

RWANDA ENERGY GROUP

ENERGY UTILITY CORPORATION LIMITED (EUCL)

ELECTRICITY ACCESS ROLL-OUT PROGRAMME (EARP)

**RWANDA ELECTRICITY SECTOR STRENGTHENING PROJECT
(RESSP)**

**ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR PLANT DESIGN,
SUPPLY AND INSTALLATION OF LOW VOLTAGE AND MEDIUM
VOLTAGE LINES FOR PRODUCTIVE USERS IN RWANDA**

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EXECUTIVE SUMMARY

The Government of Rwanda (GoR) through the Ministry of Infrastructure (MININFRA) has proposed for funding under World Bank IDA, the Rwanda Electricity Sector Strengthening project (RESSP) which is in line with NST1 (National Strategies for Transformation) for the energy sector. The RESSP will allow the Government of Rwanda to achieve and expand upon result from Electricity Access Rollout Programme EARP which continues to construct the backbone of the power supply system to rural areas and will align generation capacity and demand to achieve an efficient tariff. EARP is being implemented within the framework of a Sector Wide Approach (SWAP) to encompass all donors active in the sector under one common sector investment program. The aim of RESSP is to increase Access to Electricity and to Strengthen the Capacity in Electricity Sector aiming to improve the performance of the electricity sector institution. The project is financing also activities of construction of transmission and distribution electricity network in all provinces of Rwanda. However, those activities will have adverse impact (both positive and negative) on environment and connected communities. This project stands to increase the access to electricity services as well as better services delivery in electricity sector especially for Productive users. The project will also improve the living conditions of people, as well as the quality of environment and socioeconomic development in Rwanda. This section is focusing on the subproject of productive users under the same project (Rwanda Electricity Sector Strengthening Project) and will cover 57 individual productive use among them are Milk Collection Centers (MCC), Water Pumping Stations (WPS), Health Facilities, Administrative offices and Schools which are distributed in 15 districts namely Gakenke, Gatsibo, Huye, Kamonyi, Kayonza, Kirehe, Muhanga, Musanze, Ngoma, Ngororero, Nyagatare, Rubavu, Ruhango, Rutsiro and Rwamagana.

Therefore this EMP report has been prepared in accordance with the RDB's guidance and request and basing on the environment law N° 48/2018 of 13/08/2018 and in accordance with the Ministerial Order N° 001/2019 of 15/04/2019 establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct environmental impact assessment.

This report gives the findings of the impacts identified during the screening phase of this project and gives in details the proposed and required actions/ measures to better manage and protect the environment and the population.

Objectives of the study

The main objective of this study is to identify the environmental impacts associated with the proposed project of plant design, supply and installation of low voltage and medium lines for productive users in Rwanda and recommend appropriate environmental management strategies for the project. Thus, a core outcome of the report is an Environmental Management Plan (EMP) for the project.

Approach and Methodology

To conduct this study, care has been taken for the requirements of the conduct of the Environmental Management Plan and considering the objectives, purpose and the scope of works of the project.

The study followed the following approach: (i) field surveys (ii) review of primary and secondary data on baseline information on the project area (iii) review of project documents and (iv) consultations with the administrative districts and other involved stakeholders. This was completed to collect information and data on various aspects of the project.

Locations, surrounding land cover, proposed project activities and any other associated works were fully accessed to make the task of planning and monitoring easier during the implementation of the mitigation measures of identified impacts.

The prediction of positive and negative impacts, analysis of alternatives, proposal of mitigation measures leading to the preparation of an Environmental Management Plan, were all incorporated in this Report.

Main Impact identified

The project highlights significant social, economic and environmental issues associated with the design, construction and operational aspects of the proposed project. The project is meant to stimulate the socio-economic development and sustainable infrastructure development of Productive users in Rwanda at large. The identified impacts are categorized as negative and positive. The identification of the impacts on the environment showed that during the construction, there will be a number of some negative impacts on environment however the positive impacts associated to the project implementation prime on the negative impact

- Positive impacts expected include:
 - Job creation and employment opportunities
 - Improved electrical supply network System
 - Access to reliable electricity Supply
 - Increased economic activities and other associated opportunities arising from the project.
 - payment of taxes on purchased goods and materials and hence contributing to poverty alleviation
 - Transfer of skills from construction activities.

Shortly the project will improve the existing condition of electricity power supply within the country and will pave the way for economic development with continued investment in all allied infrastructure development sector.

However, the project is also expected to generate some negative impacts on the environment including:

- Air pollution through dust and machinery emissions
- Risk of excess soil being eroded and deposited on working area.
- noise pollution by using machinery and other transportation systems on site,
- soil erosion downstream project area and loss of vegetation and soil
- dust emissions which may rise during excavation works
- Pollution of the areas of origin of the construction materials(quarries)
- Possible injuries and incidences from work activities
- Disruption in Daily Living and Movement Patterns

- Disruption of Infrastructure and Services

Mitigation measures are proposed for each of identified adverse impacts to an extent that they can be reduced, limited or eliminated hence manageable and avoided where possible.

This plan recommends the mitigation measures, procedures be followed, and the responsibility to the implementation as well as the estimated cost of implementing each of the proposed mitigation measures.

Conclusion

The project aligns with the Government of Rwanda's policy objectives and visions as well as programs that support the increase of wellbeing of all Rwandans. The proposed project is very important to the country and its residents. The EMP indicates that the general project negative impacts value is rated as low since the project shall not involve Physical resettlement and only some few crops and trees will be affected on small land because the individual productive users are not far from existing MV Lines. They were chosen because they are not far from existing MV Lines (not more than 2 km from existing MV lines). The identified impacts for the project can easily be reduced, limited and eliminated by the application of appropriate proposed mitigation measures. This EMP has been developed to guide in mitigating the project negative impacts and there is no doubt that the implementation of the recommended measures will entail no harmful impacts provided that they are adequately and timely put in place.

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ACRONYMS

cm	centimeter
EMP	Environmental Management Plan
MDG	Millennium Development Goals
MININFRA	Ministry of Infrastructure
OHS	Occupational Health and Safety
MoH	Ministry of Health
PPE	Personnel Protective Equipment
RDB	Rwanda Development Board
REMA	Rwanda Environment Management Authority
RURA	Rwanda Utility Regulatory Agency
RNP	Rwanda National Police

CHAPTER I: INTRODUCTION

1.1 Project background

The Government of Rwanda (GoR) through Rwanda Energy Group (REG) and its subsidiaries Energy Development Corporation Limited (EDCL), Energy Utility Corporation Limited (EUCL) and the Rwanda Electricity Sector Strengthening Project (RESSP) which will contribute to National Strategy for Transformation one (NST1) targets are supported from different donors including World Bank as the main donor. This project complements the on-going EARP (Electricity Access Roll out Program) which will continue to lead on grid electrification in urban areas and rural settlement. The economic transformation pillar for NST1 by Scale up electricity generation and improve quality, affordability and reliability. Generation plans will be informed by medium and long-term projections and analysis of supply and demand. Long-term generation plans will include identification of least cost sources of energy generation with the objective of ensuring a cost-reflective and competitive tariff. A pro-active strategy will be developed to attract industries for economic growth and to ensure that they are supplied with available, reliable and affordable electricity. Key sectors of focus to increase demand include mining, health, manufacturing, ICT and commercial premises.

1.2 Scope of work

The Productive Uses will consist of “Design, supply, and installation of low voltage and medium voltage lines for productive users in Rwanda (the facilities) in the Gakenke, Gatsibo, Huye, Kamonyi, Kayonza, Kirehe, Muhanga, Musanze, Ngoma, Ngororero, Nyagatare, Rubavu, Ruhango, Rutsiro and Rwamagana Administrative Districts”. It will cover 107 km of MV line, 1.1237 km of LV Line with 57 transformers.

The Project activities in these Productive users will only affect trees and crops that are within the right of way during the construction phase.

The RoW is determined by the National mandated Authority for Utility Regulatory (RURA)/ Guidelines N^o 01/GL/EL-EWS/RURA/2015; this is highlighting that the RoW for Power Lines should Project activities

I.3 General Environmental protection

Consistent with economy and efficiency in the execution of the project, the Contractor must prevent, minimize, or mitigate environmental damages during all erection activities. The natural landscape should be preserved to the extent possible by conducting operations in a manner that will prevent unnecessary destruction or scarring of the natural surroundings.

Except where required for permanent works, storing and processing areas, all trees, saplings, and shrubbery should be protected from unnecessary damage by Contractor's operations.

After unavoidable damage, replanting, or restoration are required promptly to prevent further damage (e.g., erosion), and to restore quasi-original conditions where appropriate.

The Contractor's facilities, such as warehouses, and storage areas, should be planned in advance to decide what the area would look like upon completion of work. These facilities should be located so as to preserve the natural environment (such as trees and other vegetation) to the maximum extent possible. Temporary buildings, storing and processing areas should be landscaped and planted according to an ecological design to provide some substitute area for lost natural habitats.

The Contractor's operations should be so performed as to prevent accidental spillage of contaminants, debris, or other pollutants, especially into streams or underground water sources. Such pollutants include untreated sewage and sanitary waste, tailings, petroleum products, biocides, mineral salts. Waste-waters must not enter streams without using settling ponds, gravel filters, or other processes, so as not to impair water quality or harm aquatic life.

The Contractor should ensure proper disposal of waste materials and rubbish.

CHAP TWO: STUDY AREA DESCRIPTION

This chapter gives background information of the subproject area as whole specific sites in terms of its location, physical and socio-economic environment, which will play a crucial role in the identification, predict and analysis of environment impacts and proposed the appropriate mitigations of measures and influence the overall direction in the development of the subproject. This subproject is in four provinces of Rwanda (East, South, West and North) and its description takes the characteristic of the whole country.

II.1. Subproject Location

The subproject is located in 15 districts of Rwanda distributed in Eastern, Southern, Western and Northern provinces. All Productive users were chosen because they are located near the existing MV lines normally not more than 2 km from these existing MV lines. The Geographical features of the subproject combines the features of the four provinces combined. The table below gives the details about the individual Productive users and their locations.

Table 1: Location of PU in different Administrative Districts

No	District	Sector	Cellule	Name	Type	X	Y
1	Gakenke	MINAZI	MUNYANA	Minazi	Water Pumping Station		
2	Gakenke	Busengo	Birambo	Birambo	Cell Office	29.68293	-1.62773
3	Gakenke	Minazi	Munyana	Munyana	Cell Office	29.78405	-1.74378
4	Gakenke	Mugunga	Gahinga	Gahinga	Cell Office	29.66079	-1.68296
5	Gakenke	Rusasa	Kamonyi	Kamonyi	Cell Office	29.66618	-1.63756
6	Gatsibo	Rugarama	Matunguru	Matunguru	Cell Office	30.43938	-1.7018
7	Gatsibo	Rugarama	Matunguru	E.P MATUNGURU	Primary	30.44714	-1.69103
8	Gatsibo	Kageyo	Nyagisozi	Kageyo	Sector Office	30.28115	-1.68841
9	Gatsibo	Kageyo	Nyagisozi	Biyanga	Water Pumping Station	30.29145	-1.69196
10	Huye	Rwaniro	GATWARO	Rwaniro	Health Center	29.74748	-2.59605

11	Huye	Mbazi	Mwulire	G.S MWULIRE	Secondary School	29.75494	-2.54561
12	Kamonyi	Kayumbu	Gaseke	G.S KABERE	Secondary School	29.81819	-1.96161
13	Kamonyi	Mugina	Mugina	G.S ST ISIDORE MUGINA A	Secondary School	29.96833	-2.11325
14	Kamonyi	Nyamiyaga	Ngoma	G.S MATABA	Secondary School	29.93717	-2.07186
15	Kamonyi	Rukoma	Bugoba	G.S BUGORA	Secondary School	29.91642	-1.90153
16	Kamonyi	Rukoma	Mwirute	G.S NYARUSAVE	Secondary School	29.92225	-1.92381
17	Kamonyi	Rugarika	Kigese	Rugalika	Water Pumping Station	29.95609	-2.02879
18	Kamonyi	Kayenzi		Water Pumping Station	Water Pumping Station	29.84118	-1.89644
19	Kayonza	Ndego	KIYOVU	Ndego	Health Center	30.499	-2.021
20	Kayonza	Mwiri	Kageyo	Kageyo	Milk Collection Center	30.65833	-1.83882
21	Kayonza	Mwiri	Migera	Migera-Nyawera	Water Pumping Station	30.567	-1.91645
22	Kayonza	RWINKWAVU	GIHINGA	GIHINGA	Water Pumping Station		
23	Kirehe	Mpanga	Nasho	Nasho	Health Center	30.75163	-2.21695
24	Kirehe	Kigarama-Kirehe	NYAKERERA	Kigarama	Health Center	30.61201	-2.366
25	Kirehe	Nasho	NTARUKA	Ntaruka-Nasho	Health Center	30.57333	-2.149
26	Kirehe	Mpanga	Nasho	Mpanga	Sector Office	30.84558	-2.08617
27	Kirehe	Gahara	Rubimba	Nyakarambi	Water Pumping	30.5185	-2.33262

					Station		
28	Kirehe	Mpanga	Kankobwa	Kankobwa	Water Pumping Station	30.81404	-2.15649
29	Muhanga	Kabacuzi	BURAMBA	Buramba	Health Center	29.692	-1.96511
30	Muhanga	Rugendabari	KANYANA	Gasovu	Health Center	30.10683	-1.91253
31	Muhanga	Kibangu	GITEGA	Gitega-Kibangu	Health Center	29.76963	-1.855
32	Muhanga	Kabacuzi	Ngoma	Ngoma (Kabacuzi)	Health Post	29.77377	-1.91898
33	Muhanga	Kiyumba	Budende	Budende	Health Post	29.80198	-1.87237
34	Muhanga	NYAMABUYE	GIFUMBA	RUTARABANA	SCHOOL		
35	Muhanga	Kabacuzi	Buramba	G.S BURAMBA	Secondary School	29.71572	-1.96381
36	Muhanga	Rongi	Gasagara	G.S MUREHE A	Secondary School	29.77931	-1.84328
37	Muhanga	Rongi	Gasharu	G.S NYAMIYAGA	Secondary School	29.74844	-1.78681
38	Muhanga	Rongi	Nyamirambo	G.S RONGI	Secondary School	29.75625	-1.82125
39	Muhanga	Rongi	Nyamirambo	COLLEGE NOTRE DAME NTARABANA	Secondary School	29.74647	-1.79494
40	Muhanga	Rugendabari	KIBAGA	G.S KIRWA CATHOLIC	Secondary School		
41	Muhanga	Kibangu	Gitega	Kibangu	Sector Office	29.68477	-1.84442
42	Muhanga	Rongi	Nyamirambo	Rongi	Sector Office	29.7655	-1.81548
43	Musanze	Gataraga	Rungu	Rungu	Cell Office	29.52452	-1.55294
44	Musanze	Shingiro	Mudende	Mudende	Cell Office	29.53957	-1.51361
45	Musanze	Cyuve	Cyanya	G.S GITINDA	Secondary School	29.66764	-1.45656
46	Musanze	Gacaca	Karwasa	Nyabinyoni-	Water Pumping	29.69947	-1.49886

				Gasakuza	Station		
47	Ngoma	Mutenderi	Mutenderi	Mutenderi	Water Pumping Station	30.48345	-2.25745
48	Ngororero	MUHANDA	BUGARURA	Bweru	Milk Collection Center		
49	Ngororero	MATYAZO	Binana	G.S KAVUMU B	Secondary School	29.63553	-1.75497
50	Nyagatare	RWIMIYAGA	Rutungu	Gakagati	Health Post	30.414	-1.211
51	Nyagatare	KARANGAZI	Nyagashanga	Nyagashanga	Health Post	30.4356	-1.44
52	Rubavu			Kanama MCC	Milk Collection Center	29.41324	-1.72269
53	Rubavu	KANZENZE	NYAMIRANGO	GS NYAMIRANGO	Secondary School		
54	Ruhango	Kinihira	Muyunzwe	G.S NYARUTOVU	Secondary School	29.64097	-2.17194
55	Rutsiro	Murunda	KIRWA	Karumbi	Health Center	29.34865	-1.86492
56	Rutsiro	Gihango	RUHINGO	Kibingo-Rutsiro	Health Center	29.29242	-1.99715
57	Rwamagana	Kigabiro	Bwiza	Mwurire, Kigabiro, Munyaga	Water Pumping Station	30.46224	-2.00185

Source:EUCL, 2019

II.2 Current state of biodiversity

Although Rwanda is a small country, it has a remarkable variety of ecosystems of flora and fauna. Its location at the heart of the Albertine Rift eco-region in the western arm of the Africa's Rift Valley is a contributory factor. This region is one of Africa's most biologically diverse regions. It is home to some 40 per cent of the continent's mammal species (402 species), a huge diversity of birds (1,061 species), reptiles and amphibians (293 species), and higher plants (5,793 species).

Biodiversity has, over the years, been subjected to various threats causing loss within species richness, populations sizes and ecosystems degradation due to the following main threats:

poaching, boundary encroachment, fires, alien invasive species, predation, deforestation, illegal mining, illegal grazing, human-wildlife conflict, damming, dropping water levels, fish and lions poisoning, commercial fishing, lack of proper regulations, infrastructures' development, water extraction, plant extraction, drainage of wetlands outside park, plant and animal diseases transmissible from livestock to wildlife, lack of connectivity, climate change, etc. However, since the early 1990s, Rwanda has made tremendous efforts to address these threats through national programmers and through international cooperation including ratification of the Convention on Biological Diversity (CBD) and related protocols.

The Albertine Rift is considered to have the highest species richness in Africa. It is considered a biodiversity hotspot containing more endemic mammals, birds, butterflies, fish and amphibians than anywhere else in Africa. Habitats supporting such an array of biodiversity are very varied. Being at the heart of the Albertine Rift, Rwanda's habitats are equally varied, ranging from Afromontane ecosystems in the northern and western regions to lowland forests, savannah woodlands and savannah grasslands in the southern and eastern Provinces. There are other habitats around volcanic hot springs and old lava flows, especially in the northern and western Provinces of the country. Rwanda also has several lakes and wetlands which 43 rich in different species. Though not yet well surveyed, all these ecosystems host a rich variety of fauna and flora and micro-organisms. Besides these natural ecosystems, as an agrarian country, Rwanda agro-ecosystems comprise cultivated land, agro-pastoral areas, grassland, grazing and fallow land.

II.3 Flora and Fauna

Rwanda harbours very diverse flora due to a considerable geo-diversity and a climatic gradient from west to east. The number of vascular plants is estimated at around 3000 species originating from the different bio-geographical regions (Fischer and Killmann 2008). About 280 species of flowering plants from Rwanda are considered to be endemic to the Albertine Rift. Of these endemic species, about 20 are restricted to Rwanda, 50 species confined to Rwanda and Eastern Congo and 20 species found only in Rwanda and Burundi.

Rwanda shelters 151 different types of mammal species, eleven of which are currently threatened and none of which are endemic. Among them are the primates (14 to 16), with half of the remaining world population of mountain gorillas (*Gorilla gorilla berengei*). The gorillas are found in the Volcanoes National Park in Northern and Western provinces of Rwanda. Others

includes the owl-faced monkey (*Cercopithecus hamlyni*), the mountain monkey (*Cercopithecus hoesti*) in Nyungwe, the Chimpanzee (*Pan troglodytes*) in Nyungwe and Gishwati, and the Golden monkey (*Cercopithecus mitis kandti*) found in Volcanoes National Park. There are also 15 species of antelope, and a wide diversity of species such as buffalo, 44 zebra, warthog, baboon, elephant, hippopotamus, crocodile, tortoise and rare species such as the giant pangolin. Rwanda is one of the top birding countries with 670 different birds having been recorded. Four of species of birds in Rwanda are threatened with extinction: the shoebill (*Balaeniceps rex*) found in Akagera; Grauer's rush warbler (*Bradypterus graueri*) found in Volcanoes National Park in Nyungwe and in the swamps of Rugezi; the Kungwe apalis (*Apalis argentea*) found in Nyungwe; and the African or Congo barn owl (*Phodilus prigoginei*) found along Lake Kivu. However during this project activities, they will not be affected.

The project area has no specific natural flora and is mainly characterized by grown flora. Noticeable flora include trees that are exotic to the project site mainly the eucalyptus trees that have been extensively planted in the hillsides and play a vital role in controlling soil run off that is prevalent in the steep hillside. Other floral species that can be observed in the project area include: Grevillia, Jacaranda, Cyprus and Pine. Also present in the project area and hence can be termed as flora are crops planted by local communities and make an important component of the vegetation cover. These crops include beans, coffee, bananas, passion fruits, yams and cassava.

The project area has known significant species of wildlife and avifauna that could be adversely impacted by the project. However, domesticated animals like goats, chickens, pigs and cows are kept by the local communities at small scale level.

In North and western provinces, the project area has no specific natural flora and is mainly characterized by grown flora. Noticeable flora include trees that are exotic to the project site mainly the eucalyptus trees that have been extensively planted in the hillsides and play a vital role in controlling soil run off that is prevalent in the steep hillside. Other floral species that can be observed in the project area include: Grevillia, Jacaranda, Cyprus and Pine. Also present in the project area and hence can be termed as flora are crops planted by local communities and make an important component of the vegetation cover. These crops include beans, coffee, bananas, passion fruits, yams and cassava.

The project area has known significant species of wildlife and avifauna that could be adversely impacted by the project. However, domesticated animals like goats, chickens, pigs and cows are kept by the local communities at small scale level.

The housing in the Northern and Western Provinces is characterized by 4 different types: the well-developed urban area (Karongi), urban areas in settlement (Burera, Rutsiro, Ngororero), villages-imidugudu (Ngororero, Rutsiro, Karongi, Burera) in rural areas and house scattered in rural areas (Karongi, Rutsiro and Ngororero). Most of time, you find many households which are scattered (mainly in Ngororero, Rutsiro and Karongi) in the landscape and this, given the complexity to connect a lot of households at the sometime.

Forests and woodlands can be classified into four categories: the natural forests of the Congo Nile Ridge comprised with Nyungwe national park Gishwati, and Mukura; the natural forests of the Volcanoes national park; the natural forests in the savannah and gallery-forest of the Akagera national park and remnants of gallery-forests and savannahs of Bugesera, Gisaka and Umutara; and forest plantations dominated by exotic species (Eucalyptus sp, Pinus sp, Grevillea robusta) and trees scattered on farmlands (agroforestry) and along antierosion ditches.

II.4. Socio Economic Environment

II.4.1. Agriculture

Major economic activities are small scale businesses and agriculture. The Northern Province is leading in the agriculture production in country, the region has been blessed by its fertile soils and its geographical location as it bordered by Uganda in the north, and this also boosts business across the border. It has fertile agricultural land, producing crops like, maize, potatoes, beans and coffee. Cows, as well as sheep and goats mainly produce compost for agriculture. The industrial sector in Burera District is not very well developed. In the district there are coffee processing centers and centers for seedling variety improvement.

In East, The economy of the Eastern province district is mostly dependent on agriculture and livestock, where fertile soils are exploited and give satisfactory production for food crops like cassava, banana, maize, beans, soya beans cassava and marshlands suitable for rice growing then fruits like pineapples oranges, mangoes 32 etc. Banana plantation is cultivated in most of the areas and is mixed with maize, beans and sorghum.

In South, The agriculture production system is based on small family exploitation whose production is consumed by the owners at more than 80%.The systems of crops are complex, based on the diversification of the production and the association of crops. Seven main crops, namely banana, bean, sweet potatoes, cassava, sorghum and potatoes of which the first five are present in 90% of the production units and constitutes the common basis for all the region of Rwanda (EUCLESMF, Septembre 2015).

II.4.2 Housing and Settlement

The housing in the project area of the Eastern Province is characterized by four different types: the well-developed urban area, urban areas in settlements, villages (imidugudu) in rural areas and houses scattered in rural areas. For the project area in the peri-urban areas, most of the houses are built in earth brick and timber and roofed in iron sheet.

The housing in the Northern and Western Provinces is characterized by 4 different types: the well-developed urban area (Karongi), urban areas in settlement (Burera, Rutsiro, Ngororero),villages-imidugudu (Ngororero,Rutsiro, Karongi, Burera) in rural areas and house scattered in rural areas (Karongi, Rutsiro and Ngororero). Most of time, you find many households which are scattered (mainly in Ngororero, Rutsiro and Karongi) in the landscape and this, given the complexity to connect a lot of households at the sometime. In South the housing is constructed mainly in family compounds. Buildings are either<temporary>(build with traditional materials),semi-permanent (with traditional wall and corrugated iron roofs or permanent (with brick or concrete walls).The majority of housing is owner-occupied (EWSA,June 2011)



Figure 1: **Scattered Rural settlement in Western Province (Rutsiro)**



Figure 2 **Rural settlement in northern Province**

II.5. Energy

Introduction

Rwanda has considerable opportunities for energy development – from hydro sources, methane gas, solar and peat deposits. Untapped resources for power generation amount to about 1,200

MW. Most of these energy sources have not been fully exploited. As such, wood is still the major source of energy for 94 per cent of the population and imported petroleum products consume more than 40 per cent of foreign exchange.

The current access targets stipulate a 100% households access to electricity by the year 2024 while productive users will be all connected before the end of the year 2022. To achieve this target, REG intends to increase the number of new connections by 500,000 every year, including 200,000 on-grid and 300,000 off-grid. This is the status of electricity access both on grid and off grid combined in all district of Rwanda.

Table 2 Energy Access in Rwanda as of 27th November 2019 (Source: <http://www.reg.rw/what-we-do/access/>)

District	Access rate
Bugesera	55%
Burera	35%
Gakenke	29%
Gasabo	55%
Gatsibo	32%
Gicumbi	46%
Gisagara	43%
Huye	43%
Kamonyi	32%
Karongi	43%
Kayonza	43%
Kicukiro	86%
Kirehe	48%
Muhanga	48%
Musanze	58%
Ngoma	56%
Ngororero	35%
Nyabihu	40%
Nyagatare	45%

Nyamagabe	37%
Nyamasheke	38%
Nyanza	39%
Nyarugenge	51%
Nyaruguru	74%
Rubavu	65%
Ruhango	55%
Rulindo	43%
Rusizi	60%
Rutsiro	40%
Rwamagana	61%
NATIONAL	53%

The provision of transformers to the productive users will help the residents to access the quality services but also to the nearest neighbors will be connected from the same grid, increasing the rate of electricity access.

II.6. Hydrology

BURERA has an important hydrographic network composed of lakes BURERA (55 km²) and RUHONDO (28 km²), Rugezi marchland (6735 hectares), several rivers such as river URUGEZI, river CYERU, river KABAYA, river KABWA and other non-made-up sources. The district profits from regular precipitations of an importance of more than 1.400 mm/an, which offers to him a theoretical reserve of 531,560,000 m³ water each year.

The Ngororero District has a very dense hydrographic network consisting of several streams. The main rivers draining the waters of the basins slopes are (i) Giciye (between Muhanda-Nyabihu), (ii) Satinskyi (between Sovu-Bwira-Muhororo-Kageyo-Ngororero-Hindiro-Matyazo), (iii) Kibilira (Ngororero), (iv) Sebeya (Muhanda), (v) Kibilira (Gatumba-Bwira-Muhororo), (iv) Mukungwa (Matyazo), (vii) Cyintiti (Ndaro- Gatumba) and their tributaries like Rubagabaga. All these streams, with the exception of Sebeya, supply water are tributaries of the great Nyabarongo River, located on the East side (between Muhanga-Ngororero) Nyabarongo is one of the rivers

polluted by the eroded land on steep catchment cultivated without erosion control measures. District Rutsiro knows a dense hydrographic dominated by Lake Kivu in the west. He also knows several rivers which each head to the Congo basin, the other to the Nile. The most important of these rivers are Muregeya, Koko, Nyangore, and Gashashi kimbili, Nyamwenda, Bihongora, 21 Bikeneko Sebeya and flowing into the Congo Basin, Satinskyi, Nyamwotsi Kiguhu and pointing in the Nile Basin. Hydrography of Rutsiro District is also characterized by a variety of sources and furnished other undeveloped. All these waters belong to the basin of the Congo.

The Karongi District has a very dense river system consisting of several rivers (Muregeya, Mushogoro, Kiraro, Bipyisi...). The rivers located in west of the District flow into Lake Kivu while those draining the waters of the basins Eastern slopes feed Nyabarongo. Most streams cross small swamps that are also silted during the rainy season. It has several small marshes (Gasharu, Magarama, Kamabuye, Nyabinyenga, GIsayo, Nyabahanga, Kabilizi, Mushogo, Muregeya Gatara, Mubuga, Murambi, Nyabarongo, Gisoro, Mbirurume). between hills and crossed by streams. Most of these marshes are not yet fitted. They are essentially exploited in a traditional way and valued by planting food crops like sweet potato and vegetables. All these swamps are exposed to silting because their steep catchments remain generally exposed to water erosion and landslides.

The rainfall characteristics for Rwanda are known to exhibit large temporal and spatial variation due to varied topography and existence of large water bodies near the country. However, two rainy seasons are generally distinguishable; one centred on March – May and the other on October – December. For the area of concern, rainfall averages 29 Figure 6: Vegetation in the project area in the range of 900-1200mm/yr as may be observed from the figure below, in the central region of the country

Water availability and use

The pressures on water resources primarily result from utilizing the natural resources to meet basic needs as well as social-economic development. The effects of water resources use is demonstrated in the changes in the quantity and quality of water. All aspects of human activities in four provinces of Rwanda (East, West, South and East) have produced varying impacts and degrees of modification to the available water resources and these impacts are manifest at the

catchment and sub-catchment levels. Water is a vital matter and impacts life positively and negatively when bad managed. During the implementation of project activities much effort will be put in water resources protection. Rwanda's agriculture is rain-fed and is therefore exposed to vagaries of climate fluctuation. Many areas which use poor farming methods without integrating soil and water resources conservation tend to have weak agricultural productivity. In such instances, soil moisture becomes the limiting factor for crop growth

CHAP III: DESCRIPTION OF PROJECT ACTIVITIES AND PHASES

The project shall have different activities which shall be carried out in for different phases namely pre-construction, construction, operation and decommissioning phases.

The activities of the project include but not limited to

- Site clearance and earthworks
- Excavation to remove unsuitable materials
- Electrical cables laying and stringing
- Backfilling the excavated cable trenches with approved materials as specified
- Improvement/construction of drainage facilities
- Repairs and/ construction of damaged roads
- Tower election for the overhead lines
- Cables stringing

III.1 Activities of Pre-construction investigations

The activities of the pre-construction phase will start with detailed investigation of the site's biological and physical characteristics in order to minimize any unforeseen adverse impacts during the project cycle. This phase also entails mobilization of labor force, equipment as well as acquisition of various permits as required by the law. The investigation of the sites intervene to develop a baseline data bank that shall guide in impact monitoring.

The main activities to be involved in the pre-construction phase include:

- Line surveys;
- Maps reproduction
- Geo-technical investigation (soil test) where applicable;
- Materials analysis including soil, stones and sand tests;
- Mobilization of the labor and equipment's
- Permit acquisition if necessary

III.2 Activities of construction phase

III.2.1 Staffing and employment

This project will be the most source of job creation for local community, skilled and unskilled people. It will generate a number of jobs since it is expected to employ a maximum of more than 100 employees in total and this number will be attained when the project is fully operating.

III.2.2 Site preparation

Manpower will be used to clear the project site and holes excavation and trucks and other machinery will be used to transport materials and personnel to the project sites. The indicated place where excavation will take place for the overhead lines will be rehabilitated and restored accordingly.

III.2.3 Sourcing and transportation of construction materials

Construction materials and other equipment's (cross arms, cables, stubs, transformers, wires, aggregates, stones, sand, bricks, cement etc.) will be transported by trucks to the construction sites where possible, and in remote areas, manpower will be used to transport these materials.

III.2.4 Storage sites

The project is expected to have different storage sites for material and machinery parking and will be implemented by one contractor. The selection of the location will be made based on the availability of adequate land for establishing the storage site, including parking areas for machinery, stores and easy access to working site and an appropriate distance from environmental sensitive areas. Some of the materials from borrow pits like sand and stones will be used directly after delivery and as such no piling up is expected. Other materials like aggregates and sand will be stored at the operation site ready for use. Cement will be stored in special storage rooms. No Fuel will be stored in the project area since all machinery will use the approved petrol stations in the area.

III.2.5 Storage of materials

The storage will be properly made to avoid any soil/ water contamination or environmental pollution. Bulky materials such as rough stones and sand will be brought to site only when

needed due to space constraints. To avoid stacking large quantities of materials on site, the contractor should order bulky materials such as sand, gravel and stones at crusher & asphalt plant sites.

III.2.6 Excavation and foundation works

Excavation will be carried out to prepare the cables trenches and tower legs. The excavated soil will be re-used to backfill the excavated trenches after cable laying as well as backfilling the tower legs after erection.

III.2.7 Demolition works

Any wastes or debris arising from any demolition works will be transported to their respective site disposals.

III.2.8 Landscaping

To improve the aesthetic value or visual quality of the sites once construction ceases, the contractor will be required to restore the damaged areas. The landscaping will include establishment of roadside tree planting, backfilling and vegetating of abandoned quarry sites.

III.3 Operation phase

The operation phase is made of power distribution and maintenance of the lines when deemed necessary. No major activities are expected to be carried out during the operation phase. Maintenance will include replacement of old and/ or damaged materials, activities which are considered not to be harmful to the environment.

III.4 Occupation health measures for workers and the general public

During project implementation, some diseases and work accidents may occur. For this matter, safety measures must be observed and respected. These include but not limited to the following:

III.4.1 Personal Protective Equipment (PPE)

- The use of appropriate personal protective equipment (PPE) such as helmet, gloves, reflectors, protective boots etc, have to be mandatory for all site workers during project implementation.

- Workers will be trained on proper use of personal protective equipment (PPE) regardless of their prior working experience elsewhere.

- Workers have to be informed and sensitized on the relevance of using adequate PPE.

- First aid equipments will be made available and staff will be trained on their use.

- Warning notices will be put on working site for the safety of workers and persons passing nearby

- Power cuts will be communicated one week prior to their execution.

III.5 Wastes Generation and Management

The proposed project shall generate a substantial amount of waste both degradable and non-degradable. The contractor should provide facilities for handling them by providing adequate waste management facilities like dust bins, and mobile toilets will be made available on site where applicable. Storm water from the project area shall be channeled into the storm water drainage system with consideration of downstream effects.

Types of waste to be generated by the project activities and their management methods are summarized and provided in the table below:

Waste	Types	Amount	Treatment/ Disposal
Solid Waste (bio-degradable)	Vegetation and remnants of Timber.	To be determined	They can be used as source of energy for cooking
Solid Waste (Non Bio-degradable)	Food remains, cardboards and papers Top soils	To be determined	Collected in a large skip bucket at site then disposed at the authorized dumpsite or decomposed for use in adding nutrients to landscaped areas and planted trees or manure
	Tins, glasses	To be	Sold to recyclers and those that cannot be sold

	and plastics	determined	due to their quality should be collected in a large skip bucket at the campsite then disposed at the authorized dumpsite
Liquid waste	Sewage	To be determined	considering the extent of the project, mobile toilets will be provided at construction sites.

Table 3: Type of waste to be generated by the project activities

III.6 Project activities closure

Upon completion of the works, the contractor shall remove all of its tools, materials and other articles from the construction area. The Contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the project activities and shall maintain the site in a clean, orderly and safe condition. Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to leave the area aesthetical clean.

CHAP IV: IMPACTS IDENTIFICATION

IV.1 Introduction

The potential environmental impacts of any project depend on its location and its type as well as the volume of the interventions due to the proposed development. The project activities such as clearing of vegetation, construction of culverts, holes excavation, tower erection and other related operations are bound to cause some environmental impacts (positive/negative).

The impacts can be minimized or avoided, if appropriate management measures are adopted during design, construction and operation phases. In our case the identification of potential impacts was done based on field inspection of existing power lines. The impacts identified for both positive and negative are presented in the following sections.

IV.2 Positives impacts

Based on project's existing environmental conditions, potential positive impacts have been identified that are likely to result from the proposed project implementation. Positive impacts have been identified for different phases of project cycle and are presented below:

Employment opportunities

During the planning and design period, new jobs will be created in the form of skilled and unskilled labor in the community to conduct topographical and geological investigations. A majority of unskilled labor will be sourced from the local residents and hence this will create employment. Women will also have an opportunity to employment. During the construction phase the expected job opportunities will be working as labor both skilled and unskilled such as engineers, electricians, labors etc. Indirect employment will be in the form of suppliers and other forms of sub-contracted works that will be required for the project components.

Skills transfer

The consultant will associate with local counter parts. In the process of planning and design the local technical manpower will work with the experts. This process of working together will

transfer design and planning tools, computer software uses and other useful guidelines which are used in similar conditions countrywide.

Boost to Industrial Activities

During construction phase, the country in made products will be utilized such as cement, gravel, sand, stones, bricks, etc. The consumption of these materials will give an increase to industrial production of material manufacturing organization.

Increase to public revenue / taxes

The implementation of the project will increase revenue and taxes collection for both the central (Rwanda Revenue Authority) and local authorities. The project will fully participate in increased payments of taxes from suppliers of construction materials and other associated objects

Gender balance enhancement

It is expected that during the project implementation women will also equally benefit as men in terms of employment benefits. This will contribute to the government vision of fighting against gender inequality and ensuring that women are given equal opportunity in terms of employment.

Improved electrical network System

With the improvement of electrical infrastructure within the country, this will also improve electricity supply and stability in the project sites and its vicinities.

Access to reliable electricity Supply

The long-term direct positive impact for the resent project is access to reliable electricity supply, which will lead to better provision and easier management of goods and services and enable new facilities for the individual productive users and local residents. Electricity would support overall investment and strengthen the ongoing effort of capacity building to overcome critical constraints in the implementation of development programs. As a consequence of the project implementation, the quality of life and extent of economic opportunity will be changed for the better.

IV.3 Negative impacts

The present project is vital, positive and necessary intervention project, however it has some negative impacts which are described below:

Change of Land Use Pattern

The development in the study area will definitely bring substantial change in the land use patterns (especially on overhead lines) as rehabilitation of the line will require additional land. Excavations of earth from borrow areas may also lead to loss of topsoil and soil erosion problem during rain seasons.

Soil loss and Pollution

The soil loss will be in terms of top soil from cable trenches and borrow pits of tower legs as well as on areas of storage of material. Excavated earth materials will be reused to fill the laying areas and hence its disposal is not likely to have impact on the environment. To prevent the soil erosion, during rainy season, works are likely to be stopped. The soil pollution may take place due to improper disposal of waste material on the open ground. Appropriate waste disposal methods have to be adopted. Proper care should be taken while locating the above facilities so as to minimize the soil pollution. The impacts are of short duration and will be reversible.

Injuries of workers

During construction activities, workers will be subject to situations that could be harmful to their health and safety. Among risks that can occur include injuries caused by poor handling of construction materials and equipments injuries from walking on or using sharp objects, transmission of diseases; injuries from electricity manipulation and connections etc. This impact is also of medium significance in terms of magnitude since it directly affects the humans. Injuries are common in such kind of project but can be reduced to an extent with safety precautions taken.

Air Pollution

Although, air quality impacts are of short duration, but it does not mean that these should not be considered. Consumption of diesel during construction activities will be the principal cause of incremental air pollution. Diesel powered trucks required for the haulage of earth and other materials and running of construction machinery are the major sources of air pollution in the project area.

Water Pollution

Soil erosion from borrow areas, may increase sediment load in the nearby water bodies ultimately impact the water quality. The short-term increase in runoff with sediment may also occur due to the removal vegetation cover and top soil. The suspended sediments and the associated pollutants may get washed into these water sources leading to change in water quality. Contamination of water bodies may also due to spilling of construction materials, oils and greases. But the quantity of such spill will be negligible. However, care needs to be taken when conducting the excavation works.

Noise Pollution

The magnitude of impact during construction phase will depend upon the types of the equipment used, the construction methods and the scheduling of the works. Noise generation associated with the present project has three main sources: a) vehicles; b) driver behavior and c) construction and maintenance activity .

Poor vehicle maintenance is a contributing factor to this noise source. Drivers contribute to noise generation by using their vehicles' horns, by playing loud music, and sudden braking or acceleration.

Diseases from construction activity

During construction, some communicable disease such as STDs and other hazards may occur due to interactions among the workers or with service providers such as food vendors, dust from clearing and excavation works and fumes from vehicles and other that might cause respiratory dysfunctions, etc. This impact is also of medium significance in terms of magnitude, since it directly affects the humans and the project being of short time.

Impacts on water quality

During the construction works, water quality downstream may be deteriorated in terms of higher turbidity levels due to increased sediments. Depending on the type of suspended material, this effect will continue over a short period.

Impacts on Climate Change

Factors likely to lead to climate change due to project implementation are;

- Emissions from vehicles, machines and equipments due to inefficient combustion systems and use of unclean fuels. These emissions have different impacts on the atmosphere leading to climate change, acid rain and impacts on human health.
- The project should establish the transport management plan for project activities such as workers, materials, equipments and other supplies. If not well planned the emissions levels from the gadgets shall be high thus contribute to climate change.
- Clearance of vegetation: Vegetation plays a natural role in cleaning the air of pollutants thus its clearance shall have an impact on the areas micro-climate. Ozone depleting substances (ODS) due to the use of halogenated compounds chlorofluorocarbons (CFCs), hydro chlorofluorocarbons (HCFCs), methyl bromide, carbon tetrachloride, and methyl chloroform found in cooling system in the vehicles and, refrigerators, fire extinguishers and other machines and equipments.

Disruption in Daily Living and Movement Patterns

It is anticipated that the construction activities will result in some intrusions and disruptions in the daily living and movement patterns. Such disruptions are anticipated to be of high significance, but of a short-term nature, and could be caused by temporary road cutting, the movement of construction vehicles and frequent entries to the project sites.

Disruption of Infrastructure and Services

Without the implementation of appropriate management measures, general services (such as underground pipes, existing distribution lines) could be damaged during the construction period. Any disruption in the services (especially in the local electricity supply) could potentially have a negative impact on local enterprises (e.g. businesses activities). The nature and extent of the impact will depend on the length of the interruption in general services. The contractor is expected to undertake the rehabilitation works and construction works sometimes in the vicinity of energized lines.

Mitigation measure of the identified impacts are summarized in the table below:

Impacts	Mitigation measures
Fail in proper designing of the project component (design, line routes) could lead to the fail of the project implementation	Development of the designs and line routes of the project must be compatible with the existing slope conditions of the project area, the existing infrastructures and structures as well as the existing environmental considerations of the project intervention.
	The project should use appropriate and experienced personnel in the domain.
The project might influence migration and settlement if labor requirements are not planned in advance	Local and surrounding people with the necessary skills shall be employed for the project works;
Failure of advanced planning of safety requirements	Development of safety procedures and operational manual has to be available before project implementation.
	Acquiring of PPs materials has to be done before project implementation
Soil contamination due to improper storage of materials and poor waste disposal	Waste disposal should be done in proper way and in appropriate designated areas.
	Storage of construction materials should be done in protected surfaces to prevent contamination
Exposed soil during excavation works prone to erosion by water or wind	Limitation of earth moving to dry periods
	Protection of susceptible soil with appropriate protectors such as iron barriers
	Protection of drainage channels by stone pitching.
	Installation of sedimentation basins where applicable
Soil erosion and degradation	Exposed soil should be avoided by selective soil stripping
	Clearing shall be limited to the site approved for the project

Loss of vegetation due to site clearing.	Less vegetated areas shall be preferred.
	Careful site planning.
	Proper implementation of this EMP mitigation measures.
Surface and Ground water contamination especially at Abattoir Nzove overhead line	Generated Waste should be carefully managed to prevent contamination
	Proper setting of the construction sites
	Proper siting of pit latrines away from water logged areas
	Good hygienic standards and proper maintenance of pit latrines.
Pressure on existing socio-economic nature.	Local people with the necessary skills shall be prior employed by the project
Temporary and casual sex relationships and more chances of transmission of STDs due to interaction of project workers with local communities.	There shall be provision of education both to the local community on STDs and HIV/AIDS
	Recruitment of workers shall be done to local people who may return to their home immediately after work
Lack of enforcement of safety and health regulations could impact negatively workers and local community.	Enforcement of Public health and safety regulations.
	Use of adequate and required sign posts where necessary.
	Enforcement of the use of PPs.

Table 4: Mitigations measure for identified project impacts

CHAPTER V: ANALYSIS OF ALTERNATIVES

During the project analysis, different options were explored and were weighed from all considerations such as cost, environment, and ease of implementation. The aim of alternative analysis is to arrive at a development option which maximizes the benefits while minimizing the adverse impacts. Alternative analysis is also a form of mitigation measures. The two alternatives were considered “With Project Scenario” and “No Project Scenario”.

V.1 With project alternative

The implementation of this project will contribute to socioeconomic improvement and will have positive impacts on residents’ life quality and increase the production within the said productive users. The project alternative has the following advantages:

- Job creation,
- Income generation,
- Electricity power supply increases
- improved and assured power supply sustainability
- Electricity Infrastructure development etc.
- etc

However, this alternative may cause negative impact on air pollution, and on water pollution during construction phase. The alternatives to mitigate the adverse impact include proper project designs, proper management of cable and pits areas, proper disposal of wastes, stabilization of excavated soil, provision of adequate sanitation facilities, provision of protective equipments to workers, use machinery and truck in good condition and during daytime, proper re-use of the excavated soil after cable laying etc.

V.2 Alternative Routes

An analysis of alternative routes was undertaken through mapping and involvement of Local authorities and they were selected among the possible ones, based on the following general sitting criteria (which are related to economic and environmental values):

1. Location of the existing lines to be upgraded
2. Avoidance of restricted zones;
3. Location of the targeted infrastructures being developed;
4. Shortest distance from the tapping point
5. Route with constant slope;
6. Minimization of infrastructure crossing (paved roads, other power lines, etc.).

V.3 On-Grid Electrification

Provide on-grid electrification.

This is the alternative that is proposed by this project. Through the project all target area will be provided with electricity from the transformers to be provided.

This alternative will contribute positively to improving the lives of the target communities and Productive users, increased communication via use of mobiles and opportunities for seeking alternative livelihood options. Local government institutions will also benefit through reduced time and money spent on sourcing firewood from local communities, as well as increase in accessibility to information through various media sources, internet and improved communication.

V.4 Without project alternative

The No Project option in respect to the proposed projects implies that the status quo is maintained. This option is suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing environmental conditions. This option will however, involve several losses on socioeconomic condition both to the local population and the nation as a whole. Productive users will continue to face the same constraints they are experiencing due to lack of electricity supply which make them wasteful, poor service and less productive, and the targeted economic development of the country will remain unattainable.

The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The socio economic status of the residents of the area of intervention would remain unchanged.
- The access to the electricity will remain unachievable dreams,
- The social interaction connected to the project implementation would not exist.
- No employment opportunities will be created for local population who would have otherwise worked at the project area.
- Reduced infrastructure development will remain and be aggravated.

CHAP VI: ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) presents the implementation schedule of the proposed mitigation measures for the project's impacts. It also includes the associated costs needed to implement the recommended mitigation measures. The implementation will involve the contractor, the districts themselves, infrastructure users and the local communities at large. Both parties should take stock of the contents of the present report and implement the proposed mitigation measures as much as possible and improve them based on their practical implementation. The EMP of the present project is given in the following tabular form:

VI.1 Pre-construction phase

Table 5: Environmental Management Plan of the pre-construction phase

Activity	Impact	Mitigation Measure	Responsible	Time Frame	Cost (Rwf)
Planning	Possible loss of property	-Develop and implement site and land acquisition plan before project implementation -Restrict clearance to road reserve	Contractor REG Respective Administrative Districts	Before and during project starts	No budget required
Storage site selection	Failure in selecting the materials storage site	Selection of storage sites must be done in consultation with Districts. Storage facilities should be located far from general public and water resources.	Contractor REG Respective Administrative Districts	Before project starts	No budget required
Procurement	Contactors selection criteria	- REG/EUCL procurement unit should develop selection criteria that take into consideration the ability of contractor who will be able to implement environmental conservation criteria - All tender applications should be submitted with documents in support of the status of the machines and	Contractor REG Respective Administrative Districts	Tendering Phase	Covered in tender evaluation fees

		equipments such inspection certificates, calibration certificates among others before tender ward.			
Planning	Inadequate Knowledge of Environmental Management Issues	-Organize campaigns and morning briefs of staff on environment protection aiming at environment protection and safety.	Contractor REG Respective Administrative Districts	Daily	covered in project implementation
Design	Climate change	Incorporation of “green/clean development mechanism” in all project components. The contractor should possess project equipments and machinery that are designed to avoid pollution and its impact on climate change Ensure that machines and equipments for the project are used with maximum precaution measure to mitigate climate change Where need be provide adequate day natural lighting and use energy saving bulbs	Contractor REG Respective Administrative Districts REMA	Design phase	5,000,000
Planning	Health and Sanitation	Before project implementation it is mandatory to the contractor to Develop a sanitation management plan that includes appropriate sitting of sanitation	Contractor REG Respective	Site mobilization ,	3,000,000

		facilities/or providing mobile toilet facilities along the project site. Develop eco-friendly sanitation facilities with capability to recycle water and reuse of sludge	Administrative Districts REMA		
Planning	Land degradation at query sites	Purchase of all raw materials and construction inputs from approved sources by competent Authority.	Contractor REG Respective Administrative Districts	During implementation	No budget required

VI.2 Construction phase

Table 6: Environmental Management Plan of the construction phase

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Site installation and Site clearing	Soil erosion	All earthworks for site preparation and holes excavation have to be carried out during the sunny days of each implementation phase. Use only the approved line route during the surveying exercise.	Contractor REG/ EUCL Respective Administrative Districts	Construction phase	under construction budget

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
	Soil Loss	Excavated earth material should be reused in backfilling tower legs and cable trenches.	Contractor REG Respective Administrative Districts	Construction phase	450,000
	Loss of biodiversity	<i>Compensation of affected or damaged assets by the project should be done before project implementation and by respecting the provisions of Rwanda Expropriation Law in place.</i> Project sites, storage areas and vehicles movement should be concentrated in sites with minimal stand of vegetation.	Contractor REG Respective Administrative Districts	Construction phase	1,200,000
Excavation	water pollution and damaging downstream project area	Backfilling and leveling of the borrow pits to prevent water percolation and accumulation Adequate drainage systems have to be developed to minimize the impact on downstream project area Use the area dedicated to only project activities	Contractor REG Respective Administrative Districts	Construction phase	25,000,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction works	Health and Sanitation	Develop sanitation facilities and adequate management plan of waste on place Provide eco-friendly sanitation facilities with capability to recycle water and reuse of sludge Provide adequate protective equipments to all workers. Adopt disease control measures	Contractor REG Respective Administrative Districts	Construction phase	600,000
Construction works	Possible vandalism	Fencing off the project critical areas and limiting movements and entrance of the non-authorized personnel to the working areas. Installation of sign posts at working area.	Contractor REG Respective Administrative Districts	Construction phase	860,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction	Water pollution and Soil Erosion	<p>Adequate soil erosion management strategies will be provided.</p> <p>Soil works should be done in sunny days;</p> <p>Rehabilitation works are also recommended.</p> <p>Solid and liquid waste must be handled as prescribed by law</p> <p>Discharged waste water into the environment should meet recommended standards</p> <p>All waste have to be collected and disposed to approved waste disposal sites</p>	Contractor REG Respective Administrative Districts	Construction phase	1,890,000
Compaction	Vibration	<p>Provide advance notice to local communities when activities likely to cause vibration are to be undertaken</p> <p>Use of sign posts to alert local residents and other personnel</p> <p>Acquire license from competent Authority before project activity</p>	Contractor REG Respective Administrative Districts	Construction phase	35,520,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction	Air Pollution	<p>Construction equipments shall meet emission standards and have to be maintained and operated in a manner that ensures relevant air discharge regulations.</p> <p>Regular maintenance of construction vehicles and equipment is recommended.</p> <p>Water should be sprayed when deemed necessary during all along the construction phase to avoid dust emission</p>	Contractor REG Respective Administrative Districts	Construction phase	6,650,000
Construction	Road accidents	<p>There should be traffic management plan before project implementation.</p> <p>Speed limits should be available along the working areas.</p> <p>Enforcement of traffic laws.</p> <p>Installation of speed control devices like humps where necessary</p> <p>Screen for use of alcohol among workers, drivers and machine operators.</p>	Contractor REG Respective Administrative Districts RNP	Construction phase	To be with the project budget

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction works	Noise Pollution	Noisy activities have to be scheduled to occur within prescribed normal working hours (from 7h00 am to 5h00 pm) and limited to day light only. Proper choice of equipment and qualified personnel in the use of machinery.	Contractor REG Respective Administrative Districts	Construction phase	To be with the project budget

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction	Increased Spread of HIV/AIDS and other STDs	<p>Health Safety and Environment induction course should be provided to all workers.</p> <p>Awareness campaigns against HIV/AIDS and other transmitted diseases should be provide to all workers.</p> <p>Employ a large number of local communities to minimize number of new comers in the project site.</p> <p>Provide and train all workers on the use of first aid kit on site</p> <p>Provide appropriate working gear and adequate PPEs to all workers.</p> <p>Provide adequate sanitary facilities on the site.</p> <p>Provision of firefighting equipments on the site.</p> <p>Hygiene and sanitation standards should be respected by providing adequate clean water for drinking and domestic use.</p>	Contractor REG Respective local administrative officials	Construction phase	5,000,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction	Equipment /Vehicles /Machinery	<p>All construction equipments/vehicles and machinery should be in good working condition.</p> <p>All equipments and machinery should be removed from the site immediately at the end of defects liability period.</p>	Contractor REG Respective Administrative Districts	Construction phase	6,500,000
Construction works	Poor waste management	<p>Staff to be regularly sensitized on appropriate waste management.</p> <p>On site adequate sanitary facilities have to be provided and properly maintained and satisfactorily decommissioned after the project.</p> <p>Garbage should be segregated, biodegradable composted based on their type.</p> <p>All unused materials have to be properly handled</p> <p>Regular monitoring of waste collection and management is required</p>	Contractor REG Respective Administrative Districts	Construction phase	1,200,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction works	Road Accidents	<p>Traffic management plan incorporated in the designs should be implemented by all road users.</p> <p>No total closure of the road should be allowed even during construction works.</p> <p>Installation of proper road signs and regular inspections for their presence is mandatory.</p> <p>Installation of speed control devices like humps must be respected.</p> <p>Provision of pedestrian paths, at areas of high human presence is required.</p>	Contractor REG Respective Administrative Districts RNP	Construction phase	9,540,000

VI.3 Operation phase

Table 7: Environmental Management Plan of the post-construction phase

Activity	Impact	Mitigation Measure	Responsible	Time Frame	Cost (Rwf)
Electricity Supply	Incidents	<p>Capacity building to all electricity power users.</p> <p>Enforcement of laws in place related to electricity</p> <p>regular maintenance of the installed infrastructures</p> <p>Regular checks on site the presence of installed warning</p>	Contractor REG Respective Administrative	During construction and operation phases	8,000,000

	sign posts	Districts		
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VI.4 Decommissioning phase

Table 8: Environmental Management Plan of the pre-construction phase

Activity	Impact	Mitigation Measure	Responsible	Time Frame	Cost (Rwf)
Removal of Construction Equipment/Vehicles/Machinery	Environmental pollution	<p>All construction equipments/vehicles and machinery should be removed immediately from the site at the end of defects liability period.</p> <p>The removed materials should be transported and kept in safe place for use by the Contractor in other works.</p> <p>The area should be cleaned and all domestic wastes, debris/waste metals, grease and oils must be cleaned up and disposed of in a manner approved by competent authorities</p>	<p>Contractor REG Respective Administrative Districts REMA</p>	After construction works	3,000,000

VI.5 Specific mitigation measures and associated monitoring plan

VI.5.1 Occupational Health and Safety management plan to prevent accident

The contractor

The contractor is responsible for:

- preparing, updating and implementing the occupational Health and Safety Management Plan, including all associated procedures;
- identifying OHS training required for an activity;
- having insurance of all works during the project life span
- identifying and observing all legal OHS requirements;
- ensuring that all works are conducted in a manner without risk to workers;
- planning to do all work safely;
- ensuring workers undertake identified OHS training;
- communicating and consulting with workers;
- investigating hazard reports and ensuring that corrective actions are undertaken;
- Dispute resolution.
- complying with any direction given to them by competent authority
- undertaking site-specific induction before starting work and signing off that they have completed the induction
- Ensuring that all workers have the correct tools and equipments and well served to and in good conditions.

Workers

All workers are responsible for:

- Use personal protective equipment in accordance with manufacturer's instructions and where directed and in accordance with site signage.
- Taking reasonable care of their own health and safety and make sure that their conduct does not adversely affect others.
- Complying with instructions given to them.

- Cooperating with reasonable notified policies or procedures.
- Keep working areas clean and tidy at all times.
- No smoking on site except the provided place.
- No fighting, bullying or aggressive behaviour.
- No drugs or other illegal substances are permitted on site or are to be consumed on site.
- Place all rubbish in bins provided.

VI.5.2 General EHS information

Hazard identification, reporting and accident prevention procedures

- All works related injuries, illnesses and dangerous events and incidents will be reported to site manager who will record and investigate the cause.
- Workers are responsible to inspect machinery, equipment, tools, excavations, confined spaces to ensure they are safe and without risk to the health and safety of themselves or others before using or entering them.
- All hazards, unsafe conditions, defective items or equipment are to be reported to site management, or are removed from service immediately they are detected. Risk assessments will be undertaken prior to commencing any task to assess the risk of injury.

Emergency preparedness and response

For environmental and social performance of the project, emergency situations will be managed according to the Emergency Preparedness and Response Plan that have to be prepared and separately to this plan.

That plan should cover the:

- ❖ Emergency preparedness
- ❖ Emergency procedure
- ❖ Management of modifiable incidents
- ❖ Management of first aid cases
- ❖ Emergency communication

VI.5.3 Induction and training before works

Workers induction

The contractor will ensure a site specific induction is provided every day for all workers before starting.

This induction must outline:

- ❖ the expectations outlined in Environmental Health and Safety Management Plan;
- ❖ the site rules
- ❖ the facilities
- ❖ any site specific hazards
- ❖ high risk construction work activities

Visitor's Induction and safety

All visitors if any must undergo a visitor's Induction prior entering the site and they must always be accompanied by the Site Manager or a designated contractor's representative whilst on the workplace. Before entering the site, visitors will be provided with appropriate PPEs in order to ensure their safety during the visit tour.

Workers training

The contractor will:

- ❖ ensure workers are trained and are competent for the work they carry out
- ❖ ensure workers are trained to deal with any risks associated with the work and understand the control measures in place
- ❖ ensure on-site training and supervision is provided
- ❖ Communicate with subcontractors to ensure their workers are appropriately trained and competent.

Disciplinary procedures

During both the construction phase, if any worker does not comply with the requirements of the EHS plan, the following will apply:

- **First violation:** verbal warning (and advice providing)

- **Second violation:** written notification (and advice providing)
- **Third violation:** complete removal/suspension from the project.

For a serious breach of safety, workers can be immediately dismissed or removed from the site without notice.

VII.5.4 Construction waste management plan

The Waste Management Plan (WMP) sets out how resources will be managed and waste controlled during construction works and operational phase.

The construction activities of this project will generate waste, of different categories including mainly clearing and excavation debris, unusable construction materials, etc. The contractor will refer to the standard waste management hierarchy for efficiency; whose priority relies on avoidance, reusing and recycling. Mostly important to note is that the excavated soil will be reused to backfilling the holes after cables are laid.

Safety management plan

The contractor is committed to the safety of vehicles and machinery that will be involved in the project; they will be operated only by authorized persons who meet the driver criteria and licensed by the relevant authority.

- ❖ Employees who drive on company vehicles must follow all instructions provided to him. They must do a walk around inspection of any vehicle before driving it and they must not use those vehicles for personal business unless it is approved, in writing by the Project Manager.

- ❖ When operating company vehicles and machinery, employees should remember that their driving habits reflect on all employees.

- ❖ Employees are strongly encouraged to plan mini-breaks during long periods of driving and to allow for no more than 10 hours driving per day in good driving conditions.

- ❖ Smoking is not permitted in company's vehicles.

Accidents management plan

All hazards, accidents or incidents, must be reported immediately to the EHS Staff. In the event of an accident vehicles should not be moved unless their location poses a hazard to other vehicles, personnel, or the environment in the area.

Air quality management plan

During construction phase, it is expected that there will be increase of dust in project sites; dust will be the principal air quality concern. The construction activities will also generate air pollutants such as NO_x, SO_x and particulate matter. Those air contaminants have potential effects on human life especially workers and locals.

This air quality management plan addresses, at a minimum, the following requirements if applicable:

- ❖ Control of emissions of fine particulate matter
- ❖ Dust shall be controlled on unpaved roads using water (water pouring by a water bowser)
- ❖ Limit general site traffic to established haul routes
- ❖ Covering of trucks/dumpers to avoid spillage; compacted roads and speed control on vehicles.
- ❖ As a safety measure, all workers must be provided with Personal Protective Equipment
- ❖ Use modern machinery and commercially with low sulphur fuels
- ❖ Minimize engine wasting to the extent feasible
- ❖ Optimize trucking loads to reduce the number of trips between the source and destination of materials

Security management plan

The contractor is committed to maintaining the security and well-being of employees, visitors, and the surrounding community. The security management responsibilities will include:

- ❖ Ensuring that security is maintained in the sites and its surrounding
- ❖ Enforcing disciplinary actions as needed
- ❖ Adequate, day-time night-time lighting shall be provided.

Decommissioning plan

Upon completion of works, the contractor shall remove all of its tools, materials and other articles from the construction area. The Contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the contracted work and shall maintain the site in a clean, orderly and safe condition. Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to leave the area aesthetical clean.

All natural drainages must be restored and excavated materials must be used to fill excavated areas. The damaged areas must be restored to make it compatible with future use. Natural drainage must be preserved during rehabilitation and restoration works, ditches must be created to facilitate water run-off by installing drains and derivation ditches perpendicular to the slopes.

The compacted soils must be cut to at least 15 cm deep to loosen it and facilitate vegetation growth where applicable.

The solid waste dumping site must be cleaned, leveled and returned to a regular form. All wastes in the dump site should be thoroughly covered with a layer of soil. The Contractor must ensure that no wastes are visible and no surface water drains into the site.

The eliminated dry materials should form a stable slope and must be in harmony with the surrounding landscape.

Training Requirements

The effective implementation of the EMP requires that all persons working for the project be aware of the importance of environmental requirements of the project. They should also be aware of the significant actual or potential environmental impacts of their work activities; the benefits of improved performance and the consequence of not complying with environmental requirements.

The following entities shall need to be trained:

- ❖ All persons working for the project

- ❖ Persons whose actions can affect compliance
- ❖ Persons with environmental responsibilities
- ❖ Construction workers
- ❖ Persons involved in emergency procedures

The following shall need to be trained:

- ❖ Legislative framework, applicable laws, regulations, standards and technical guidelines.

The training should also include policies or procedures of the implementing agency which is applicable to the project.

- ❖ Environmental monitoring compliance Records keeping and reporting.
- ❖ Communication methods and procedures
- ❖ Dealing with complaints to maintain good relationship with stakeholders; understanding the needs, traditions and behavior of local communities

CONCLUSION

The present project will cause some impacts on air, soil and downstream waters. The identified negative impacts can be reduced by adopting eco-friendly technologies and enhancing proper implementation of this EMP. The identified positive impacts will strengthen the implementation of the present project. In order to mitigate impacts on the environment to a level of low significance, it is vital that all mitigation measures listed within this EMP are adhered to. Key recommendations are that

- ✓ All management measures made in this report be strictly adhered to.
- ✓ Implementation of the proposed project will entail no detrimental impacts provided that the recommended mitigation measures are adequately and timely put in place
- ✓ A rehabilitation plan of the damaged properties must be drawn up and be implemented.
- ✓ Local communities should be full involved in all activities.
- ✓ The project should recruit an environmental and Social Safeguard who shall follow the implementation of environmental management mechanisms

This can be achieved by effective implementation of the necessary mitigation measures as stipulated in this report.