	REMA, SC and TS of District and Sectors	Budget (2,000)

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		intake and other routes crossing buffer zone in order to protect lakeshores' habitats and their biodiversity.			
	There may be alteration of water quality through deposit of sediments from earthworks.	Accurate supervision of construction works, collection and deposit unused soil in dumping site selected and approved by local administrative authority.	Report on water quality parameters measured; Visit report on the existing dumping site	WASAC, SC and TS of District and Sectors	Budget (5,000)
	Lake water body polluted by solid and liquid wastes from intake construction works	Proper collection and disposal of wastes. Sorting solid waste and deposit this in transit zone, then to the selected landfill; Collection and pre-treatment of liquid waste before leasing in environment.	Report on water quality parameters measured; Visit report on the existing dumping site	REMA, SC and TS of District and Sectors	Budget (5,000)
	Through clearing of vegetation and soil excavation, there is loss of natural habitats and their biodiversity	Where construction materials are exploited, implementation of quarries and borrow pits management plans shall be considered.  All terraced areas surrounding the WTP shall be backfilled and re-vegetation utilizing pre-	Number of quarries and borrow pits rehabilitated;  Hectares of green areas created  Number of plant species planted	REMA, SC and TS of District and Sectors	Budget (20,000)

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		existing species or ornamental ones; Creation of green belts areas in local environment; Regular biodiversity monitoring.			
	Spreading of solid and liquid wastes generated during construction activities in local environment and lake water body.	Proper execution of waste management plan including: -sorting solid waste and deposit this in transit zone, then to selected landfill; -Avail proper toilets with septic tanks for liquid waste management Construction of temporary drainage channels to direct dispersal of rainy waters;  Storage and stockpiling of materials on the site done away from drainage channels.	There is no remaining solid waste visible on the site  -Report on solid waste disposal methods which have been applied	REMA, SC and TS from District and Sectors	Budget (4,000)
	Discharge of polluting substances into soil and lake water including washed water from construction areas, oil, accidental spills etc...	Well supervision of construction works;  Keep in appropriate containers oil, leakage and good management of waste water before releasing in	-Visit report on the site by environmental Officer to verify oil leakage	REMA, SC and TS from District and Sectors	Budget (1,500)

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		natural environment; Plan for good management of hazardous substances, if any.			
	The construction process will create noise, unusually movements of human and vehicles throughout the lakeshores. These activities may disturb sensitive biodiversity species.	Noise minimized by limiting operating times to daylight hours Reduce as possible the vehicles' speed and movement of people; Physically identify sensitive habitats and ensure biodiversity protection.	-Visit report on the site by environmental Officer to verify oil leakage	REMA, SC and TS from District and Sectors	Budget (1,000)
	Induced services to local companies which will offer jobs opportunity to several people.	Contractor to apply recruitment policy and procedure. Priority for hiring local companies as sub-contractors	Number of Companies hired Number of jobs offered	Concerned Sectors and Ministry of Public Labor	-----
	Increased prevalence and transmission of HIV/AIDS and other STDs due to influx of workers migrating to worksites seeking jobs or already recruited.	Application of public health management plan; Increasing awareness and campaigns against transmitted diseases among workers and local population.	-Health centers reports on HIV/AIDS cases -Number of training session delivered -Number of educated persons	Ministry of Health, Health care Centers, STS & Contractor	Functioning budget of Ministry of Health, Sectors and NGO's Budgets

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			on environmental health		
	Loss of arable fertile soil during excavation works and decreasing of agriculture products.	Backfilling non utilized area, covering with deposited arable fertile soil and continue agriculture development	Number of hectares of excavated areas -Rate of decreased agriculture production	-Report from Land Manager and Agronomist of the District and Sectors	Budget (3,000)
	High noise levels will be produced during transport of materials using heavy trucks and construction activities.	Ensure that all vehicles and machineries are properly maintained and if possible having silencers;  Limit works to the hours of daylight;	Report related to operations of machinery and traffic at the evening and late night	Sc and Ts from District and Sectors	Budget (500)
	Clearing the right of way and loss of microhabitats and their biodiversity	Clearing of just needed surfaces for pipelines installation  Backfilling the excavated area using removed soil, compacting, and re-vegetation by pre-existing species.	-Surfaces of areas backfilled and re-vegetated  -Report of site visit by Environmentalist	REMA, SC and TS of District	Budget (1,000)
<b>Operational Phase</b>					
Pumping water in Mugesera lake to feed water treatment plant.	Change of lake hydrology, fluctuations of water levels leading to loss of habitats	Avoid sedimentation pollution of water.  Initiate a sustainable	-Regular reports on lake water levels fluctuations;	REMA, RWB and TS of the District and Sectors	Budget (25,000)



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	and their biodiversity.	hydrological monitoring component to check the fluctuations of water levels in lake water and tributaries.	-Report on the loss of habitats and biodiversity by the environmentalist		
	Pumping and delivery of enough water to people and therefore mitigate against the potential impacts of waterborne diseases transmission and climate change.	Positive impact-no mitigation	-Percentage of population in Ngoma District served with distributed water -Health report on decrease of waterborne diseases.	WASAC, RWB and TS of the Ministry of Health at the District and Sectors levels	-----
Management of Water Treatment Plant and its residual effluents	It is obvious that non proper management of sludge and backwash water from WTP can lead to impacts on water quality alteration, health deterioration of people, loss of aquatic life in lake and the destruction of natural habitat.	The produced sludge should be kept in containers or on site temporarily before disposal.  Ensure waste water treatment before its release in natural environment;  Alternative use of sludge such as use as fertilizer or	-Reports on the physic-chemicals parameters of released sludge and waste water; -Reports from environmentalist on loss of habitats and their biodiversity	REMA, RWB and TS of District and Sectors levels	Budget (150,000)

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		bricks making.			
	<p>Backwashed water which will be produced in WTP will contain high concentrations of particulate material.</p> <p>Once directed into the lake or in nearby natural environment without treatment, this can have serious impacts on water quality, soil composition and loss of aquatic life as well as human living conditions.</p>	<p>Backwashed water from the WTP shall be recycled or treated with an appropriate waste water treatment plant before any use or spreading in environment.</p> <p>Initiate a regular water sampling tests for both bacteriological and physicochemicals elements, at least twice a year.</p>	<p>-Reports on the physicochemicals and bacteriological parameters of released sludge and waste water;</p> <p>-Reports from environmentalist on loss of habitats and their biodiversity</p> <p>Reports on the physicochemicals, bacteriological parameters of water in the Lake</p> <p>-Reports of the training sessions of workers</p> <p>-Reports on waste water</p>	REMA, RWB, WASAC and TS of Ngoma District	Budget (60,000)
	<p>Water purification process requires the addition of chemicals Aluminum sulphate and Chlorine to assist in the removal of particles suspended in water.</p> <p>Improper use of these chemicals may have an impact on water and soil quality.</p>	<p>Strictly follow instructions indicated in material safety data sheets, dedicated to chemicals handling and disposal off.</p> <p>Awareness creation and training amongst workers on proper handling of chemicals;</p> <p>Avoid spreading waste water with chemicals directly in natural environment without treatment.</p>		REMA, RWB, WASAC and TS of Ngoma District	Budget (60,000)

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	Management of pipes and ponds for storing water before treatment against siltation and logging.	Avoid stop for long time flush out the water in piping system Regular inspection of ponds to reduce siltation.	treatment methods and results.  -Calendar of regular inspection of water distribution system including ponds	WASAC technical services and RWB technicians	Budget (1,000)
Management of reservoirs for water supply, pumping stations and accessories	Water mismanagement at storage reservoirs level and inadequate distribution could result in misuse of high quantity delivered or shortage of water in delivered entities.	Enhance knowledge and skills of technicians necessary to minimize surplus and/or shortage of water applications  Enforce high levels of maintenance of drainage pipelines network till the last water users.	-Number of training sessions for technicians  -Calendar for the maintenance of the whole water distribution system	Rwanda Water Board (RWB) & Ngoma District	Budget (3,000)
Maintenance of safe and	Vandalism and gradual	Ensure security of	-Number of	WASAC and TS	Budget

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cleaned environment within and around constructed infrastructures.	deterioration of constructed infrastructures will lead to a water supply failed project.	constructed infrastructures within 24 hours' basis shall be considered; Ensure proper cleaning of infrastructures	security staff deployed to guard infrastructures	of Sectors level	(10,000)
<b>Sub-Total</b>					<b>468,000</b>
<b>Contingencies (5%)</b>					<b>23,400</b>
<b>G. Total</b>					<b>491,400</b>

## **CHAPTER IX: CONTINGENCY PLAN**

The contingency plan is a course of action designed to help an organization respond effectively to a significant future event or situation that may or may not happen. It is a plan devised for an outcome other than in the usual plan. It is often used for risk management for an exceptional risk that, though unlikely, would have catastrophic consequences.

The environmental Risk Management makes it possible to determine the accidents likely to occur within the framework of the construction works of infrastructures and drinking water supply system from Lake Mugesera, to assess the consequences, and then to propose to prevention or control measures for these potential accidents. These may arise from risk associated with the stored substances like oil spillage, risk associated with the installation of the base camp and site offices, the risk associated with the worksite, risk associated with the operation and the infrastructure and the network, risk associated with the climate, etc.

### **9.1. Identification and assessment of the risks of accidents**

#### **9.1.1. Objective**

The aim here is to identify all the dangers to which personnel may be exposed during periods of work and operation. The proposed approach is based on the analysis of the tasks and work situations of the operators. For construction companies, it is similar to the approach necessarily implemented when drafting a Health and Safety Plan.

This work will consist of asking questions about: the list of tasks necessary for carrying out the work, the list of operations for each task, the risk analysis of these operations, and determining preventive measures to act effectively on these risks.

On account of our project, the various risks to which staffs are exposed are recorded in the table below depending on the project phase:

#### **9.1.2. Work phase**

During this phase, the dangers likely to arise relate to the installation of life and technical bases (site office). The table below illustrates those risks.

9.1.3. Risks associated with the installation of the base camp

The table below summarizes the risks associated with the installation of the base camp:

**Table 24: Identification and analysis of the risks associated with the installation of the base camp, site offices**

Source of dangers/ Activity	Danger	Risk	Risk evaluation				Nature of the risk	Prevention measures
			P	F	E	Score of risk (R)		
Movement of construction site vehicles	Speeding	Collision	6	2	15	180	Negative with required measures	Limit the speed on the site to 30 km / h; Make truckers aware of the code of conduct; Install speed bumps in line with work zones and built-up areas.
Climbing (formwork)	Fall from height	Fractures	3	1	3	9	Very limited risk - "acceptable"	Provide workers with harnesses; Require respect for the wearing of harnesses; Provide staff with PPE.
Formwork stripping	Fall from height/ objects	Fractures, luxation	3	1	3	9	Very limited risk - "acceptable"	Provide workers with harnesses; Require respect for the wearing of harnesses; Provide staff with PPE.
Electric installations	Stripped electric cables	Electrification / electrocution	3	2	1	6	Very limited risk - "acceptable"	Regularly check the electrical installations Protect the electric cables in sheaths Report electrical risk areas

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	Short circuits	Fires Equipment losses	3	2	1	6	Very limited risk - "acceptable"	Install suitable extinguishers Train staff in the use of fire extinguishers Report areas at risk of fire or electrocution Insure the equipment
Roof installation	Work at height	Fall from height	3	3	1	9	Very limited risk - "acceptable"	Raise staff awareness of the risks Establish a security procedure Provide workers with harnesses

**Table 25: Identification and analysis of the risks associated with the installation of the site offices**

Source of dangers/ Activity	Danger	Risk	Risk evaluation				Nature of the risk	Prevention measures
			P	F	E	Score of risk (R)		
Equipment	Uncontrolled handling of equipment	Abrasion / amputation / crushing	6	3	15	270	Immediate improvement required	Train staff about the use of equipment Protect the equipment
Cement mixer	Happage	Fracture	3	1	7	21	Attention required	Raise staff awareness of the risks; Establish a security procedure
Reinforcement	Handling iron bars	Abrasions	6	6	3	108	Required actions	Raise staff awareness of the risks; Provide staff with PPE; Ensure compliance with the wearing of PPE

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Loading	Fall of objects	Crush / Fracture / Dislocation	6	3	3	54	Attention required	Provide staff with PPE; Establish a security procedure; Raise staff awareness of the risks; Monitor compliance with procedures
Unloading	Fall of objects	Crush / Fracture / Dislocation	6	3	3	54	Attention required	Provide staff with PPE; Establish a security procedure; Raise staff awareness of the risks; Monitor compliance with procedures



## 9.2. Risks associated with stored substances

The stored substances are lubricating oils, diesel, and admixtures for different use at site.

### 9.2.1. Lubricating Oil Products

Lubricating oils are used for rotating parts. They are composed of severely refined mineral oils and additives whose content of polycyclic aliphatic hydrocarbons (carcinogen) in mineral oils is less than 3% or consisting of paraffinic hydrocarbons. These products are intended for the maintenance of vehicles on the site. They are used for ad hoc operations and are present on the operating site. They will be contained using local earth material and /or sand bags. Spill clean-up equipment specifically designed for other fuel and Oil products are to be located at the construction camp areas and at other detached storages. Under normal conditions of use, lubricating oils present no risk of toxicity, ignition or explosion.

However, eye or skin contact can cause irritation in some cases. Also, ingesting large amounts of oil will cause diarrhea and nausea. In addition, the dangers associated with accidental fuel oil spills include:

- a) Risks associated with flammability.
- b) Mildly toxic by ingestion, highly toxic if aspirated.
- c) Moderately toxic to aquatic organisms.
- d) Harmful to waterfowl
- e) Floats on water.

Spills or leaks of all light and medium oils, including fuel oil at storage facilities will be responded to by the following steps:

- a) Identifying the source of the leak or spill
- b) Stopping flow if possible
- c) Eliminating open flame ignition processes.
- d) Containing the spill.
- e) Notifying the Supervisor's Representatives
- f) Initiating Spill Response Plan.

Spilled diesel fuel can be covered by commercial sorbents or by sand straw or peat moss. If necessary, contaminated soil will be excavated. Digging sumps or trenches and pumping from below water table can recover diesel fuel saturated soil. Fuel spills on land will be responded to by the following procedures:

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- a) Construction of earth berm down slope of the running or seeping fluid.
- b) Plastic taps may be placed at the base of the berm to allow the fuel pool on the plastic tarp for easy capture with absorbent pads,
- c) Pads may be squeezed into empty drums and re-used.
- d) Larger pools may be pumped back into the drums.
- e) Special care will be taken to prevent the fuel from entering the water body or water where it will have greater negative impact.
- f) Contaminated soil and vegetation may have to be removed and disposed off at well designated dump site in each district.

Fire Response methods for Diesel Fuel includes:

- a) CO<sub>2</sub>, dry chemical, foam, or water spray.
- b) Water to cool tank surface.
- c) Diversion of the diesel to an open area and let it burn off under control.
- d) Awareness of re-ignition if the fire is put before all diesel fuel is consumed

Fuel spills on water will be contained immediately to restrict the extent of the floating fuel. The methods, which may be used to contain the fuel include:

- a) Booms deployed to contain the spill.
- b) Absorbent pads used to capture small spills on watercourse.
- c) A skimmer to recover oil contained by boom and then pumps the recovered fuel into empty fuel drums.

#### **9.2.2.Diesel/Fuel**

Diesel or gasoline is a fuel for a compression ignition engine. Physically, it is a light fuel oil and, by law, a fuel obtained from petroleum refining. Petroleum/Gasoline may be stored on-site for use by machinery and vehicles during construction. The gasoil presents the following dangers:

- ◆ aspiration hazard, category 1;
- ◆ skin corrosion / irritation, category 2;
- ◆ acute toxicity (by inhalation), category 4;
- ◆ carcinogenicity, category 2;
- ◆ specific target organ toxicity - repeated exposure, category 2;
- ◆ Easily ignited by flame or spark; lighter than water (floats on water)
- ◆ hazards for the aquatic organisms - Chronic hazard, category

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The initial response to petrol/gasoline spill will be:

- a) Stopping the flow at the source if possible.
- b) Eliminating all possible sources of ignition (e.g. extinguish cigarette, shut off motors, generators)
- c) Evacuating danger area
- d) Carefully considering the hazards and merits of trying to contain the spill if it is safe to do so and obvious benefits of containment is apparent (e.g. contain if flowing towards a water course.) otherwise leave gasoline to spread and evaporate
- e) Meeting at the emergency assembly point
- f) Notifying the Supervising consultant.

In the event of fire, the response will be:

- a) Using CO<sub>2</sub>, dry chemical, foam or water spray (fog);
- b) Using jet streams to wash away burning gasoline.
- c) Diverting the gasoline to an open area and let it burn under control.
- d) Using water to cool the tank surfaces.
- e) Being aware of re-ignition if the fire is put out before all the gasoline is consumed.

Petrol/gasoline can be recovered in the following manner:

- a) Unburnt gasoline can be soaked up by sand or pit moss or by commercial sorbets.
- b) If necessary, contaminated soil will be excavated,
- c) Gasoline entering the ground can be recovered digging sumps or trenches and pumping from below water table.
- d) Petrol/ gasoline can be disposed of in the following manner.
- e) Evaporation incineration under controlled manner.

#### **9.2.3. Acid Spills**

These occur mainly from vehicle batteries and other materials with acidic chemical properties. Spills of acid will be contained using sand bags and neutralization can be accomplished using either soda ash or lime. Both the sand bags and lime will be stored at equipment maintenance yards'/service areas. Following neutralization, the area will be carefully flushed with water. Any water used for flushing a spill shall be contained, recovered and disposed of in an approved manner.

### 9.2.3. Ad mixtures

Admixtures are common chemicals in the manufacture of concrete. Added at low doses during the preparation of concrete (admixtures represent less than 5% of the mass of the concrete), these products improve certain characteristics of this material (waterproofing or setting time, for example). The different types of admixtures that exist will allow obtaining concrete with the specific characteristics you want to give it.

The main adjuvants are:

- ◆ setting accelerator;
- ◆ hardening accelerator;
- ◆ setting retarder;
- ◆ plasticizer;
- ◆ super-plasticizer;
- ◆ air trainer;
- ◆ pigments.

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The table below summarizes the identification and analysis of risks associated with stored substances as follows:

**Table 26: Identification and analysis of risks associated with stored substances**

Source of dangers/ Activity	Danger	Risk	Risk evaluation				Nature of the risk	Prevention measures
			P	F	E	Score of risk (R)		
Fuel storage	Presence of heat source nearby	Fire	3	1	40	120	Required actions	Provide the unloading site with suitable extinguishers;  Provide the site with a sandbox with accessories;  Prohibit heat sources on the dumping site; Set up appropriate signals;  Train pump attendants in the handling of equipment
	Loss of containment of storage tanks	Spreading of fuel with risk of ignition	1	0,5	1	0,5	Very limited risk - "acceptable"	Build a sealed containment site around the vessel Regularly monitor leaks
Cement storage	Fine dust	Respiratory infections	6	6	3	108	Required actions	Provide staff with PPE;  Store in a container or warehouse;  Ensure health monitoring of exposed personnel;

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								Require compliance with the wearing of PPE
Storage of used oils	Loss of containment of storage tanks	Spreading of fuel with risk of ignition	1	1	15	15	Very limited risk - "acceptable"	Build a sealed containment site around the vessel; Regularly monitor leaks; Set up monitoring sheets for the supply and emptying of the tank
Storage of admixtures	Accidental leak	Spreading of fuel with risk of poisoning	1	1	15	15	Very limited risk - "acceptable"	Build a sealed containment site around the vessel; Regularly monitor leaks; Set up monitoring sheets for the supply and emptying of the tank
	Soil contamination	Soil contamination	1	1	15	15	Very limited risk - "acceptable"	Build a sealed containment site around the vessel; Regularly monitor leaks; Set up monitoring sheets for the supply and emptying of the tank
Storage of gas cylinders (acetylene, butane)	Inadequate exposure to heat sources	Explosion	1	1	15	15	Very limited risk - "acceptable"	Build a sealed containment site around the vessel; Regularly monitor leaks; Set up monitoring sheets for the supply and emptying of the tank.

### 9.3. Risks associated with the worksite

The following table summarizes the risks associated with the worksite as follows:

**Table 27: Identification analysis of risks associated with the worksite**

Source of dangers/ Activity	Danger	Risk	Risk evaluation				Nature of the risk	Prevention measures
			P	F	E	Score of risk (R)		
Topographic survey	Proximity to vehicle traffic	Collision	6	3	15	270	Immediate improvement required	Place work signs in survey areas Provide staff with PPE Limit speed in survey areas
	Survey in the brush	Reptile bite	6	2	15	180	Required actions	Provide staff with PPE
Geotechnical survey	Nearby roads direct collection of data	Collision	6	3	15	270	Immediate improvement required	Place work signs in survey areas Provide staff with PPE Limit speed in survey areas.
	Handling of fine dust	Respiratory infections	6	3	3	54	Required actions	Provide staff with PPE Ensure compliance with wearing of PPE Make staff aware of health risks.
Transport of staff to the site	Speeding	Collision	6	3	15	270	Immediate improvement required	Limit site speeds to 30 km / h Set up appropriate road works signs Follow up on signs
Construction machinery	Proximity to staff	Collision	6	3	15	270	“	“
Material transport	Crossing of agglomerations	Collision	6	3	40	270	Immediate improvement required	Limit site speeds to 30 km / h Set up appropriate road works signs Follow up on signals Install speed bumps when crossing built-up areas

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Source of dangers/ Activity	Danger	Risk	Risk evaluation				Nature of the risk	Prevention measures
			P	F	E	Score of risk (R)		
Maintenance and repair	Spreading drain oils	Soil contamination	10	6	1	60	Attention required	Use the appropriate emptying equipment Train staff in safe emptying Make waterproof coverings for the floors of technical workshops Install a drain oil tank
	Short circuits	Fire / Loss of equipment	6	3	1	18	Very limited risk - "acceptable"	Set up fire extinguishers Train technical staff Insure the equipment Establish security procedures
Reinforcement	Handling iron bars	Abrasions	6	2	3	36	Attention required	Provide staff with PPE Ensure compliance with the wearing of PPE
Formwork and stripping	Fall of objects	Fractures	3	1	3	9	Very limited risk - "acceptable"	Establish a security procedure; Provide staff with PPE; Ensures compliance with the wearing of PPE Report work areas
Loading and unloading	Proximity to staff	Fractures	3	1	3	9	Very limited risk -	Report work areas Establish a security procedure



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							"acceptable "	Provide staff with PPE Ensures compliance with the wearing of PPE
Sealing	Storage	Spills	1	2	1	2	Very limited risk - "acceptable "	
	Work at height	Fall from height	3	2	3	18	Very limited risk - "acceptable "	
	Work posture	Musculoskeletal problems	6	3	2	36	Attention required	
Food paint	Storage	Spills	1	2	1	2	Very limited risk - "acceptable "	Ensure management
	Works in height	Fall from height	6	2	3	18	Attention required	Organize workshops
	Posture de travail	Musculoskeletal problems	6	3	2	36	Very limited risk - "acceptable "	Respect of working hours Use appropriate scales
Pressure test	Implementation	Injuries or weakening of the	1	2	3	6	Very limited risk	Recognize buildings all along the water drinking network;

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		frames linked to the explosion of pipes					- "acceptable"	Inform and conduct awareness to the staff and residents about the risks associated with pressure tests; Organize the site
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### 9.3.1. Exploitation phase

The risks are related to the electrical installations, the condition of the dosage units and human activities around the source. They are related to the operation of infrastructure and the network.

### 9.3.2. Treatment plant

The different risks like Electrocutation / Electrification and Fire may result from Electrical Installations Operation. Another issue is the overdose that may result from the Chlorine and/or other chemicals used in water purification.

#### **Prevention measures are as follows :**

Report the different risks; protect the cables with sheaths; and inform and sensitize staff against the risks. For fire: Report the sources of fires; Install the appropriate extinguishers; and Display a site evacuation plan. For Chlorine dosage, the users must respect the provided dosage as stipulated within their safety data sheets.

#### **Lake**

The different risks like Water pollution by fertilizers and pesticides that may result from Agricultural activities around the lake and Water contamination by chemical substances that may result from Accidental spill from a site upstream may occur.

#### **Prevention measures are as follows :**

The way to prevent these is to prohibit the establishment of those activities. For agriculture activities, follow procedures stipulated by REMA for water resource protection.

### 9.3.3. Water distribution

Bacteria in the water that may result from Unhygienic handling of water at home may be produced.

#### **Prevention measures are as follows :**

Make drinking water users aware of the use of clean containers and ensure regular maintenance of the perimeter of standpipes;

## 9.4. CLIMATE RISKS

The WSS construction project could face risks of external hazards to the construction works. These are dangers linked to climatic phenomena.

### 9.4.1. Lightning

Lightning is an electrical phenomenon produced by the electrical charges of certain clouds. This phenomenon can occur during stormy weather conditions. The current produced by lightning is electrical and causes the same effects as any other current flowing in an electrical conductor. As a result, the following effects are possible:

- ◆ thermal effects (release of heat);
- ◆ rise in potential of the earth electrodes and ignition;
- ◆ induction effects (electromagnetic field);
- ◆ electrodynamic effects (appearance of forces that can lead to mechanical deformations or ruptures);
- ◆ acoustic effects (thunder).

In general, a complete lightning strike lasts between 0.2 and 1 second and has an average of four partial discharges. The median value of the intensity of a lightning strike is around 25 kA. Between each (drive) discharge, a current of the order of a hundred or a thousand amperes continues to flow through the ionized channel. The risks presented by lightning therefore result from the associated lightning current.

Lightning could cause loss of facilities and loss of life. However, no cases have been reported to date.

#### **Prevention and treatment measures**

The following measures are recommended for lightning prevention:

- Provide earthworks for the buildings constructed;
- Regularly check the electrical installations in the constructed buildings;

## **9.4.2. Flood**

Climatic phenomena could be at the origin of torrential rains, a source of flooding of plots and developed and existing villages. Flooding could cause loss of property (agricultural production), collapse of buildings, flooding of roads and loss of life.

### **Prevention and treatment measures**

The measures for the prevention and treatment of environmental risks external to the project are summarized as follows:

- Integrate the development of storm water drainage networks into the project;
- Put low points and structures out of water.

## CHAPTER X: COMMUNITY HEALTH, SAFETY AND SECURITY MANAGEMENT PLAN

This plan provides potential community health, safety and a security risk associated with the implementation of the Sake WSS in Ngoma District and helps to provide guidance that respond and mitigate the identified risks. Under this plan, all applicable laws and standards stated in legal and institutional framework shall apply. The table below summarizes the Community Health, Safety and Security Management Plan and shows the potential risks of the water supply project activities, the proposed mitigation measures and the responsibilities.

**Table 28 Summary of Community Health, Safety & Security Management Plan**

Potential Risk	Mitigation Measures	Responsible
Increased pressure on health services and infrastructure. The influx of new workers from outside areas to the project area will increase demand on existing health services	Health services of the new workers shall be provided especially the medical insurance “Mutuelle de santé” and where possible, the contractor may assist with the improvement of healthcare infrastructure.	Contractor Community Liaison and Health Officer WASAC
Spread of Communicable diseases. The influx of new workers to the project area could bring with it an increase of communicable diseases, HIV/Aids, STD and Covid-19.	Awareness campaigns on hygiene and sanitation, how these diseases spread and how to avoid their contaminations.	Contractor Community Liaison and Health Officer WASAC
Respiratory diseases due to dust emission from transport and vehicles and machineries on roads	<ul style="list-style-type: none"> <li>○ Control speed limits;</li> <li>○ cover trucks transporting volatile construction materials</li> <li>○ Ensure haul trucks are not overloaded</li> <li>○ Control of moisture content on haul road via sprinkling; Monitoring to ensure all dust emission are within</li> </ul>	Contractor Environmental Officer WASAC

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Potential Risk	Mitigation Measures	Responsible
	national and international best practice limits.	
Increased road accidents	<ul style="list-style-type: none"> <li>○ Control speed limits;</li> <li>○ Ensure haul trucks are not overloaded and are covered where necessary;</li> <li>○ Erect speed control signs</li> <li>○ Sensibilization among local people especially children to avoid suspending themselves on the trucks</li> <li>○ All measures are written in separate Traffic Management Plan</li> </ul>	Contractor WASAC Traffic Police
Diffuse run-off from roads, construction areas and other disturbed areas may contain elevated concentrations of suspended solids or pollutants.	<ul style="list-style-type: none"> <li>○ Ditches will channel surface water runoff to the designated areas</li> <li>○ Maximum reuse or recycle of process waste water;</li> <li>○ Water monitoring will be conducted.</li> <li>○ Access roads and ditches maintenance where necessary</li> </ul>	Contractor WASAC District Environmental Officer
Noise will be significant during construction.	<ul style="list-style-type: none"> <li>○ Operating hours of the open pit activities only during the daily hours;</li> <li>○ Speed restrictions on site traffic</li> </ul>	Contractor WASAC Community Liaison
Potential Economic impact on household livelihoods	<ul style="list-style-type: none"> <li>○ Local residents will be hired where possible</li> <li>○ Implementation of a livelihood restoration program in the Districts (eg: avoid non regal increase of</li> </ul>	Contractor WASAC Districts authorities

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Potential Risk	Mitigation Measures	Responsible
	food price in the project area)	
Loss of properties due to project activities	<ul style="list-style-type: none"> <li>○ Ensure expropriation and compensation are carried out as per the ARAP and expropriation Law</li> <li>○ All compensations and expropriation should be paid prior to commencement of works</li> </ul>	<p>Contractor WASAC</p> <p>Community Liaison and Health Officer</p>



## **CHAPTER XI: TRAFFIC MANAGEMENT PLAN**

### **11.1. Traffic issues and problems**

The following issues related to traffic can be identified:

#### **Lack of traffic discipline**

- a. Trucks or construction machineries stop near intersections and in all lanes just in front of intersection without any consideration of traffic flow or stop in the middle of the road,
- b. Trucks and construction machineries drive at high speed in the project area and can cause serious accidents,
- c. Vehicles stop near intersections and in all lanes just in front of intersection without any consideration of traffic flow or stop in the middle of the road to pick up and/or drop passengers,
- d. Motorized vehicles are parked along roads, even if parking is forbidden.

#### **Poor pedestrian facilities and behavior**

- a. Pedestrians walk on the roadway because sidewalks are being upgraded, closed or occupied by unauthorized parking,
- b. Pedestrians cross the road under construction everywhere and any time even if trucks, construction machineries or vehicle are passing through.
- c. In roundabouts, pedestrians are waking anywhere and anytime when they want.

#### **Poor Traffic Operation**

- a. The flag-person directs traffic against traffic/safety signals,
- b. The flag-person uses sign posts which are not visible at distance or during darkness periods to direct traffic.
- c. Many obstructions such as construction materials, construction equipment, and construction wastes are occupied in road spaces.

#### **Poor Traffic Management Facilities**

- a. Road markings are non-existent or out of paint and lanes are not marked on the roadway,
- b. Very few or poorly made road signs are installed on the road corridor and junctions,

**Poor Traffic Signals**

- a. No truck, construction machineries and vehicle drivers follow traffic signal,
- b. Some of the traffic signals are malfunctioning.

**Poor Compliance for Drivers**

Most people do not follow traffic rules properly because most drivers are not well-trained or are reluctant to abide by the traffic rules. Table below proposes counter measures for the traffic issues.

Table 29 **Traffic Issues and Control Measures**

ISSUES	CAUSE	CONTROL MEASURES	RESPONSIBLE
o Lack of traffic discipline	o Trucks or construction machineries stop near intersections	o All trucks and machineries should not stop near intersection	o Contractor o Health and safety officer o Flag-person
	o Trucks and construction machineries drive at high speed	o Speed limit sign posts should be installed and a flag-person to ensure compliance	o Contractor o Health and safety officer o Flag-person
	o Vehicles and construction machineries stop in the middle of the road	o Vehicle should be prohibited to stop in the middle of road when not at duty	o Contractor o Health and safety officer o Flag-person
	o Motorized vehicles are parked along roads	o A parking should be provided	o Contractor o Health and safety officer o Flag-person
o Poor pedestrian	o Pedestrians walk on the roadway	o Ensure sidewalks are not occupied by	o Contractor o Health and

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<b>ISSUES</b>	<b>CAUSE</b>	<b>CONTROL MEASURES</b>	<b>RESPONSIBLE</b>
facilities and behavior		unauthorized parking	safety officer ○ Flag-person
	○ Pedestrians cross the road under construction everywhere and any time even	○ Pedestrians should be guided when crossing the road under construction	○ Contractor ○ Health and safety officer ○ Flag-person
	○ Pedestrians are waking in roundabouts, anywhere and anytime when they want	○ Pedestrian should be stopped from walking in the round or guided when construction activities are being carried out	○ Contractor ○ Health and safety officer ○ Flag-person
○ Poor Traffic Operation	○ The flag-person directs traffic against traffic/safety signals	○ The flag-person should follow the safety signals provided	○ Contractor ○ Health and safety officer ○ Flag-person
	○ The flag-person uses sign posts which are not visible at distance or during darkness periods to direct traffic	○ New and visible sign posts should be provided	○ Contractor ○ Health and safety officer ○ Flag-person
	○ Many obstructions such as construction materials, construction equipment, and construction wastes are occupied in road	○ All obstructions should be removed on the road space and corridor	○ Contractor ○ Health and safety officer ○ Flag-person

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<b>ISSUES</b>	<b>CAUSE</b>	<b>CONTROL MEASURES</b>	<b>RESPONSIBLE</b>
	spaces.		
○ Poor traffic management facilities	○ Road markings are non-existent or out of paint and lanes are not marked on the roadway near project activities	○ Ensure all required sign posts are installed or marked on the roadway near project activities	○ Contractor ○ Health and safety officer ○ Flag-person
	○ Very few or poorly made road signs are installed on the road construction corridor and junctions.	○ Ensure worn out sign posts are removed and replaced by new ones	○ Contractor ○ Health and safety officer ○ Flag-person
○ Poor traffic Signals	○ No truck, construction machineries and vehicle drivers follow traffic signal	○ Ensure all drivers comply with traffic signs. Failure to comply sanctions should be provided	○ Contractor ○ Health and safety officer ○ Flag-person
	○ Some of the traffic signals are malfunctioning.	○ Ensure malfunctioning sign posts are replaced	○ Contractor ○ Health and safety officer ○ Flag-person
○ Poor compliance for drivers	○ Most people do not follow traffic rules properly most of drivers are not well-trained or are reluctant to abide by the traffic rules.	○ Toolbox meetings about traffic rules should be provided to all workers and drivers	○ Contractor ○ Health and safety officer ○ Flag-person

## 11.2. Road safety signs

Road safety signs to be used for Mugesera water supply project can be classified basing on the purpose and message intended as:

**Regulatory signs:** regulatory road sign are signs that are used to indicate or reinforce traffic laws, regulations or requirements which apply either at all times or at specified times or places upon a road, street or highway under use or construction the disregard of which may constitute a violation, or signs in general that regulate public. These include signs indicating: Stop, Do not enter, No parking, No hooting, Slow down, Students crossing, Speed Limit, Road closed, etc.

**Warning signs:** Warning sign is a type of sign which indicates a potential hazard, obstacle or condition requiring special attention. Some are traffic signs that indicate hazards on roads that may not be readily apparent to a driver. The warning signs usually contain a symbol and include signs indicating: Men at Work, Narrow road, Humps ahead, Zebra crossing, etc.

**Advisory signs:** Advisory sign posts are often seen under a warning sign and typically placed at sharp curves, exits, or exit ramps.

## **CHAPTER XII: CHANCE FIND PROCEDURE**

### **12.1. Purpose of the chance finds procedure**

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project design, construction or operation. It is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

### **12.2. Responsibility**

WASAC as the implementation institution is responsible for siting and designing the project Ngoma District to avoid significant damage to cultural heritage. When the proposed location of a project is in areas where cultural heritage is expected to be found, either during construction or operations, the client will implement chance find procedures established through the Social and Environmental Assessment. The client will not disturb any chance finds further until an Assessment by a competent specialist is made and actions consistent with the requirements of this Performance Standard are identified.

### **12.3. Scope of the chance finds procedure**

This procedure will be applicable to all activities conducted by the personnel, including contractors for the project that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

### **12.4. Induction/Training**

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

## 12.5. Details on chance find procedures

If any person/worker under the project discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

- 1) Stop all works in the vicinity of the find, until a solution is found for the preservation of these artifacts, or advice from the relevant authorities is obtained especially the Institute of National Museums of Rwanda (INMR);
- 2) Immediately notify the foreman. The foreman will then notify the Site engineer and the Environment Officer of the contractor;
- 3) Record details in Incident Report and take photos of the find;
- 4) Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- 5) Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
- 6) Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the INMR, once completed.
- 7) In case of significant find the INMR, will be informed immediately and in writing within 7 days from the find,
- 8) The onsite archaeologist provides INMR with photos, other information as relevant for identification and assessment of the significance of heritage items.
- 9) The INMR will investigate the fact and provide response in writing.
- 10) Decisions on how to handle the finding shall be taken by the responsible authorities which is INMR. This could include changes in the layout (such as when finding an

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irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;

11) Construction works could resume only after permission is granted from the responsible authorities.

12) In case no response received, this will be considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photocopy of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports are kept.

### **Additional information: Management options for archaeological site**

- *Site avoidance.* If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option);
- *Mitigation.* If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- *Site Protection.* It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

## **12.6. Management of replicable and non-replicable heritage**

Different approaches for the finds apply to replicable and non-replicable heritage.

### ***Replicable heritage***

Where tangible cultural heritage that is replicable (Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the



particular eras and cultural values they represent are well represented by other sites and/or structures.) and not critical is encountered, mitigation measures will be applied.

**The mitigation hierarchy is as follows:**

- a) Avoidance;
- b) Minimization of adverse impacts and implementation of restoration measures, in situ;
- c) Restoration of the functionality of the cultural heritage, in a different location;  
Permanent removal of historical and archaeological artefacts and structures;
- d) Compensation of loss - where minimization of adverse impacts and restoration not feasible.

***Non-replicable heritage***

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

Nonreplicable cultural heritage (Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.) must not be removed unless all of the following conditions are met:

- a) There are no technically or financially feasible alternatives to removal;
- b) The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

## **12.7. Human remains management options**

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

***There are two possible courses of action:***

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- a) Avoid. The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- b) Exhume. Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain procedures may need to be followed before development activities can recommence in the area of the discovery.

### **XIII. CAPACITY BUILDING IN NATURAL RESOURCES AND ENVIRONMENT MANAGEMENT**

#### **13.1. Training needs for capacity building**

In the District of Ngoma and its ten Sectors, as well as among Non-Governmental Organizations working in these administrative entities and involved in natural resources exploitation, environmental management, health care and social welfare development; there are strong needs for human capacity building in order to fulfill their responsibilities, but also maintain within their working places environmental, social, safety and health better conditions.

These needs can be expressed in the following terms:

- ✓ the need for senior technicians working in District, Sectors and Cells to enhance their capacity in collecting field data, analysis of these and elaborate efficient integrated management plans of natural resources existing in their administrative entities;
- ✓ the need for technical staff in NGOs, young workers in public and/or private Organizations involved in research or consultancy works, to know how to evaluate and monitor changes in environmental, safety and health parameters susceptible to generate serious effects on human life and environment in general;
- ✓ the need to implement a comprehensive peer review information-communication on the development programs of their Institutions.

In this line, several subjects included in the following themes (but not limited to) would be taught to various staff, workers in public and private institutions, young working in NGOs and others stakeholders.

- ✓ Integrated Natural Resources Management (INRM)
- ✓ Wastes management and depollution;
- ✓ Health and safety hazards management
- ✓ Biodiversity evaluation and conservation
- ✓ Environmental studies

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**Table 30: Table of Capacity building plan**

<b>Theme</b>	<b>Subject</b>	<b>Beneficiaries</b>	<b>Duration</b>
<b>Integrated Natural Resources Management</b>	<p>-Watershed, lowlands and water bodies integrated management.</p> <p>-Protection of Environmental Receptors against natural calamities/hazards (flooding, landslide drought etc...).</p>	<p>-District and Sectors' technicians and NGO's staff involved in NRM projects.</p> <p>-Technical staff in Private companies dealing with natural resources exploitation and conservation.</p>	<p>-Two training sessions of 4 working days during a year period</p>
<b>Environmental studies</b>	<p>-National and regional Environmental Policies Guidelines and AfDB/WB safeguards.</p> <p>-Conduct Environmental studies (ESIA, ESMF and Environmental Audit Process).</p> <p>-ESMP evaluation and Monitoring.</p>	<p>-District and Sectors' technicians and NGO's staff involved in natural resources exploitation and environmental conservation programs.</p> <p>-Technical staff in private institutions and manufacturing companies (Level from S 6).</p>	<p>-Three training sessions of 3 days during a year period.</p>
<b>Biodiversity Evaluation and Conservation</b>	<p>Deliverance of Information-Education and Awareness (IEA) on biodiversity conservation.</p> <p>Applied techniques for increasing and protect biodiversity in residential areas.</p>	<p>-District and Sectors' technicians and NGO's staff involved in biodiversity conservation.</p> <p>-Technical workers in private companies and leaders of Community Based Organizations.</p>	<p>-Two training sessions of 2 days during a year the first and fourth year</p>

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<p align="center"><b>Waste management and depollution</b></p>	<p>Waste water management techniques.</p> <p>Solid waste sorting, recycling and reuse.</p> <p>Use of technical tools and biological kits for pollution parameters monitoring.</p>	<p>-All technical staff of development projects</p> <p>-District and Sectors' technical staff</p> <p>-Senior technical staff of NGOs and Community based organizations (CBO)</p>	<p>-Two training sessions of 2 days during a year period</p>
<p align="center"><b>Health and safety hazards management</b></p>	<p>Occupational health and safety plan applied in a working environment</p> <p>Diseases awareness and prevention within and around executed projects.</p>	<p>-All works in the project by groups rotation</p> <p>-Local government administrators</p> <p>-Residents in and around development projects under execution in the zone.</p>	<p>-Short training sessions during 2 to 3 hours</p> <p>-Several training sessions during a year.</p>

## **CHAPTER XIV: STAKEHOLDERS AND PUBLIC CONSULTATIONS**

### **14.1. Background**

Consultation and participation is a process through which stakeholders influence and share control over development initiatives, and participate in decisions on resources that affect them. It is a two-way process where the executing agencies, policy makers, beneficiaries and affected persons discuss and share their concerns in a project process. According to the AfDB policies, project affected persons and host communities are to be meaningfully consulted early in the planning process and encouraged to participate in all stages up to the implementation of the project. Prior to commencement of works and during ESIA scoping and sites visits, consultations were held with potential Project Affected Persons, neighboring communities of the project areas, local leaders and client personnel.

The stakeholders and public consultations were carried out in accordance with the provisions of Ministerial Decree N° 001/2019 of 04/15/2019 establishing the list of projects to be the subject of an environmental impact study, instructions, conditions and procedures to carry out the environmental impact assessment

### **14.2. Stakeholders and Public consultations objectives**

The principal objective of these consultations is to inform, consult and involve the stakeholders at different levels concerned by the project in order to ascertain their sensitivity to the project (acceptance, reluctance, nature of fears and requirements), the needs of the actors and their recommendations in view of good environmental performance of the project.

The specific objectives of the ESIA stakeholders and public consultations process are to:

- ✚ Make the ESIA study participatory and transparent;
- ✚ Share the potential positive and negative environmental and social impacts and their proposed mitigations;
- ✚ Inform the PAPS about their right and how they will be put in actions;
- ✚ Explain and make the compensation process transparent, but more detailed in the ARAP;
- ✚ Determine the attitudes of PAPS towards the proposed project; and finally
- ✚ Provide a platform for future consultation by:
  - reducing conflict through early identification of contentious issues;
  - improving transparency and accountability of decision making;
  - facilitating participation to increase public confidence in the ESIA process;

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- Identifying stakeholders with whom further dialogue will be constructive in subsequent stages of the project.

### **14.3. Consultations with key stakeholders**

Discussions with decision making bodies, key stakeholders, sectors institutions and environmental experts were made on the concepts and nature as well as the importance of Mugesera Water Supply System project, giving emphasis on levels of public participation, role of key stakeholders and joint contributions of these actors to the success of the project. In addition, the scope of the proposed project and possible means of maximizing local communities' social, economic and environmental benefits from the project implementation were underlined.

Key stakeholders and institutions with whom consultations have been done include: (i) Ministry of Environment (MoE) , (ii) Rwanda Water and Forestry Authority (RWFA), (iii) Regional Direction of WASAC, (iv) High Authority of NGoma District, (v) Rwanda Development Board (RDB), (vi) Zaza Sector Administration and (vii) Project Supervisor/Consultant.

The team of Consultants has been received by the Vice- Mayor of Ngoma District Authority.

**Figure 16 Vice Mayor of Ngoma District receiving the Consultant team**



At Zaza Administrative Sector, the team of Consultants has been received by the Executive Secretary of the Sector accompanied by the key technicians.

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**Figure 17: Executive Secretary of Zaza Sector receiving the team of Consultants**



At the regional Direction of Water and Sanitation Corporation (WASAC), the team of consultants was received by the Director accompanied by the water technical team.

**Figure 18: Regional Direction of WASAC receiving team of Consultants**





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The team of Consultants has also received information from key informants relative to local population's perceptions and expectations about the new water project.

**Figure 19: Exchange with Key informant about the project**



**Table 31: Recommendations from stakeholder's consultations to be considered**

N°	Recommandations	Aims	Actor concerned
1	During construction period of project infrastructures, especially pipelines installation, please consult map of existing old pipelines route in order to avoid damages of these and prevent water to residential people.	Avoid preventing water to local population through protection of existing pipelines.	Eng. NYIRAHABIMANA Francoise
2	At the beginning, involve Sectors officers in the project in order to avoid delivery of permits to other Companies for the same lands already dedicated the water project infrastructures, especially in Karemba Sector.	To keep the selected lands dedicated for Mugesera WSS project and avoid future conflicts of interests	Mrs. KIRENGA Providence
3	Initiate a monitoring program for physic-chemical parameters measurements of water due to uncertain sludge management and appropriate waste water treatment from WTP.	Avoid the pollution of Mugesera water body	DUSABE Jean Pierre
4	There will be likely sedimentation pollution of Mugesera water body due to watershed mismanagement with participation of local communities.	Avoid to collect Mugesera raw water charged with heavy suspended matters	Eng. NYIRAHABIMANA

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		which will be costly for water treatment.	Francoise
5	Recruitment of local residents for employment opportunities during construction phase should be a priority.	Improve the income of households in areas covered by the project.	NZAMWITAKUZE Epiphanie

#### 14.4. Consultations with potential Project Affected Persons (PAPs)

Local residents in the project areas have been consulted during the meetings which were conducted by the team of consultants accompanied with CEDO of Sectors.

**Figure 20: Consultation with local community**



The consultation has gathered identified potential PAPs who will likely be affected by the project activities and some of nearest local residents inhabiting closer the selected sites where water infrastructures will be constructed. The main objective of the public consultations with PAPs was to gather information on their concerns, perceptions, reactions and fears of the livelihood changes to be brought about as a result of the Project implementation. Other specific objectives were the following:

- Explain the project in deep to local people;
- Gathering information on socio- economic and environmental information on the community;
- Explain the process of the RAP and its importance;

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- Explain some important concepts of the new expropriation law;
- Introduce the importance of resettlement grievance mechanism to people.

During the presentation sessions, local communities were given some detailed information about the project by consultant team. The presentation highlighted the project background, components, objectives, expected upcoming activities, potential socio-economic and environmental impacts. After the presentations the community was given opportunity to give their views, comments and queries. The general point of view expressed by local community was that the project is really needed in their living environment. Questions were answered, clarifications offered and their recommendations recorded.

Meetings were arranged to have a general and same understanding on the benefits and negative effects of the project. This meeting raised an intense discussion on the following:

- The needs of the Mugesera WSS project;
- Identification of different problems related to the project;
- Related socio-cultural and economic parameters to be considered in enhancing and mitigating associated positive and negative impacts respectively;
- Suggestions and propositions on what can be done to address raised problems due to the potential displacement of people and their affected properties.

**Table 32: Summary of issues raised during public consultation and responses provided**

Issues raised	Response provided to raised issue
Population was worried about project's concept, its extension, what the Government is asking them to loose or contribute for its implementation.	Consulted Communities in the project areas were aware of the project but they didn't know more details about it. After the consultants have explained the project components, objectives, positive advantages and adverse impacts to be mitigated, scope and implementation schedule, they have agreed and acknowledged the considerable importance of the project for their development.
How is the management of negative effects of the Project implementation to the local community and risks likely to	It was explained that whenever expropriation / compensation shall be required, affected properties shall be properly compensated with reference to the national Expropriation/compensation Law.

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<p>be encountered in the followings:</p> <ul style="list-style-type: none"> <li>▪ Loss of houses and related accessories ;</li> <li>▪ Temporal loss of agriculture lands;</li> <li>▪ Inappropriate compensation for affected assets;</li> <li>▪ Loss of crops due to dumping earth material from excavated areas;</li> <li>▪ Loss of trees &amp; fruits along water pipelines installation.</li> </ul>	<p>The consultants have explained that:</p> <ul style="list-style-type: none"> <li>▪ Compensation for any asset to be affected by implementation of this project shall be done and basing on market value;</li> <li>▪ It was agreed upon that PAPs shall receive their compensation before the beginning of any project activity;</li> <li>▪ Only the owner of the affected asset will receive the compensation;</li> <li>▪ Local residents shall be given priorities during recruitment;</li> <li>▪ Construction shall start after harvest the crops if possible during dry season.</li> </ul>
<p>Issue of water shortage during construction phase due to the risk of damages affecting the existing pipelines;</p>	<p>It was also explained that during construction phase, WASAC will help the contractors with maps indicating the existing water pipelines routes in order to avoid any accident of cutting the pipes. In case an accident will occur, quick reparation by the contractor was promised.</p>
<p>Which will be the benefits expected by different stakeholders from the new project?</p>	<p>Project benefits were explained and identified as:</p> <ul style="list-style-type: none"> <li>▪ Increased income for different employed personnel that will contribute to the welfare of their families;</li> <li>▪ Access to cleaned and enough water which will enhance and promote hygiene and sanitation;</li> <li>▪ The project is located in areas having many schools including boarding ones like Lycee de Zaza, TTC Zaza, GS Zaza, Petit Seminar Zaza, Nazareth etc..., a health center that suffer during all seasons as the available pipelines don't provide sufficient quantity of water versus water demand.</li> </ul> <p>This project will be a solution of water</p>

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	<p>problems in the whole District, especially in Zaza Sector.</p> <ul style="list-style-type: none"> <li>▪ Improved wellbeing of households.</li> </ul>
The willing to accept and participate in resources mobilization for all involved stakeholders of the project.	<ul style="list-style-type: none"> <li>▪ Districts/Sectors to arrange and assist the compensation and expropriation process;</li> <li>▪ Local communities are willing to give land to WASAC as they are aware that they will be compensated and after implementation of this project, land will be reused as usually.</li> </ul>

**Table 33: List of consulted persons and their positions during public consultation**

<b>N°</b>	<b>Names</b>	<b>Institution</b>	<b>Position</b>
1	Eng. NYIRAHABIMANA Francoise	WASAC	Support Engineer/Ngoma District
2	DUSABE Jean Pierre	WASAC	District Water Technician
3	UMULISA Jeanne	NGOMA DISTRICT	FOCAL POINT: Water and Sanitation Development
4	The List To Be Completed After Other Consultation In Kigali	WASAC	SPIU Coordinator
6	The List To Be Completed After Other Consultation In Kigali	CIRA	Manager of Utility Planning Unity
7	The List To Be Completed After Other Consultation In Kigali	ITEC JV CIRA	Project Coordinator
8	The List To Be Completed After Other Consultation In Kigali	WASAC	Environmentalist
17	SINGIRANKABO Jean Claude	Zaza Sector	Executive Secretary
18	NDURURUTSE Isaie	Zaza Sector	Land Manager

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19	NKURANGA David	Nyagasozi Cell	CEDO
20	NZAMWITAKUZE Epiphanie	Sugira village	Village Monitor
21	NGENDAHIMANA Celestin	Sugira village	PAP
22	IZEMANA Eric	Sugira village	Local Resident
23	MURWANASHYAKA Ignace	Sugira village	PAP
24	IZERIMANA Joseph	Sugira village	PAP
25	NKUNZURWANDA Vedaste	Sugira village	Local Resident
26	KABAGENI Forothea	Sugira village	Local Resident
28	VUGUZIGA Clementine	Sugira village	Local Resident
29	MUKAMUGANGA Agnes	Sugira village	Local Resident
30	NTIRANDEKURA Clement	Sugira village	Local Resident
31	WIHOGORA Cecile	Sugira village	Local Resident
32	MUKAMUGANGA Agnes	Sugira village	Local Resident
33	HATEGEKIMANA Jean Bosco	Sugira village	Local Resident
34	UWINGABIRE Verena	Sugira village	Local Resident
35	UWINEZA Denyse	Sugira village	Local Resident
36	DUSABIMANA Pacifique	Sugira village	Local Resident
37	NTIRANDEKURA Clement	Sugira village	Local Resident
38	TUYISABE Emmanuel	Sugira village	Local Resident
39	KABAGENI Forothea	Sugira village	Local Resident
40	UWARUGIRA Beatrice	Sugira village	Local Resident
41	BIRAMAHIRE James	Kanyinya village	PAP
42	MUKAMUGANGA	Nyagatugunda	PAP

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	Prudencienne representing NSABIMANA Innocent		
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**Table 34: List of Consulted potential PAPs**

No	Names	Village	Cell	Sector
1	BIRAMAHIRE James	Kanyinya	Mutsindo	Gashanda
2	NSABIMANA Innocent represented by MUKAMUGANGA Prudencienne	Kizenga	Nyagatugunda	Zaza
3	NGENDAHIMANA Celestin	Sugira Village	Nyagasozi	Zaza
4	IZERIMANA Joseph	Sugira Village	Nyagasozi	Zaza
5	MURWANASHYAKA Ignace	Sugira Village	Nyagasozi	Zaza

## **CHAPTER XV: CONCLUSION**

An effective implementation of Mugesera Water Supply System will surely generate an array of positive socio-economic benefits as mentioned in point 6.4. above, and by the way, will accelerate access to clean water supply in Ngoma District, contribute to alleviation of poverty within the area through improvement of socio-economic activities generating revenues in rural zones as well as enhance hygiene and sanitation hence reducing water borne diseases

Nevertheless, as development project to be implemented in densely populated region, it will likely generate adverse impacts to human community and environment in general, regarding for example acquired individual lands and destruction of crops for water infrastructures construction, mismanagement of sludge and backwashed water susceptible to pollute the lake and affect aquatic biodiversity etc....

With reference to the potentials impacts and risks to be encountered in the implementation of the project, the present ESIA study proposes adequate preventive and mitigation measures to offset these adverse impacts in return. Moreover, in the present ESIA report, all the identified potential positive and negative impacts have been highlighted and responsibilities to implement the proposed mitigations measures as well as monitoring the execution of project's activities have been mentioned.

Therefore, the implementation of the ESMP consigned in the present report, conducting regular inspections and audits, plus continuous monitoring of project's activities implementation, all these will constitute favorable conditions for the success of the project through the complete achievement of its objectives.

The envisaged total benefits of Mugesera water supply system project during its operational phase will far outweigh the sum total of adverse impacts highlighted during the other phases of project implementation.

In conclusion, the implementation of Mugesera WSS project's activities will not pose irreversible damages to the socio-environment and there is no adverse impact for which remediation is not feasible. Furthermore, we assume that the socioeconomic returns as a result of all planned activities efficiently executed worth to the investment.



## **CHAPTER XV: REFERENCES**

- AFRICAN DEVELOPMENT BANK'S INTEGRATED SAFEGUARDS SYSTEM; Policy Statement and Operational Safeguards, December 2013.
- Rwanda's Vision 2050.
- National Strategy for Transformation 1(NST1) for Rwanda 2017-2024.
- The Constitution of the Republic of Rwanda 2003 and 2015.
- Rwanda's Law on Environment 2018.
- Law determining the use and management of water resources in Rwanda 2018.
- National occupational, Safety and Health Strategy for Rwanda 2019.
- Rwanda's Urbanization and rural settlement Sector strategy 2017 for 2018-2023.
- Rwanda's National Biodiversity strategy and action Plan 2016.
- Rwanda's National Policy for Water resources management 2011.
- Rwanda's National Health Policy 2016.
- Rwanda Environment and Climate Change Policy 2019.
- Rwanda Vision 2020, 2001.
- Law no. 18/2007 of 19/04/2007 relating to expropriation in the public interest for Rwanda 2007.
- Ministerial order No. 003/2008.Relating to the requirements and procedure for Environmental Impact Assessment, for Rwanda 2008.
- Ministerial Order establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct environmental impact assessment for 2019.
- Ministerial order No. 007/2008.Establishing the list of Animal and plant species, for Rwanda 2008.
- National Land policy for Rwanda 2004.
- Sector policy on water and sanitation in Rwanda 2004.
- Law N° 08/2005 of 14/07/2005.Determining the use and management of Land in Rwanda 2005.
- Technical report, REMA, 2020: Lakeshores ecologically sensitive areas
- Ngoma District website, [www.ngoma.gov.rw](http://www.ngoma.gov.rw) ; visited on 6<sup>th</sup>April 2021
- Ngoma DDP (2013-2018).
- Ngoma District Potentialities; Ngoma District Health Strategic Plan 2011-2012
- Mugesera-Sake Feasibility study, CIRA JV ITEC Eng. Ltd.
- EICV4
- EICV5



## **CHAPTER XVI: ANNEXES**

### **ANNEX I: TERMS OF REFERENCE**

#### **TERMS OF REFERENCE FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY OF THE PROPOSED MUGESERA WATER SUPPLY SYSTEM PROJECT**

##### **INTRODUCTION**

##### **1.1. Context**

Water supply affects broad areas of human life. The provision of adequate Water Supply System services is more generally a prerequisite and indicator for socio-economic development. The Government of Rwanda has a plan to develop Towns near borders interaction with the neighboring countries. Towns would decentralize urbanization and reduce the rate of immigration to the city of Kigali, especially youth and unemployed. Those towns include :

- Musanze: borders South West of Uganda and is on the road linking Rwanda and Uganda;
- Nyagatare and Gatsibo: border Southwest of Uganda and Northwest of Tanzania;
- Rubavu and Nyabihu: Rubavu borders Eastern DRC;
- Ngoma: borders Northern Burundi;
- Ngororero, Muhanga and Kamonyi: at the centre of Rwanda. There is a high economic development and estate development along the road Kigali-Muhanga mainly in Kamonyi District;
- Nyanza and Ruhango: Located in the centre of the country and have water scarce area (Amayaga).

In line with the above, through the loan received from African Development Bank (AFDB), Water and Sanitation Corporation (WASAC ltd) representing the Government of Rwanda intends to apply a portion of it to feasibility study, detailed designs and the supervision of the construction of Mugesera Water Supply System (MWSS), Phase 1 (6,000 m<sup>3</sup>/day treatment plant and distribution network). The target is to increase the access to clean water in Ngoma District.

Objectives and scope of Environmental and Social Impact Assessment (ESIA) Study

The purpose of this document is to identify for the decision making institutions, Water and Sanitation Corporation (WASAC), Ngoma District as well as the public, the information required

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for an Environmental and Social Impact Assessment (ESIA) report with respect to the proposed implementation of Mugesera Water Supply System (MWSS) project.

The developer, Water and Sanitation Corporation, through the selected ESIA expert mandated by a Joint Venture Companies CIRA SAS and ITEC will prepare and submit an ESIA report which describes the environmental and social impacts of the proposed Project to human community and the environment in general, and propose appropriate mitigation measures for to minimize, reduce, mitigate or compensate those impacts during all phases of the projects implementation.

The report will include tables highlighting the environmental and social management and monitoring plans and other that cross-reference the report to the ESIA Terms of Reference. Its final submission will be based upon these Terms of Reference and issues raised during the public consultation process.

#### **Requirements**

This study is justified by:

- the requirements prescribed under article 30 of the Organic Law, the General ESIA Guidelines 2006, the Ministerial Order 001/2019 of 15/04/2019 relating to the requirements and procedures for environmental impact assessment.
- Operational Safeguard 1: Environmental and social assessment of African Development Bank. This safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.

## **II. TASKS TO BE ACCOMPLISHED BY THE CONSULTANT**

### **Task 1: Description of the proposed Mugesera WSS project:**

The Consultant will provide a detailed description of the relevant components of the project using maps, drawings, and appropriate scale where necessary and include the following information: (i) Entitlement and site location of the project, (ii) General layout of the project and its infrastructures, (iii) Project objectives and components, (iv) Land use plan related to selected intake and water treatment plant installation, (v) Reservoirs, pumping stations and pipelines network technical specification, (vi) Upgrade of preexisting public utilities, and (vii) Description of prevention and security measures.

Considering all planned infrastructures to be set, their operation and maintenance as well as the location of the project closer to Lake Mugesera and Sake as well as Ngoma District landscape, it is obvious that project implementation will generate negative impacts which should be minimized,

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reduced, mitigated or compensated during all stages of the project implementation. Therefore, it is necessary to elaborate an ESIA document which will serve as an important tool to manage the impacts generated.

#### **Task 2: Baseline Physical- Biological and Socio-economic conditions**

The Consultant will collect and present baseline data on the relevant environmental and socioeconomic characteristics of the study area. He will highlight the pre-project environmental and socioeconomic conditions in areas covering the project.

For physical environment: data on climate, topographical features, hydrological system, geology, soils and wastes discharged will be collected and reported.

For biological environment: flora and fauna species diversity and their conservation status; sensitive ecological zones to be preserved; and potential disease vectors in the shallow bays of the lakes Mugesera and Sake and in wetlands area.

For sociocultural and economic environment: socio-cultural characteristics of the population, educational characteristics, water and sanitation, health, existing socioeconomic infrastructures; employment and income generation as well as economic activities in the sectors covering the project.

#### **Task 3: Relevant Policy-Legal and Institutional frame work**

The Consultant will review and briefly describe policies, laws and regulations prescribed at national, regional and international levels that govern environmental and social issues, safety

and health coverage and relevant to the construction, operation and maintenance of the Mugesera water supply system project.

The Consultant will review and analyze laws, regulations, guidelines and international treaties /conventions that govern the conduct of the environmental and social impact assessment as well as given instructions, requirements and procedures to conduct ESIA study.

The Consultant will identify and report the institutions and their respective roles in the ESIA development process as well as in the implementation and monitoring of Environmental and Social Management Plan (ESMP).

#### **Task 4: Description of the Potential Impacts of the Mugesera WSS Project**

The Consultant will describe direct and indirect impacts of the Mugesera WSS project on human communities and on the environment in general during all phases of the project. He will produce a

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tool highlighting on how to manage all impacts generated by the project implementation. He will gather and analyze the information on:

- Description of the likely significant impacts of the project on the human community and environment resulting from earth materials and solid waste accumulation during intake, water treatment and reservoirs construction, washed water and sludge evacuation,
- Lake's water pollution, dust emission as well as nuisances and esthetical effect from the infrastructures construction;
- Description of likely impacts of waste water from householders receiving distributed water from WASAC company and proposition of measures to avoid, reduce and/or compensate those impacts;
- Description of the impacts of the project on the socio economic environment at District and national levels.
- The Consultant will describe the method used in the impacts analysis and their classification.

#### **Task 5: Analyze the Alternatives to the project**

Consultant will analyze alternatives to the Mugesera project based on site location, technology selection, compliance to environmental and social issues, operating cost and construction techniques.

He will describe different alternatives to the project and their respective impacts, including the '*no project*' alternative to demonstrate how should be the socioeconomic and environmental conditions in the area without the project.

He will evaluate and compare different alternatives in terms of specific potential environmental and social impacts, suitability under local conditions and justify the selected choice that would be environmentally and socioeconomically well sound.

#### **Task 6: Develop the Environmental and Social Management Plan**

The environmental and social management plan focuses on five generic issues: potential impacts generated, proposed mitigation measures, institutional responsibility to implement the mitigation measures, monitoring and estimated implementation cost of mitigation measures. The emphasis on each of these issues depends on the context-specific project needs.

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**Proposed mitigation measures:** the task 4 provides potential impacts and the Consultant will propose feasible and cost-effective measures envisaged for avoiding, reducing, minimizing or compensating potential adverse impacts as well as estimating their implementation cost. He will consider compensation to affected parties for impacts that cannot be mitigated. Concerning estimation of measures implementation cost, the consultant will consider planned actions, financial needs, schedule, required staff/personnel and other necessary support services to implement the mitigation measures.

**Institutional responsibility to implement measures:** the Consultant will identify and report national institutions, non-governmental organizations and private sector associations with capacity to implement proposed mitigation measures.

**Monitoring:** monitoring of environmental, social, safety and health issues will be required in all phases of the project in order to ensure that measures proposed and recommendations formulated in the ESIA report will be effectively incorporated and implemented

Monitoring of environmental, social and safety parameters will identify potential problems from the project development activities and will give basis data necessary for proposing, canceling or replacing inefficient measures as well as implementing effective corrective ones.

The Consultant will enumerate major issues that need to be monitored before, during and after Mugesera WSS project implementation. He will build a monitoring plan which will highlight especially the indicators to be monitored, the responsibilities for monitoring as well as sources of cost estimates for mitigation measures implementation. The indicators are selected according to the project context and major anticipated impacts.

#### **Task 7: Enhancing Institutional capacity for ESMP implementation**

In local government services as well as during Mugesera WSS project' operational phase, there will be strong needs for human capacity building in order to fulfill their responsibilities and maintain environmental, social, health and safety conditions.

In this line, the Consultant will prepare several subjects susceptible to be taught for various local government staff, workers in the project, other stakeholders and also propose a Capacity Building Plan (CBP) accordingly.

#### **Task 8: Organize and facilitate public consultations**

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As mentioned in the introduction, and in accordance with the provisions of the General ESIA guidelines and other attendant legislation, the Consultant will organize and facilitate public consultations.

Evidences related to stakeholders and public consultation meetings at different levels such as photographs, minutes of the meetings; addresses and signatures of consulted people will be provided and reported by the Consultant.

#### **Task 9: Preparation of the ESIA Report**

The ESIA report should be concise and limited to significant environmental, social and safety issues. The core text should focus on findings, a conclusion and recommendations supported by an analysis of the data collected and in-depth review of references consulted. Any additional important data will be presented in appendices. The outline of ESIA report will be as follows:

- ❖ Executive Summary;
- ❖ Introduction;
- ❖ Presentation of the Developer and his Consultant;
- ❖ Relevant Policy – Legal and Institutional Framework;
- ❖ Description of the Mugesera WSS Project, its objectives and components;
- ❖ Baseline Environmental and Socio-economic conditions;
- ❖ Description of environmental and social Impacts and mitigation measures;
- ❖ Analysis of the Alternatives to the project;
- ❖ Environmental and Social Management Plan (including monitoring issues)
- ❖ Institutional capacity building plan;
- ❖ Summary of public and stakeholders consultations;
- ❖ Conclusion and recommendations;
- ❖ List of references consulted
  
- ❖ Appendices:
  - Terms of reference;
  - Records of public and stakeholders consultations;
  - Detailed technical designs and layouts.

**Task 10:** Review the available Bank documents like the Loan/grant Agreement signed between the GOR and AFDB on 29<sup>th</sup> Nov 2017 and consider the environmental and social conditions to be respected in all MWSSP execution phases. Review also the AFDB's integrated safeguards system



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and Involuntary Resettlement Policy of 1995 and appreciate if these are triggered or not by Mugesera WSS project.

### **III DEADLINE**

The deadline of this study is on 28<sup>th</sup> April 2021.

### **IV. FOCUSES OF THE ESIA REPORT**

The ESIA report to be prepared should be mainly focused on: (i) the identification of impacts generated by execution of various infrastructures proposed for the project,

(ii) Proposition of appropriate mitigation measures to manage adverse impacts, and (iii) preparation of suitable environmental and social management plan as a tool used to reduce, minimize and/or eradicate impacting negative effects to human community and the environment in general.

Thus, the following areas/issues should be mainly checked and reported:

- ✚ Accumulation of earth materials from excavation, scrapping and leveling for infrastructures construction, water treatment plant, reservoirs, pipelines installation, drainage channels etc... and their management aspects;
- ✚ Accumulation of solid wastes from clearing, construction activities, installation of support utilities, connection of pipelines networks etc.. and their management aspects;
- ✚ Mismanagement of storm water from water treatment plant and supporting facilities and its consequences of erosion impacting on sensitive lake's ecosystem and wetlands areas;
- ✚ Evacuation of washed water and faecal sludge from the WTP, their drainage system and treatment technics in order to avoid pollution of soil and lake downwards;
- ✚ Occupational safety and health management plans proposed by contractors and their feasibility to ensure security during construction and operational phases;
- ✚ Procedures and results of expropriation/compensation of affected properties/assets belonging to Project Affected Persons (PAPs);
- ✚ Destruction of specific habitats and loss of their biodiversity;
- ✚ Water bodies pollution and their restoration.

### **V. REPORTING REQUIREMENTS**

The environmental and social impact assessment report will form an integral part of the project write up documents. The report should be based on the present terms of reference and an electronic copy (containing word and PDF files) of this should be uploaded in Rwanda Development Board's online system for review and approval.

### ***Mugesera Water Supply System Project: ESIA Report***

The deliverables will include both hard copies and soft copies. Hard copies will be 3 which will be submitted to the client as final documents.

#### **VI. DECISION AND AUTHORISATION ON THE SUBMITTED ESIA REPORT**

As mentioned on Chapter III- Article 11 of Ministerial Order N° 001/2019 of 15/04/2019, the authorized organ will communicate in writing its decision to the ESIA expert. The later, within twenty-four (24) hours of receipt of the decision from authorized organ must submit a copy of the written decision to the developer. Thus, in the transmission letter of ESIA report to RDB, the expert will mention a reference number of the letter and his full address.

#### **VI. CONSULTING TEAM**

The expert aligned to conduct the ESIA study is a registered ESIA Expert, affiliated to RAPEP as required by Chapter III- Article 6 of Ministerial Order N° 001/2019 of 15/04/2019 related to the instructions, requirements and procedures to conduct environmental and social impact assessment.

As the ESIA study requires an interdisciplinary analysis, the expert may be assisted by a socio-economist because the main activities of the project will be executed where human settlements and agriculture activities are developed.

#### **VII. REFERENCES CONSULTED**

The Consultant will align the list of data sources, background reports and studies, relevant publications and maps related to the project as well as other items to which the consultant's attention should be directed.

## ANNEX II. LIST OF CONSULTED PERSONS

Names	Location
Eng. NYIRAHABIMANA Francoise	WASAC Ngoma
DUSABE Jean Pierre	WASAC Ngoma
UMULISA Jeanne	Ngoma District
KIRENGA Providence	Ngoma District
SINGIRANKABO Jean Claude	Zaza Sector
NDURURUTSE Isaiah	Zaza Sector
NKURANGA David	Nyagasozi Cell
NZAMWITAKUZE Epiphany	Sugira village
NGENDAHIMANA Celestin	Sugira village
IZERIMANA Eric	Sugira village
MURWANASHYAKA Ignace	Sugira village
IZERIMANA Joseph	Sugira village
NKUNZURWANDA Vedaste	Sugira village
KABAGENI Dorothy	Sugira village
VUGUZIGA Clementine	Sugira village
MUKAMUGANGA Agnes	Sugira village
NTIRANDEKURA Clement	Sugira village
WIHOGORA Cecile	Sugira village
MUKAMUGANGA Agnes	Sugira village
HATEGEKIMANA Jean Bosco	Sugira village
UWINGABIRE Verenanda	Sugira village
UWINEZA Denyse	Sugira village
DUSABIMANA Pacifique	Sugira village
NTIRANDEKURA Clement	Sugira village
TUYISABE Emmanuel	Sugira village

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UWARUGIRA Beatrice	Sugira village
BIRAMAHIRE James	Kanyinya village
MUKAMUGANGA Prudence	Nyagatugunda village
NSABIMANA Innocent	Kizenga village
NGENDAHIMANA Célestin	Sugira village
MURWANASHYAKA Ignace	Sugira village