資料 7. その他資料

測量調査報告書

地盤調査報告書

環境社会配慮調査報告書（EIA）

環境社会配慮調査報告書（RAP）

測量調査報告書

REPUBLIC OF RWANDA

KIGALI CITY

FIRST REPORT

PREPARATORY SURVEY FOR THE PROJECT FOR STRENGTHENING OF NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY IN RWANDA

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(ENTREPRISE DE DIVERSE CONSTRUCTIONS)
CONTACT : 0788534944/0785516502

FEBRUARY 2018

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I.0. INTRODUCTION

This works of Topographic Survey for the Preparatory Survey on the Project for Strengthening of Nzove – Ntora Principal Transmission Pipeline in Kigali City was done in order to conduct a deep study of the said project for it execution. Extension activities as well as establishment of the new Nzove Water Treatment Plant in Nyarugenge District will be done for strengthening the existing water networks in Kigali city due to rapid growth of population in this city.

This survey produces the following documents:

1. The Inception report
2. The present Technical Report
3. Drawings

I.1. SITUATION ASSESSMENT

I.1.1. Geographical Location

Nzove and Ntora are two different places with a relationship Nzove is a main water treatment plant in Rwanda supplying water in different direction where Ntora is the principal destination of water from Nzove by pumping system. Nzove is one the catchment of Nyabarongo River which is the source of water treated in Nzove water treatment plant (NWTP) the NWTP is located also near SKOL industry; both are located in Kanyinya Sector, Nyarugenge District. Ntora is a village of Gisozi hill where it constructed a a big reinforce concrete reservoir distributing water in Kigali city so for reinforcing the existing water network for covering a big percentage of water demand in Kigali city the project of extending Nzove water treatment plant is under execution and this survey conducted will help in the study of installation of a new pipe line and construction of a new water reservoir at Ntora near the existing tank. .

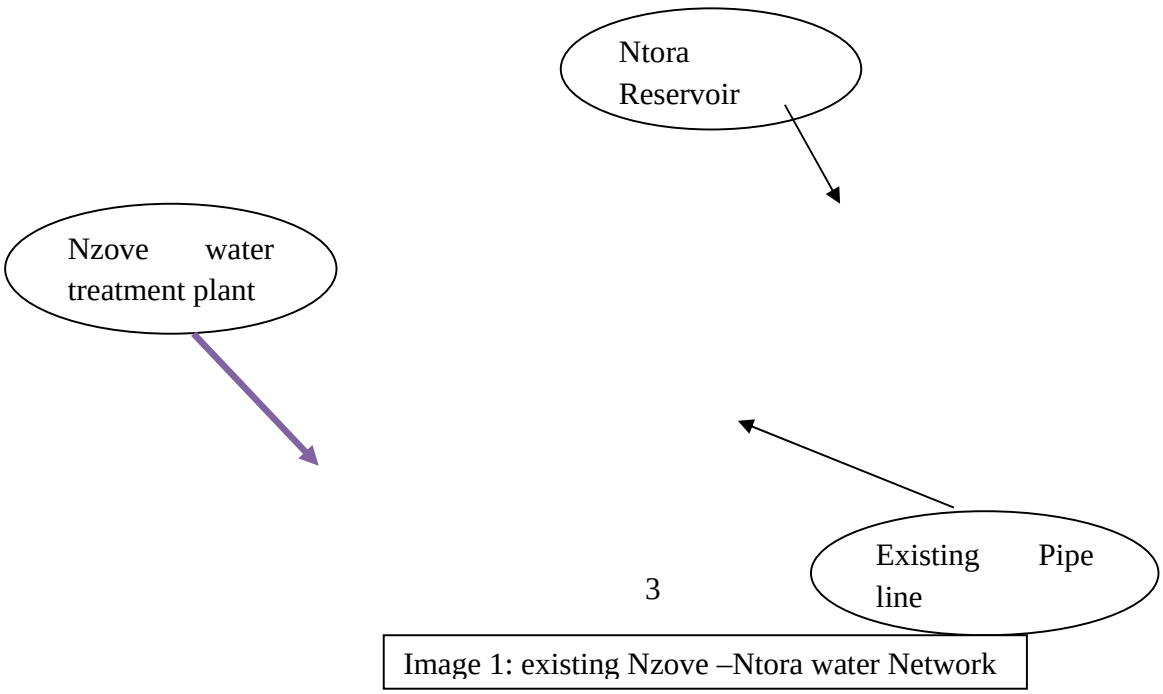
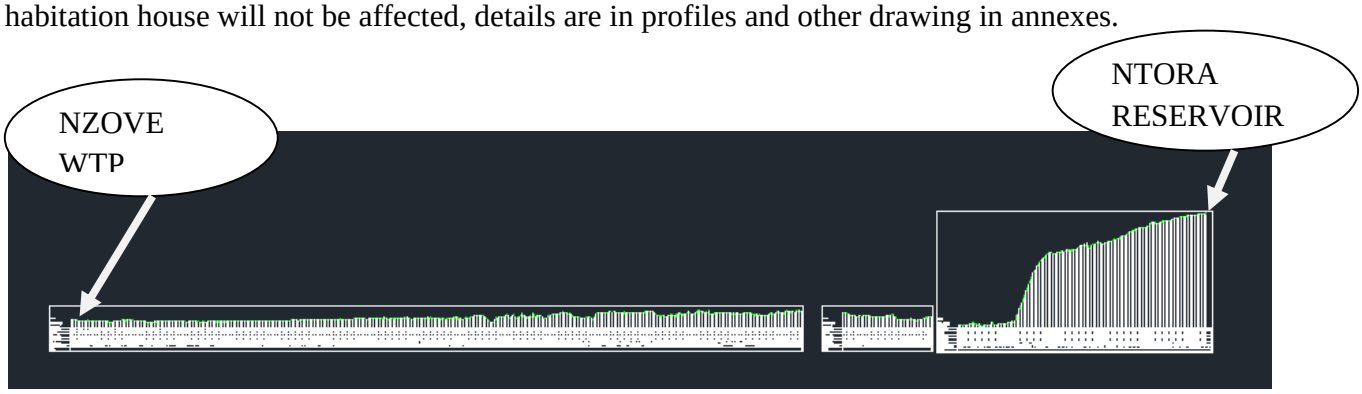


Image 1: existing Nzove –Ntora water Network

I.1.2. Relief of area

Nzove water treatment plant is at low altitudes of 1363.94 m above sea level compare to Ntora village and reservoir location why this water supply from Nzove is a pumping system, Ntora reservoir is at high altitudes 1569.00 m above sea level so that the pumping system requires pumps of high capacity. The topography survey was done in marshland in Nyabugogo catchment and in residential area so that during the work we tried to orient the surveying activities where habitation house will not be affected, details are in profiles and other drawing in annexes.



I.1.3. Water treatment plant capacity

In order to meet water demand it seem to extend water treatment plant and the progress for phase two and three works is currently at high percentage and should completely cover demand for Kigali. The second phase involves upgrading production capacity of the existing 25,000 cubic meters per day to 40,000 cubic meters per day and construction of a new treatment plant with initial capacity of 40,000 cubic meters per day with upgradable capacity of 65,000 cubic meters per day[1].

The plant added 25,000 m3/day on the existing 65,000 m3/day capacity and enabling WASAC to produces 90,000 m3 /day and thereby reducing the water demand gap for the City of Kigali. The current total water demand in Kigali is 110,000m3/day. The government seeks to reach 100 percent clean water supply, in the entire country, by 2020[2]

[1] New times news paper
[2] http://www.mininfra.gov.rw

II. TECHNICAL FEASIBILITY

II.0.Objective of the survey works

II.1.On the side of the client "KOKUSAI KOGYO CO., LTD"

II.1.1. Overall Objective of the Project

As stated the title: Preparatory Survey on the Project for Strengthening of Nzove – Ntora Principal Transmission Pipeline in Kigali City. The purpose of this survey is for obtaining data for the basic design of the water supply facilities such as pipeline and reservoir tank for reinforcing the existing water network in city of Kigali.

II.1.2. Specific Objectives

The consultancy involves in data collection and the production of drawing to be used for the above objective, the drawing to be produced are cross profile longitudinal profiles and the layout plan river cross profile where we cross river.

III.0. METODOLOGY AND MATERIALS

III.1. MATERIALS USED

- GIPS GNSSB RECEIVER STONEX S7G ,
- WOODEN PEGS (bench marks) ,
- Laptop,
- Printer of different format and colours.

III.2. METODOLOGY

After signing the contract, before starting the survey of the route a team composed by client project manager and other teammate, consultant company engineer visit the site from Nzove to Ntora reservoir for site identification.

Client team for site identification

After acknowledgement contractor surveyors guided by engineer visit the site one day and at the second day they start to take data of center line of the proposed route take data of center line of the proposed route from NZOVE to Ntora village.

After entering data the surveyor by using the buffering method he obtains the route in ten meter from the center line both side to follow and cross section in each twenty meter along the route.

At the end of this process we returned on site and taking data of all point along the route and on cross profile in every 20m for clear area and in less than 10 meter in unclear area and in turns. Special case was on areas of river cross where we surveyed 50m*50m around the river and the deep of those str r cross section profile of center line and on route limit.

DURING SURVEY

At the end of this process of taking date we import them with existing data of water network in Kigali city and we get all drawing we need. Drawings produced are:

- Route survey (Plan view, profile)
- Transversal profile in interval of 20 m
- River section vertical profile
- Layout plan with Ortho-photo
- Full report

IV.0. RESULTS AND INTERPRETATION

All required information and analysis are in the drawing depending information needed from surveying results.

We had remarks the following during surveying activities:

- SKOL industry liquid waste discharging exit,

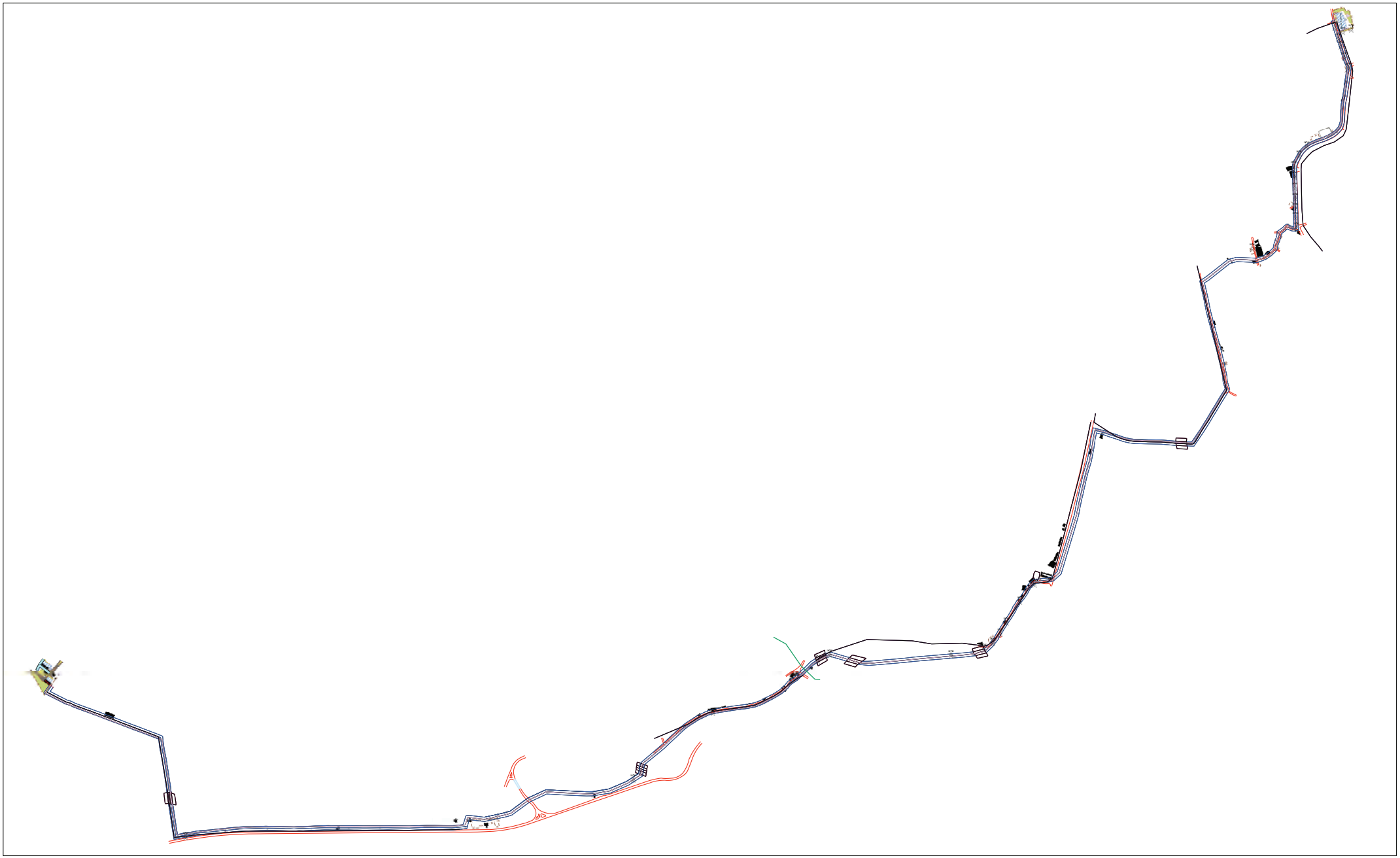
Exit of SKOL industry waste exit

Existing Water Bridge

Rocky ground at the starting of Gisozi Hill

- Existing chamber on existing water pipe line
- Existing water bridge on existing pipe line
- River cross in 6 places
- National road Kigali-Musanze

SITUATION PLAN



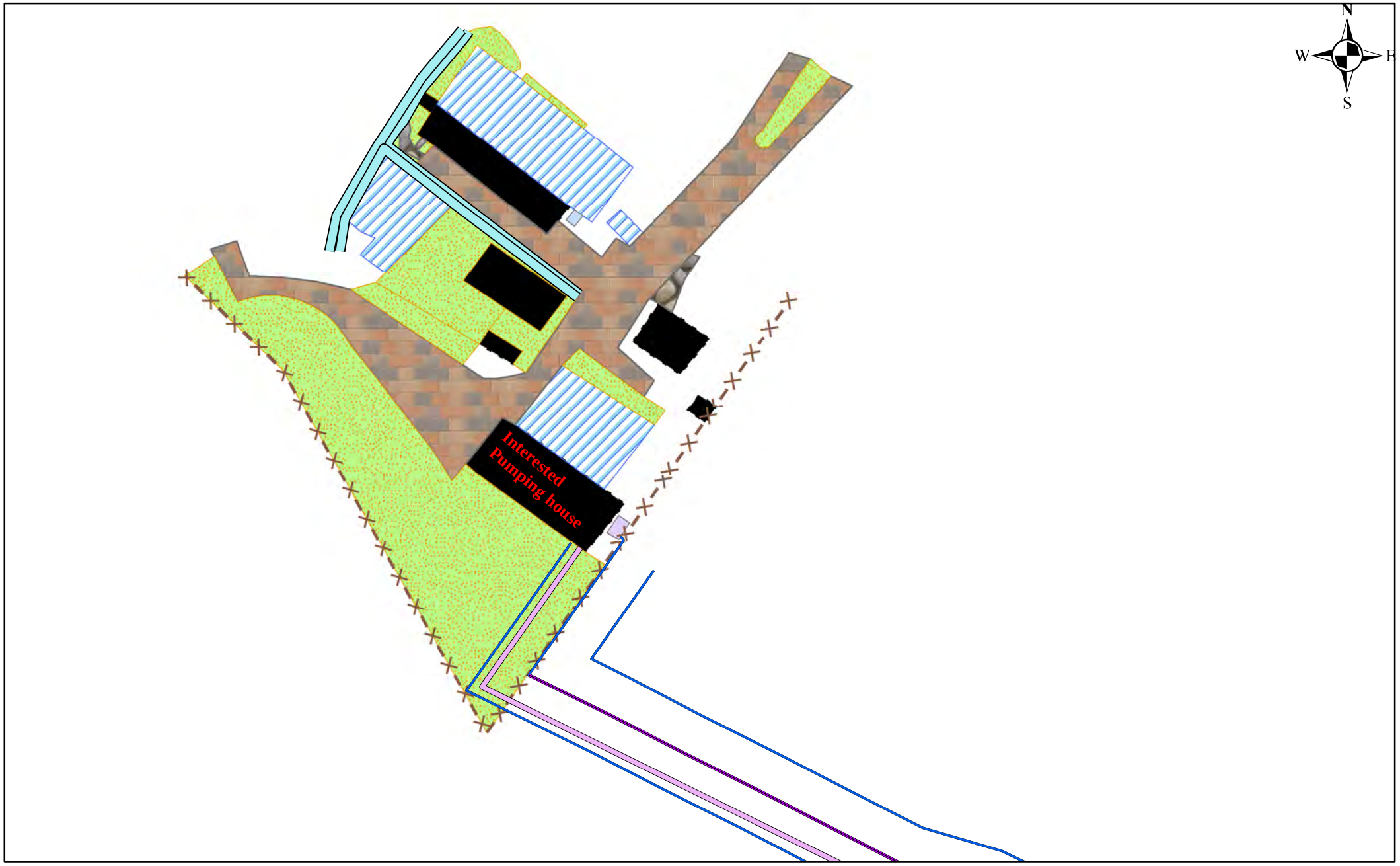
Scale:

0 0.6 1.2 1.8 Km

Legend

- LV
- Gitikinyoni_Bridge
- Water channel
- Yanze water channel
- Existing pipeline
- Proposed pipeline
- Transmission pipeline route
- Cross River
- Existing Road
- Chain wire link
- Fence
- Stone Pavement
- Garden
- Cable paver
- Transformer
- HV
- Structure
- Existing Water Chambers
- Reservoir
- Buil up area

SITUATION PLAN ON PART OF NZOVE WATER TREATEMENT PLAN

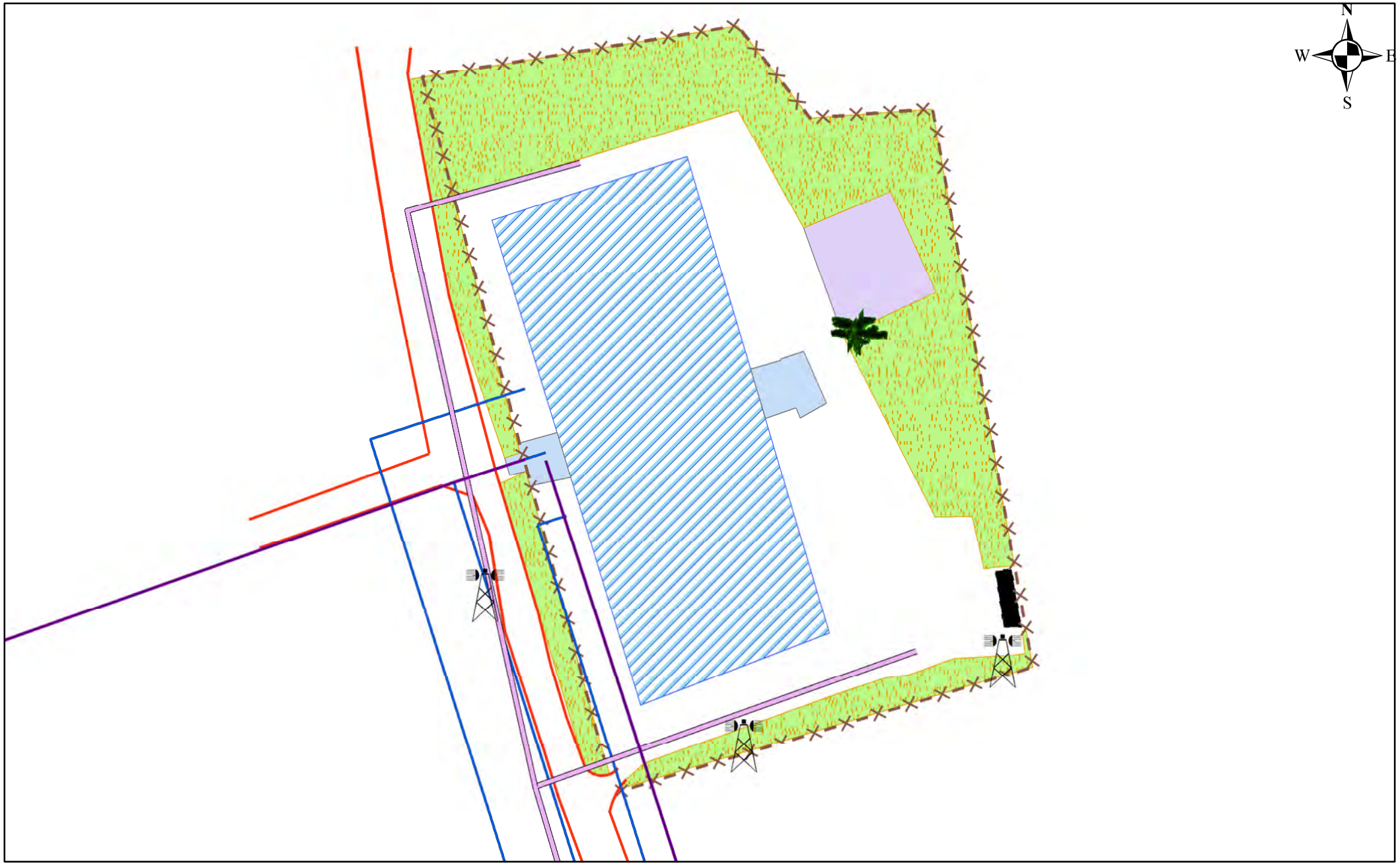


0 0.04 0.08 0.12 Km

Legend

- Water channel1
- Existing pipeline route
- Proposed pipeline route
- Transmission pipeline route
- Chain wire link
- Fence
- Stone Pavement
- Garden
- Cable paver
- Structure
- Reservoir
- Buil up area

SITUATION PLAN OF NTORA RESERVOIR



0 0.025 0.05 0.075 Km

Legend

Tree

LV

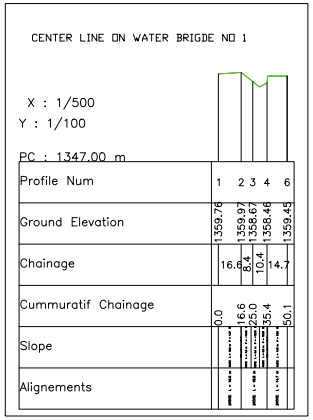
Existing pipeline route
Proposed pipeline route
Transmission pipeline route

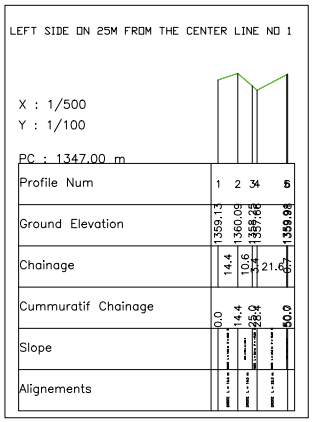
Cross River
Existing Road
Fence

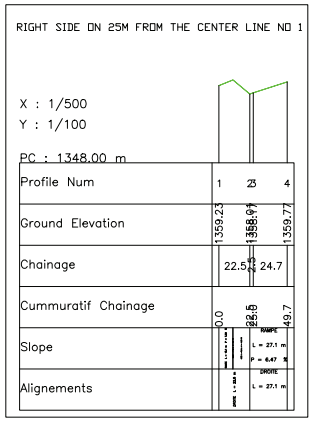
Garden
Structure
Existing Water Chambers

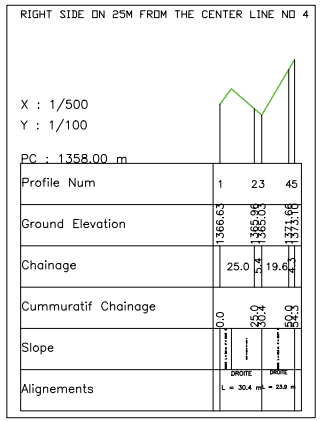
Reservoir
Buil up area

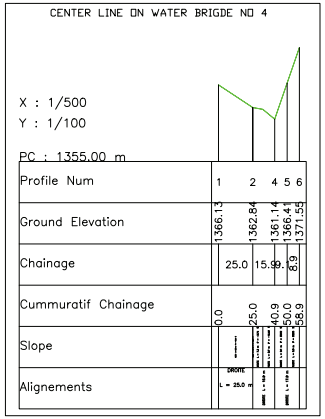
LONGITIDINAL PROFILE ON RIVER CROSS

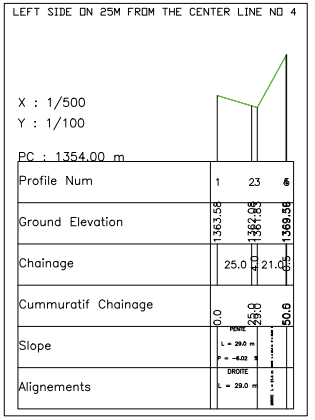


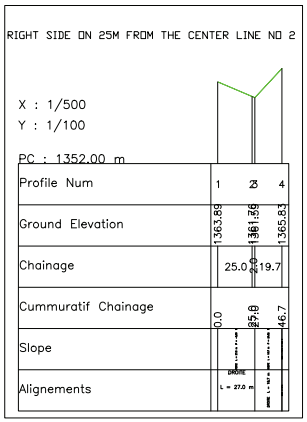


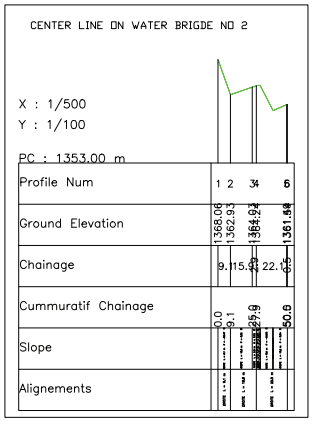


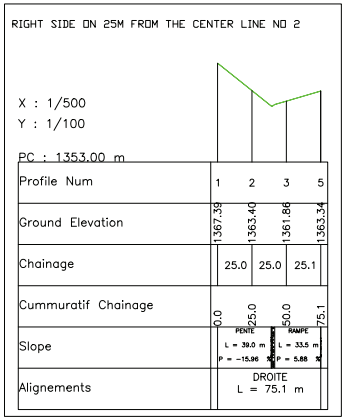


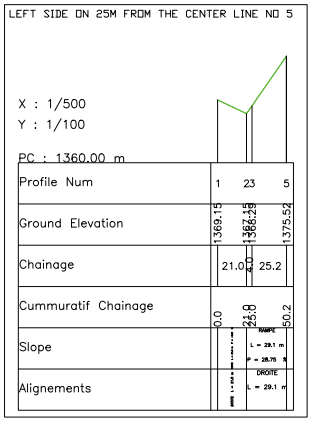


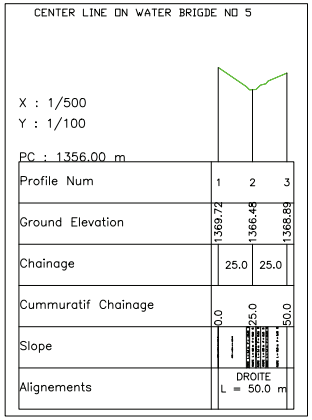


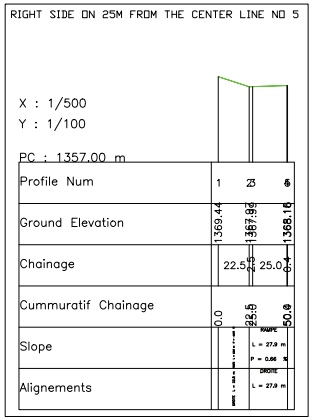


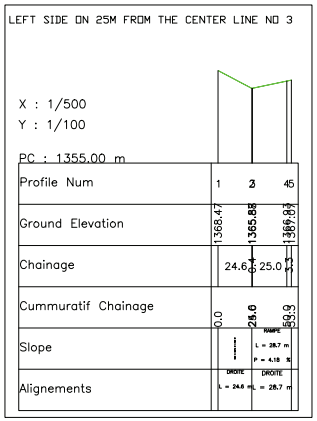


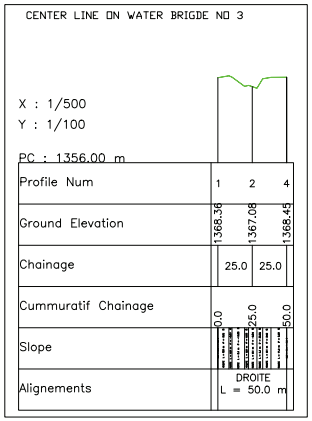


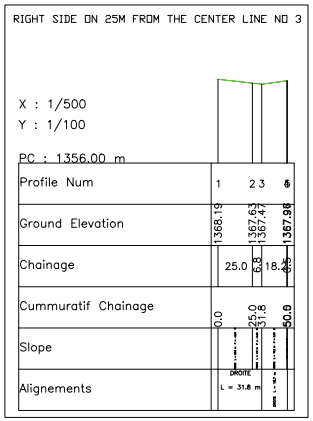


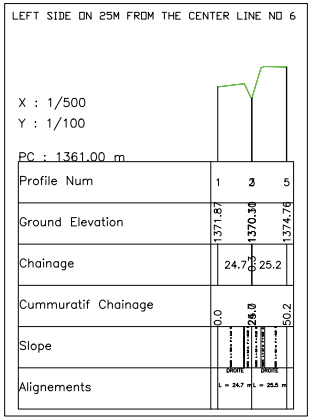


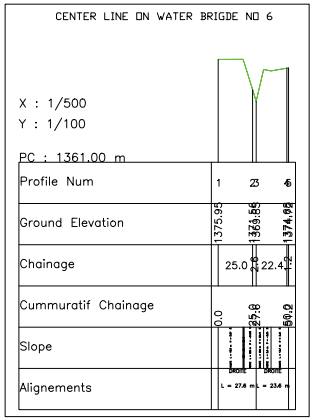


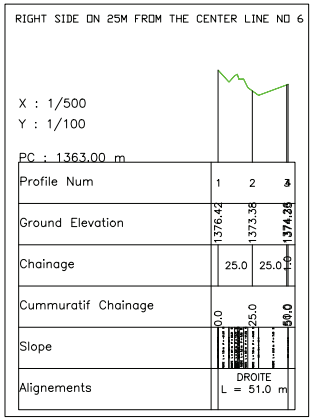












地盤調査報告書

KOKUSAI KOGYO CO., LTD

GEOTECHNICAL REPORT

Subsoil Exploration of NZOVE-NTORA
Principal Transmission Pipeline

Kigali – Rwanda

January, 2018

SUBSOIL EXPLORATION OF NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE

KIGALI - RWANDA

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CARPENTIER PATRICK

January, 2018

January 20th, 2018
FORAKY AFRICA

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Project Management Division,
Overseas Operations Department
2,Rokuban-cho, Chiyoda-ku, Tokyo
102-0085 JAPAN

Attention: Mr. Masahiro KAWAMOTO

RE: Geotechnical report of subsoil Exploration of NZOVE-NTORA principal transmission pipeline

Dear Sir,

In accordance with your request and authorization, Foraky-Africa has performed the geotechnical subsurface exploration for the proposed of NZOVE-NTORA principal transmission pipeline

We submit herewith the investigation report for your information and further action. The present report presents the methodology of the work performed, the quantity of work executed, the geological profiles, and the interpretation of SPT data obtained at site as well as the laboratory test results performed for soil corrosive analysis. At the end of the report based on the obtained data, the recommendations were highlighted.

Summarizing the results presented in our investigation, the site is considered suitable for the proposed construction. The site is located in the area of saturated soil located near the Nyabugogo liver, whereas the unsaturated soil were found to at Gisozi hill approaching Ntora reservoir.

We appreciate the professional collaboration with your team in this project and we will be happy to provide you the continuous services in the execution of project. If in any case you have questions regarding this report or if we may be of further assistance, please contact the undersigned.

Foraky Africa Rwanda.
Patrick CARPENTIER
Director

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INTRODUCTION

FORAKY Africa Rwanda Ltd represented by Mr. CARPENTIER Patrick a private drilling company was commissioned by JICA RWANDA to provide professional services and to perform a Subsoil Investigation for the proposed of NZOVE-NTORA principal transmission pipeline

SITE LOCATION AND SCOPE OF WORK

The site is located along the existing pipe line connecting from Nzove water treatment plant to Ntora reservoir. This is the main water supply pipe line in city of Kigali.
Geotechnical investigation of soil consisted to drill vertically (coring) 14 Boreholes to obtain detailed information of the geology from the full length of the hole in unconsolidated or solid formation and perform the SPT test. The exact location of the boreholes were presented in the table 1 and the map attached to this report (**Appendix B**).
Moreover, 6 trial pits were hand excavated at 2 m deep to obtain the undisturbed soil samples for the laboratory measurement of soil corrosive. The location of the trial pits was also presented in the table 2 and the map attached to this report (**Appendix B**).

Table 1: Location of boreholes Using World Geodetic System (WGS 1984) and the depth reached

No	BH	X	Y	H	Measurements, depth	Location
1	BH1	506225	4788293	1560	SPT, 10 m	Ntora reservoir
2	BH2	506212	4788300	1560	SPT, 10 m	Ntora reservoir
3	BH3	505693	4787196	1461	*N-values- DCPT*	*Slope Ruhango hill/Gisozi*
4	BH6	505628	4786397	1365	SPT &G.Water level,10 m	Foot of Ruhango hill/Gisozi
5	BH7	505505	4786266	1366	SPT &G.Water level, 20 m	Left bank of Nyabugogo river
6	BH8	505479	4786264	1366	SPT &G.Water level, 20 m	Right bank of Nyabugogo river.
7	BH9	504522	4785320	1375	SPT &G.Water level, 13 m	Right bank of Rubonobono
8	BH10	505984	4787506	1521	SPT, 10 m	Near ULK Gisozi
9	BH11	506021	4787438	1515	SPT, 10 m	Near ULK Gisozi
10	BH12	503782	4785265	1363	SPT &G.Water level, 21 m	Right bank of Nyabugog river
11	BH13	502926	4784730	1366	SPT &G.Water level, 13 m	Right bank on Nyabugogo river,
12	BH14	500727	4784587	1355	SPT &G.Water level, 21 m	Left bank on river, Nzove pipe
13	BH15	500684	4784885	1366	SPT &G.Water level, 11 m	Left bank on river, at Nzove
15	BH16	503875	4785219	1366	SPT &G.Water level, 10 m	Right bank on river, at Nzove

Table 2: Location of trial pits Using World Geodetic System (WGS 1984)

No	PIT	X	Y	H (m)	Sampling	Location
1	P1	506012	4787503	1523	Soil corrosive	Ntora reservoir
2	P2	505622	4786881	1377	Soil corrosive	In the path, Foot of Ruhango hill/Gisozi
4	P4	503874	4785220	1365	Soil corrosive	Near BH16
5	P5	504522	4785320	1375	Soil corrosive	Right bank on river, Rubonobono, near BH 9
6	P6	503786	4785252	1363	Soil corrosive	Right bank on river, near BH 12
7	P7	500677	4784875	1366	Soil corrosive	Right bank on river, opposite BH 14

METHODOLOGY OF THE WORK

Method of drilling

Drilling of Top Soil and in Unconsolidated Formation, We used two drilling machines. The drilling method (rotary + wire line system) with water mixed with polymer was used (GS 550). With this method, the Wireline equipment allows the driller to recover the inner tube and the core sample it contains without having to withdraw the rod string and the double core barrel.

From de surface (natural ground) Core drilling in unconsolidated formation up to the final depth (Core size 85mm) was taken.

The recovered cores were stored in wooden boxes and subsequently logged by an experienced geological engineer with deep knowledge of the local geology.

In situ testing

In situ testing were performed in each hole. SPT (Standard Penetration Test) was performed using the energy of a falling weight Drive the penetrometer into the soil.

Model: TECSO. Type: Standard Weight: 63.5 Kg. Norm American ASTM D 1586-63T

This test was performed according the instructions of the supervision in the vertical drilled hole in soil that has not been disturbed by the drilling process.

Table 3: Equipement description

Regulation ref.	ASTM
Weight of striking mass	63.5 Kg
Freefall height	0.76 m
Weight of striking system	4.2 Kg
Diameter of cone tip	50.46 mm
Area of tip base	20 cm^2
Rod length	3 m
Weight of rods /m	7 Kg/m
Depth first rod joint	0.8 m
Tip penetration	15 Cm
Coating/Slurries	No

Sampling and Laboratory testing

Referring to the Terms of Reference, the trial pits were excavated by hands up to 2 m deep, See figure 1. Two undisturbed samples were taken at each trial pit see figure 3 & 4.

Figure 1: Excavated Trial Pit

Figure 2: Backfilling the Trial pit

Figure 3: ø 20 mm, undisturbed samples

Figure 4: ø 90 mm undisturbed samples

Soil corrosive analysis

- ***Bulk density and Natural moisture content:*** The density and natural moisture content tests were performed on samples to be used in calculation of soil resistivity test. This tests were performed from the specimen taken from the samples of 20 mm diameter (see figure 3).
- ***PH test and Oxido-reduction Potential (ORP):*** The electronic test for the determination of PH value of the soil and the reduction potential of the soil were performed according to BS 1377 – 3 respectively.

Figure 5: Test arragement for the electronic method for the detemination of soil PH and ORP (BS 1377 -3)

- ***Electrical resistivity test:*** Six samples were tested in order to find out the electrical resistivity test which will contribute to the evaluation and classification of soil corrosive. The test was tested according to BS 1377 – 3 (10) respecting Wenner probe method.

A brief description of each test preformed on the soil samples and the results were presented in **Appendix D** of the reports.

GROUND CONDITION

Subsurface conditions

In general, from the top of Gisozi hill, i.e from the reservoir toward the valley (BH1, BH2, BH3, BH10 and BH11). For these locations the soil is unsaturated and present adequate strength to support the planned hydraulic structures.
Furthermore, the test points located near Nyabarongo liver present with dark, highly organic clay soil with a very low mechanical resistance. The almost comparable profiles, were found at BH6, BH7, 8, BH12, BH 13, BH14, BH15 and BH16. Even if it is located near the river, BH9 presents the exceptional case were a hard dark to grey quartzophyllite rock was found at 7 meters deep. The stratigraphic description of each layer at each location, is presented in **Appendix C**. and the calculated soil bearing capacity were presented in the **Appendix A** of this report.

Groundwater Conditions

At the time of our field investigation, free groundwater was only encountered at BH6, BH7, 8, BH12, BH 13, BH14, BH15 and BH16. It should be noted that groundwater and soil moisture conditions within the area might vary depending on rainfall intensity, appropriate measures to protect the subsoil from percolating surface water shall be taken during the execution of the project.

Soil corrosiveness conditions

The laboratory test performed to investigate the soil corrosiveness has to be interpreted with the consideration that the site is subjected to uncontrolled area where different chemicals might affected the actual level of corrosiveness of the soil.

However, referring to the oxido-reduction test results, the soil is classified as moderate (Class III) corrosive according to ASTM G-200-9 (2014). The results of electrical resistivity shows that the soils tested from different locations are classified as mildly corrosive soil. (Class II). This difference in classification is due to very low density of the tested soils, which affect the electrical resistivity, thus this factor should be taken into account while taking actions.

Seismic Considerations

According to GSHAP Global Seismic Hazard mapping report (2015), the geology of the region indicates the present of tectonic plates: The African Nubian plate and the Somalia plate broken into the Victoria plate.

The plates move apart, and this movement has created the young volcanoes, whereas some of them are still active (Nyiragongo in RDC). The activity of volcanoes and movement of plate create the seismic movement on the surface.

The probabilistic analysis for 10 % exceedance in 50 years of return period, estimate the Peak Ground Acceleration (PGA) of the site location to be between 0.8 to 1.6 m/s^2.

RECOMMENDATIONS

Trench excavations and backfill

For the section from Nzove towards the location of BH 6, while planning and selecting the excavation methodology, the fact that water table was found nearly to the surface should be considered. The stabilization of sides of the trench will be necessary for most sections of the pipeline. Safety measures for the workers will be a must as there is high risk of drowning.

Moreover, backfill materials will be needed as the soil present at site is not suitable for any technical fill.

Pipe protection:

We recommend the protection of the pipe against corrosion as the test for Oxido-reduction potential shows that the all the soil tested are for class II (mildly corrosive soil). This will also ensure the future safety of the pipeline in the case the soil is contaminated.

Foundation of civil works

For all civil work that will be conducted near the liver Nyabugogo, we recommend to select the deep pile foundations. This is due to the fact that the soil Bering capacity at 2 m deed was found to be less than 30 kN/m^2.

For the reservoir at Ntora, if the footing level is placed at 2 m deep, the brickfire laterite soil will provide a net safe bearing capacity of more than 400 KN/m^2 for the standard single footing. The deep analysis of presented results is required to find out the soil response while loaded by different load considered in the structural design.

The base of foundation excavation should be inspected on completion to ensure that the condition of the soil complies with that assumed in the design.

CONCLUSION.

Based on our findings, referring to obtained laboratory and in situ results the site is considered suitable for the pipeline project, given that further geotechnical analysis and structural design are well performed.

Your comments on this report and findings are strongly praised, please do not hesitate to contact the undersigned at (+250) 788-846-688

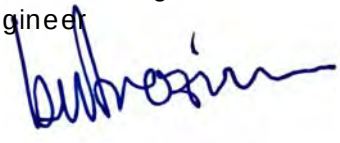
Respectfully submitted

Sincerely,

FORAKY AFRICA.

Benigni N. BUTREZI, Msc. CEng

Geotechnical Engineer



APPENDICES

List of appendices

A. Calculation notes based on SPT test
B. Investigation map
C. Lithographic sections of the bore holes
D. Laboratory test results
E. Core log pictures.

APPENDIX A

Calculation notes based on SPT test

INTERPRETATION OF DYNAMIC PENETRATION RESULTS

The standard penetration test is extensively used in fieldwork by geologists and geotechnicians due to their ease and speed of use and their low cost. The soil penetration test provides fairly precise information regarding the depth of boundary levels in the substrata, depth of water table, breach surfaces on slopes as well as the general consistency of the soil.

The use of data, derived from indirect correlations and referring to various authors, it will still be treated with due caution and, if possible, after geological experience gained in the area.

Characteristic elements of the dynamic penetrometer are as follows:

- hammer weight M;
- free fall height H;
- conical tip: cone base diameter D, base area A (aperture angle a);
- advancement (penetration) d;

Correlation

Correlation with N_{spt}

Since the standard penetration test (SPT) is, today, one of the most common and cheap method to obtain information from the subsoil, most of the existing correlations concern the values of the number of blows N_{SPT} obtained with the abovementioned test, therefore results the need to relate the number of blows of a dynamic penetration test with N_{SPT}. The correlation is given by:

$$NSPT = \beta_t \cdot N$$

Where:

$$\beta_t = \frac{Q}{Q_{SPT}}$$

Q is the specific energy per blow and Q_{spt} is the one referred to the SPT test.

The specific energy per blow is calculated as:

$$Q = \frac{M^2 \cdot H}{A \cdot \delta \cdot (M + M')}$$

Where:

M	Hammer weight.
M'	Rod's weight.
H	Fall height.
A	Tip base area.
d	Penetration step.

Computation of dynamic tip resistance Rpd

Dutch Formula

$$Rpd = \frac{M^2 \cdot H}{[A \cdot e \cdot (M + P)]} = \frac{M^2 \cdot H \cdot N}{[A \cdot \delta \cdot (M + P)]}$$

Rpd	Dynamic tip resistance (area A).
e	Average penetration per blow (d/ N).
M	Hammer weight (fall height H).
P	Total weight of the striking system.

Computation of $(N_1)_{60}$

$(N_1)_{60}$ is the standardized number of blows, defined as follows:

$$(N_1)_{60} = \mathrm{CN} \cdot \mathrm{N60} \text{ con } \mathrm{CN} = \sqrt{(\mathrm{Pa}/'\sigma_{vo})} \quad \mathrm{CN} < 1.7 \quad \mathrm{Pa} = 101.32\,\mathrm{kPa}$$ *(Liao e Whitman 1986)*

$$N_{60} = N_{SPT} \cdot (\mathrm{ER}/60) \cdot \mathrm{C_S} \cdot \mathrm{C_r} \cdot \mathrm{C_d}$$

ER/60	Energy ratio of the driving system standardized at 60%
C_S	Parameter function of the covering (1.2 if absent)
C_d	Function of the borehole diameter (1 if between 65-115mm)
C_r	Correction parameter function of the rod's length

Calculation Methodology

The calculation of the ratio of transmitted energies (correlation coefficient with SPT) was based on the researches of different authors: Pasqualini (1983) - Meyerhof (1956) - Desai (1968) - Borowczyk-Frankowsky (1981).

Data obtained was used to extrapolate useful geological and geotechnical information.

A vast experience, together with a good interpretation and correlation, can often obtain useful data for the design work and frequently more reliable data than many geotechnical data determined from few laboratory tests.

Standardization of N_{SPT}

The different equipment types introduce variability factors in the value of N_{SPT} therefore is needed a correction to report the number of blows N to the energy efficiency of the driving system. Generally all researchers refer to an efficiency of 60% (N_{60}).

The efficiency of the device is identified as follows:

$$ER_i = (E_i/\mathrm{E}^*) \text{ in } (\%)$$

where

Ei = Energy of the first compression wave produced by the impact of the hammer it is a loss of energy due to the transformation of the kinetic energy of the hammer into compression wave in the rods.

E* = Nominal kinetic energy of a hammer (free-fall energy of the hammer) of mass/weight equal to 63.5 kg in free fall from a height of 0.76 m (equal to 474 Joule).

The value of Ei is obtained, among many theories, even with the method of the compression wave integration. (F. Cestari, par. 5.3.8.5 – "*Prove Geotecniche in Sito*").

Skempton (1986) summarized the values obtained with the most commonly used devices in the world, getting the efficiency ERi as a product of two terms:

$$ER_i = ER_y \cdot \eta_d$$

Where: ER_v = velocity energy ratio equal to E_h/E^* with E_h hammer (transferable) energy in base of hammer impact velocity and h_d dynamic efficiency that depends on the dimensions of the hammer, driving system and rods.

In the table below are shown the results of a series of measurements:

	Release			Hammer system			ER_r: %
	Type	Cathead	ER_v: %	Hammer	Anvil weight: kg	η_d	
Waterways Experiment Station	Trip	—	100	Vicksburg	0	0·83	83
Japan	Tombi	—	100	Donut	2	0·78	78
Japan	Slip-rope (2 turns)	Small	83	Donut	2	0·78	65
USA	Slip-rope (2 turns)	Large	70	Safety	2·5	0·79	55
UK	Slip-rope (1 turn)	Small	85	Old standard	3	0·71	60
USA	Slip-rope (2 turns)	Large	70	Donut	≈12	0·64	45
UK	Trip	—	100	Pilcon	19	0·60	60

Energy ratios and dynamic efficiency

(Skempton, A.W. (1986) – *Géotechnique* 36, No. 3, 425 - 447).

Allowable Pressure

Allowable pressure specification on interaxis calculated according to the known processing proposed by Herminier, applying a safety factor (usually = 20-22), which corresponds to a standard factor of safety of foundations equal to 4, with a standard footing geometry of 1 m width and d = 1 m (depth).

The results of obtained allowable pressure for the boreholes are presented:

BH1

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	67	394.17
2.00	77	441.27
3.00	92	474.32
4.00	53	248.00
5.00	100	459.29
6.00	64	269.44
7.00	91	353.49
8.00	94	360.46
9.00	92	327.83
10.00	91	302.72

BH2

Depth (m)	No. of blows	Allowable pressure Herminier – Dutch (KPa)
1.00	94	553.02
2.00	90	515.77
3.00	93	479.48
4.00	97	453.88
5.00	92	422.54
6.00	102	429.42
7.00	108	419.52
8.00	93	356.63
9.00	106	377.72
10.00	112	372.57

BH3 (DCPT)

Depth (mm)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
10	10	133.76
20	39	398.68
30	32	351.14
40	70	711.36
50	65	658.62
60	82	828.48

BH 6

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	2	15.44
2.00	1	7.57
3.00	6	41.10
4.00	6	37.50
5.00	6	36.98
6.00	8	45.38
7.00	1	5.25
8.00	1	5.20
9.00	1	4.85
10.00	1	4.54

BH 7

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	1	7.72
2.00	1	7.57
3.00	2	13.70
4.00	1	6.25
5.00	2	12.33
6.00	2	11.35
7.00	2	10.51
8.00	1	5.20
9.00	2	9.70
10.00	3	13.62
11.00	5	22.54
12.00	7	29.66
13.00	8	31.96
14.00	60	172.46
15.00	73	197.53
16.00	80	204.00
17.00	94	236.41
18.00	98	231.86
19.00	98	217.95
20.00	100	217.57

BH 8

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	8	61.78
2.00	2	15.14
3.00	1	6.85
4.00	1	6.25
5.00	2	12.33
6.00	1	5.67
7.00	2	10.51
8.00	2	10.41
9.00	3	14.55
10.00	2	9.08
11.00	3	13.53
12.00	6	25.43
13.00	4	15.98
14.00	16	59.08
15.00	41	110.94
16.00	93	237.15
17.00	98	246.47
18.00	84	198.74
19.00	102	226.85
20.00	101	219.75

BH 9

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	17	123.46
2.00	43	246.42
3.00	72	371.21
4.00	79	369.66
5.00	91	417.95
6.00	97	408.37
7.00	101	392.33
8.00	91	348.96
9.00	110	391.97
10.00	112	372.57
11.00	113	372.22
12.00	115	355.13
13.00	120	348.39

BH 10

Depth (m)	No. of blows	Allowable pressure Herminier – Dutch (KPa)
1.00	3	23.17
2.00	29	192.86
3.00	95	489.79
4.00	93	435.17
5.00	100	459.29
6.00	103	433.63
7.00	90	349.60
8.00	94	360.46
9.00	95	338.52
10.00	99	329.33

BH 11

Depth (mm)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	13	94.41
2.00	10	75.70
3.00	15	96.39
4.00	12	74.99
5.00	99	454.69
6.00	25	123.54
7.00	80	310.76
8.00	88	337.46
9.00	90	320.70
10.00	100	332.66

BH 12

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	3	23.17
2.00	2	15.14
3.00	3	20.55
4.00	2	12.50
5.00	4	24.65
6.00	4	22.69
7.00	3	15.76
8.00	5	26.02
9.00	9	43.66
10.00	7	31.79
11.00	9	40.58
12.00	11	46.62
13.00	7	27.96
14.00	6	23.79
15.00	4	14.98
16.00	5	17.70
17.00	5	17.53
18.00	4	13.25
19.00	6	18.79
20.00	6	18.50

BH 13

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	3	23.17
2.00	2	15.14
3.00	2	13.70
4.00	3	18.75
5.00	2	12.33
6.00	4	22.69
7.00	14	68.76
8.00	100	383.47
9.00	100	356.34
10.00	100	332.66
11.00	100	329.40
12.00	100	308.81
13.00	100	290.32

BH 14

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	1	7.72
2.00	1	7.57
3.00	2	13.70
4.00	1	6.25
5.00	1	6.16
6.00	1	5.67
7.00	19	93.32
8.00	16	77.79
9.00	4	19.40
10.00	3	13.62
11.00	2	9.02
12.00	2	8.48
13.00	3	11.98
14.00	3	11.90
15.00	1	3.74
16.00	2	7.08
17.00	1	3.51
18.00	2	6.63
19.00	1	3.13
20.00	2	6.17

BH 15

Depth (m)	No. of blows	Allowable pressure Herminier - Dutch (KPa)
1.00	15	108.94
2.00	13	92.43
3.00	4	27.40
4.00	4	25.00
5.00	7	43.14
6.00	6	34.04
7.00	16	78.59
8.00	17	82.65
9.00	14	63.41
10.00	12	54.50

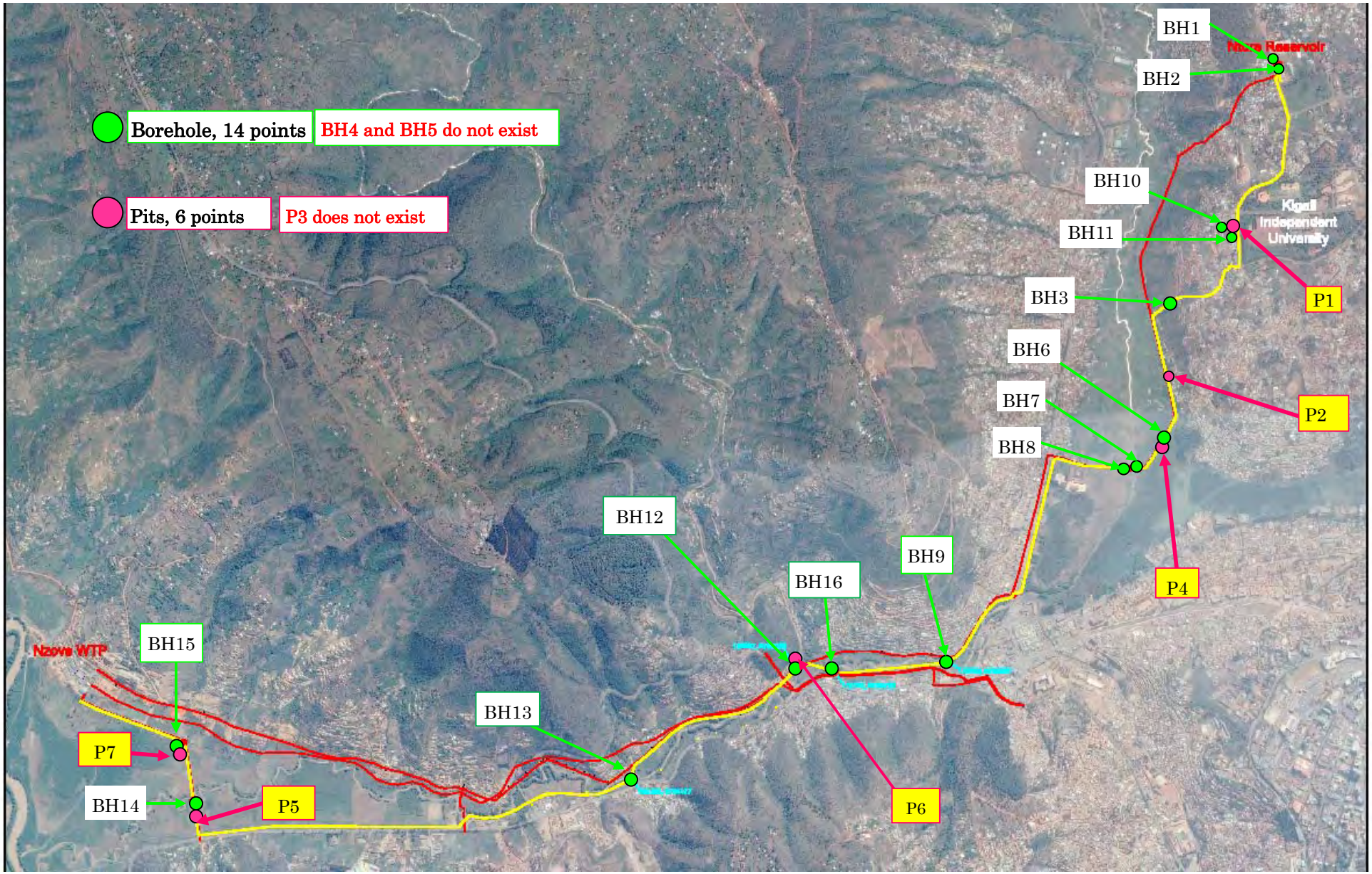
BH 16

Depth (m)	No. of blows	Allowable pressure Herminier – Dutch (KPa)
1.00	2	15.44
2.00	4	30.28
3.00	4	27.40
4.00	7	43.75
5.00	12	73.96
6.00	1	5.67
7.00	2	10.51
8.00	3	15.61
9.00	6	29.11
10.00	6	27.25

APPENDIX B

Investigation map

Nzove - Ntora Geotechnical Investigation Map



APPENDIX C

Lithographic section of the bore holes

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE BH 1: LOCATION: GASABO DISTRICT X:506225 Y: 4788293

START: 10 DECEMBER 2017 END: 12 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithology description
					Dark topsoil with roots and rock fragments
1					Brown beige lateritic soil
			1	13 -28-39	
2					Beige yellow oxidized laterite &quartz grain
			2	11-35-42 R: 9 cm	Cataclastic grey whitish quartz fragments
3					Quartz fragments with brown beige laterite
			3	34-42 R: 5 cm	
4					Grey whitish quartz fragments, subangular
			4	12-22-31	and subrounded shape, medium to coarse
5					grained size, with opened jpints
			5	44 Refusal: 5cm	
6					Quartz fragments with brown beige laterite
			6	15-28-36	
7					
			7	30-41 R: 10 cm	Grey brownish sericitized weathered schist
8					& grey brownish sandstone, medium to
			8	29-44 R: 8 cm	coarse grained size, with spaced opened
9					joints
			9	37-42 R: 11 cm	
10					
			10	21-41 R: 13 cm	

R: Refusal

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 2 -LOCATION: GASABO DISTRICT X: 506212 Y:4788300

START: 12 DECEMBER 2017 END: 14 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithology description
					Dark brown topsoil with roots, lateritic soil
1					Beige brickfire laterite, massive, coarse
			1	44 Refusal; 11 cm	grained, with quartz fragments
2					
			2	40 Refusal: 9 cm	
3					Grey brownish to whitish sandstone,
			3	43 Refusal: 7 cm	quartzite, medium to coarse grained size,
4					massive, with medium spaced opened
			4	41 Refusal: 5 cm	joints, partially oxidized
5					
			5	42 Refusal: 11 cm	
6					
			6	45 Refusal: 2 cm	
7					
			7	40 Refusal: 8 cm	
8					Grey brownish to whitish sandstone,
			8	43 Refusal: 4 cm	quartzite, medium to coarse grained size,
9					massive, with medium spaced opened
			9	42 Refusal: 6 cm	joints, partially oxidized
10					
			10	44 Refusal: 12 cm	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 3: DYNAMIC PENETROMETER LOCATION: GASABO DISTRICT

X: 505693 Y: 4787196 DATE OF EXECUTION: 10 JANUARY 2018

Depth (Cm)	Water Level	Log	SPT No	Blows	Lithology description
					Brwonish lateritic soil & quartzite debris
10			1	10	Hard sound grey to brownish Sandstone. quartzite, masive with closed to opened joints, partially oxidized
20			2	39	
30			3	32	Hard sound grey to brownish Sandstone. quartzite, masive with closed to opened joints, partially oxidized
40			4	70	
50			5	65	Hard sound grey to brownish Sandstone. quartzite, masive with closed to opened joints, partially oxidized
60			6	82	Hard sound grey to brownish Sandstone. quartzite, masive with closed to opened joints, partially oxidized

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE BH 6 -LOCATION: GASABO DISTRICT X:505628 Y:4786397

START: 17 DECEMBER 2017 END: 18 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
	0.60 m				Grey schist debris mixed with soil
1			1	1 -1 - 1	Grey clay, fine to medium grained size, medium compactness, medium spaced discontinuity, with homogenous structure
2			2	1 Blow: 45 cm	Grey black clay mixed with brown fine sand
3			3	1 - 2 - 4	Brown, grey to whitish sand, fine to medium grained size, dry, homogenous structure, subrounded shape, loose compactness & widely spaced discontinuity
4			4	2 - 3 - 3	
5			5	2 - 2 - 4	
6			6	3- 4 - 4	
7			7	1 Blow : 45 cm	Dark brown clay, fine to medium grained size, homogenous, massive, medium compactness, with a closely spaced discontinuity
8			8	1 Blow: 45 cm	
9			9	1 Blow: 30 cm	Black peaty clay, fine to medium grained size, massive, medium compactness, with a closely spaced discontinuity
10			10	1 Blow: 45 cm	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 7: LOCATION; GASABO DISTRICT X:505505 Y:4786266

START: 19 DECEMBER 2017 END: 22 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
		✶✶✶✶✶✶			Dark black soil with roots
1		∫∫∫∫∫∫∫∫			Grey weathered schists, with opened joints
	1.20 m		1	1 - Blow:45 cm	Grey brownish clay, with a dense
2					compactness and a homogenous grading,
			2	1 - Blow:45 cm	and a closely discontinuity, fine to medium
3					grained size
			3	1-1 Blow:30cm	
4					Grey brownish clay, with a dense
			4	1 - Blow:45 cm	compactness and a homogenous grading,
5					and a closely discontinuity, fine to medium
			5	1-1 Blow:30cm	grained size
6					
			6	1 - 1 - 1	Dark black compact clay mixed with peat,
7					with a homogenous grading and a closely
			7	1 - 1 - 1	discontinuity, fine to medium grained size.
8					
			8	1-1 Blow:30cm	
9					Dark black compact clay mixed with peat,
			9	1 - 1 - 1	with a homogenous grading and a closely
10					discontinuity, fine to medium grained size.
			10	1-1 - 2	
11					
			11	1 - 1 -4	
12					Dark black clay with a dense compactness
			12	2-3 - 4	and a homogenous grading, fine to medium
13					grained size and closely spaced disconti-
			13	1 - 3 - 5	nuity
14					Grey whitish sand, fine to medium grained
			14	12 -28- 32	size, poorly graded, with subrounded
15					particle size and homogenous structure,
			15	19-31-42 R:10 cm	dry humidity and loose compactness,
16					and widely spaced discontinuity. Small
			16	28-39-41 R:5cm	quartz pebbles are found inside the sand.
17					
			17	20-44 R:14cm	
18					Grey whitish sand, fine to medium grained
			18	27-42 R:9 cm	size, poorly graded, with subrounded
19					particle size and homogenous structure,
			19	29-43 R; 12 cm	dry humidity and loose compactness,
20					and widely spaced discontinuity.
			20	30-42 R: 8 cm	

Lithograthic profile

R: Refusal

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 8 LOCATION: NYARUGENGE DISTRICT X:505479 Y: 4786264

START: 24 DECEMBER 2017 END: 28 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
					Dark grey brown soil with schist fragments
1			1	3- 4 - 4	Orange to yellowish lateritic soil
2	2.19		2	1 - 1 - 1	dark grey clayey sand, poorly graded, medium grained size and less homogenous
3			3	1 Blow: 45 cm	Dark brownish clay & sandy clay, less homogenous and medium compactness, fine to medium grained size and medium spaced discontinuity
4			4	1-1 Blow:30cm	
5			5	1- 1- 1	
6			6	1-1 Blow:30cm	Dark brownish clay, compact, fine to medium grained size, less homogenous, and compact
7			7	1 - 1 - 1	Black peaty soft clay, compact,finely grained
8			8	1 - 1 - 1	Black peaty soft clay, compact,finely grained
9			9	1 - 1 - 2	
10			10	1 - 1 - 1	Black peaty clay, finely grained, with a dense to medium compactness and a closely spaced discontinuity
11			11	1- 1 - 2	
12			12	1 - 3 - 3	Black homogenous compact clay, fine to medium grained size
13			13	1 - 2 - 2	Dark grey & grey clayey sand, poorly graded, less compact
14			14	4 - 7 - 9	Grey sand, medium grained size, with loose compactness and subrounded shape
15			15	6 - 14 - 27	
16			16	21-43 R: 11 cm	Grey sand, medium grained size, with loose compactness and subrounded shape, with quartz pebbles and widely spaced discontinuity.
17			17	26-41 R: 7cm	
18			18	12-34-44 R:10 cm	Grey sand, medium grained size, with loose compactness and subrounded shape, with quartz pebbles and widely spaced discontinuity.
19			19	30-42 R: 7 cm	
20			20	27-41 R: 7cm	

Lithograthic profile

R: Refusal

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 9 LOCATION: GASABO DISTRICT X:504522 Y:4785320

START: 30 DECEMBER 2017 END: 3 JANUARY 2018

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
1					Brown orange soil and lateritic soil
			1	4 - 7 - 10	
2					Grey brown schist fragments with pebbles
			2	12 - 19 - 24	Yellow, brown yellowish laterite and
3					lateritic schists
			3	15 - 32 - 40	
4					
	4.55m		4	19-29-42 R:7cm	Beige, mauve weathered shists, medium
5					to coarse grained size, with less spaced
			5	27-41 Refusal:10cm	joints
6					
			6	30-41 Refusal:6cm	
7					
			7	29-43 Refusal:4cm	Hard dark to grey quartzophyllite,
8					maasive, medium to coarse grained size,
			8	23-41 R: 12 cm	sound with opened to cloesd joints
9					
			9	45 Refusal:10cm	Hard grey, beige to mauve quartzophyllite,
10					and sandy quartzophyllite, massive and
			10	42 Refusal: 9cm	sound with opened to cloesd joints
11					
			11	43 R: 10 cm	
12					Hard grey, beige to mauve quartzophyllite,
			12	41 R: 8 cm	and sandy quartzophyllite, massive and
13					sound with opened to cloesd joints
			13	42 R: 5cm	

R: Refusal

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE BH 10 -LOCATION: GASABO DISTRICT X:505984 Y: 4787506

START: 14 DECEMBER 2017 END: 17 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithology description
1		✶✶✶✶✶✶	1	1- 1 -2	Dark brown topsoil with plant roots
2		✶:✶:✶:✶	2	7 - 12 - 17	Brown to beige soil mixed with sandy soil. having a loose compactness
3		✸✸✸✸✸	3	28-45 Refusal:5cm	Brown to brickfire lateritic soil brown orange yellowish laterite, with a homogenous structure, oxidized.
4		✸✸✸✸✸	4	30-45 Refusal:7cm	
5		● ● ● ● ●	5	45 Refusal: 10 cm	Grey weathered sandstone, medium to coarse grained size, with spaced joints
6		∫∫∫✸∫∫∫	6	25-45 Refusal:7cm	Brown orange lateritized schists, oxidized, with opened to cclosed joints
7		∫∫∫✸∫∫∫	7	23 -40 -45 R: 5 cm	Brown orange lateritized schists
8		∫∫∫∫∫∫∫	8	34 -45 R: 10 cm	Grey beige to brownish weathered schits medium to coarse grained size, with a granoblastic structure & with opened joints
9		∫∫∫∫∫∫∫	9	38 - 45 R: 5 cm	
10		● ● ◆ ●	10	29 - 45 R: 3 cm	Quartz blocks & grey beige ferruginized quartzite, coarse grained & opened joints

R: Refusal

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE BH 11 -LOCATION: GASABO DISTRICT X: 506021 Y: 4787438

START: 17 DECEMBER 2017 END; 18 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
1		✶✶✶✶✶✶ ✶✶✶✶✶✶			Dark brown topsoil with plant roots
2		✶:✶:✶:✶	1	4 - 6 - 7	Brown to beige soil mixed with sandy soil. having a loose compactness
3		✷✷✷✷✷ ✷✷✷✷✷	2	3 - 4 - 6	Light brown to beige & firebrick laterite, with a dense compactness & a homogenous grading and an oxidized alteration
4		✷✷✷✷✷ ✷✷✷✷✷	3	4 -8 -7	
5		✷✷✷✷✷ ✷✷✷✷✷	4	5 - 6 - 6	
6		✷✷✷✷✷ ✷✷✷✷✷	5	20-49 R: 12 cm	Brown orange to yellowish lateritic blocks
7		∫∫∫✷∫∫∫ ∫∫∫✷∫∫∫	6	7 - 10 -15	Grey beige to orange yellowish lateritic limonitized schists, medium to coarse grained size, with openedd joints, slightly weathered.
8		∫∫∫✷∫∫∫ ∫∫∫✷∫∫∫	7	30- 39 -41	
9		∫∫∫✷∫∫∫ ∫∫∫✷∫∫∫	8	34-38-48 R:10cm	Grey beige to orange yellowish lateritic limonitized schists, medium to coarse grained size, with openedd joints, slightly weathered.
10		∫∫∫✷∫∫∫ ∫∫∫✷∫∫∫	9	28-36-50 R: 13 cm	
			10	40-50 R: 11 cm	

R: Refusal

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE BH 12 -LOCATION: NYARUGENGE DISTRICT X:503782 Y:4785265

START: 20 DECEMBER 2017 END: 22 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithology description
1					Brown beige topsoil
2			1	1- 1 - 2	Brown to beige soil mixed with sandy soil. having a loose compactness
3	2.50 m		2	1 - 1 - 1	
4			3	2 - 2 - 1	Brown compact clay and silty clay, closely spaced discontinuity, fine to medium grained size, homogenous structure,damp poorly oxidized
5			4	1 - 1 - 1	
6			5	2 - 2 - 2	
7			6	3 - 2 - 2	
8			7	1 - 1 - 2	Grey to brownish clay and silty clay, fine to medium grained size, graded, with medium compactness and with closely spaced discontinuity
9			8	2 - 2 - 3	
10			9	4 - 4 - 5	
11			10	2 - 3 - 4	Grey to brownish clay and silty clay, fine to medium grained size, graded, with medium compactness and with closely spaced discontinuity
12			11	3 - 3 - 6	
13			12	3 - 5 - 6	Black peaty clay, fine to medium grained, with a homogenous structure, massive with a medium compactness and a closely spaced discontinuity, poorly oxidized.
14			13	2 - 3 -4	
15			14	3- 3- 3	
16			15	2 - 2 - 2	
17			16	2 - 2 - 3	Black peaty clay, fine to medium grained, with a homogenous structure, massive with a medium compactness and a closely spaced discontinuity, poorly oxidized.
18			17	3 - 2 -3	
19			18	2 - 2 - 2	
20			19	3 - 2 - 4	Black peaty clay, fine to medium grained, with a homogenous structure, massive with a medium compactness and a closely spaced discontinuity, poorly oxidized.
			20	3 - 3 - 3	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 13 LOCATION: GASABO DISTRICT X:502926 Y: 4784730

START: 23 DECEMBER 2017 END: 27 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
1	1.57m		1	1-1 - 2	Dark brownish soil, soft clayey soil
2			2	1 - 1 - 1	
3			3	1 - 1 - 1	Dark brownish and brown clay, fine to medium grained size, compact, less homogenous and less spaced discontinuity
4			4	1 - 2 - 1	
5			5	1 - 1 - 1	Dark brownish and brown clay, fine to medium grained size, compact, less homogenous and less spaced discontinuity
6			6	2- 3 - 2	
7			7	3 - 6 -8	Dark brownish and brown clayey sand with peaty clay inclusions
8			8	45 Refusal: 5cm	Debris of quartzite, grey whitish color
9			9	35 Refusal: 3cm	
10			10	40 Refusal: 4cm	Grey whitish sandstone, quartzite massive and sound, medium to coarse grained size, with opened to closed joints
11			11	39 Refusal: 3cm	
12			12	34 Refusal: 1 cm	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 14 LOCATION: NYARUGENGE DISTRICT X:500727, Y:4784587

START: 05 JANUARY 2018 END: 8 JANUARY 2018

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
		✶✶✶✶✶✶			Brown topsoil
1					
	1.06 m		1	1 - Blows:45 cm	Dark brown soft clay, with a medium
2					compactness, fine to medium grained size,
			2	1-1 Blows:30cm	with a closely spaced discontinuity
3					
			3	1 - 1 - 1	
4					Dark brown soft clay, with a medium
			4	1-1 Blows: 30 cm	compactness, fine to medium grained size,
5					with a closely spaced discontinuity
			5	1-1 Blows:30cm	
6					
			6	1 - 1 - 1	Dark sandy clay, medium grained size,
7					not homogenous, with a medium
			7	3 - 7 - 12	compactness, massive and medium
8					spaced discontinuity
			8	4 - 6 - 10	
9					Brown homogenous and medium size sand
			9	1 - 2 - 2	
10					Black peaty clay, fine to medium grained,
			10	1 - 1 - 2	with a homogenous structure, massive
11					with a medium compactness and a closely
			11	1 - 1 - 1	spaced discontinuity, poorly oxidized.
12					
			12	1 - 1 - 1	
13					
			13	1 - 1 - 2	
14					Black peaty clay, fine to medium grained,
			14	1 - 2 - 1	with a homogenous structure, massive
15					with a medium compactness and a closely
			15	1-1 Blows:30cm	spaced discontinuity, poorly oxidized.
16					
			16	1 - 1 - 1	
17					
			17	1-1 Blows:30cm	
18					Black peaty clay, fine to medium grained,
			18	1 - 1 - 1	with a homogenous structure, massive
19					with a medium compactness and a closely
			19	1-1 Blows:30cm	spaced discontinuity, poorly oxidized.
20					
			20	1 - 1 - 1	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 15 LOCATION: NYARUGENGE DISTRICT X: 500684 Y: 4784885

START: 29 DECEMBER 2017 END: 31 DECEMBER 2017

Depth (m)	Water Level	Log	SPT No	Blows	Lithological description
1	0.65 m				Brown beige soil, lateritic soil
2			1	4 - 7 - 8	Brown beige soil, lateritic soil
3			2	3 - 6 - 7	Brown beige soil, clayey soil
4			3	2 - 2 - 2	Brown clay, homogenous, fine to medium grained size, closely spaced & dense compact
5			4	1 - 2 -2	Dark green clay & sandy clay, fine to medium grained size, closely spaced & dense compact ,less homogenous and massive
6			5	2 - 3 - 4	
7			6	3 - 3 - 3	
8			7	5 - 7 - 9	Grey sand, medium grained size, well graded, with subrounded particle shape, homogenous and massive, with a loose compactness and widely spaced discontinuity
9			8	6 - 7 - 10	
10			9	4 - 6 - 8	
			10	4 - 5 - 7	

Lithograthic profile

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

BOREHOLE 16: LOCATION: NYARUGENGE DISTRICT X:503875 Y: 4785219

START: 05 JANUARY 2018 END: 6 JANUARY 2018

Depth (m)	Water Level	Log	SPT No	Blows	Lithology description
					Dark brown topsoil
1	1,00m				
			1	1 -1 - 1	Dark brown clayey sand, medium grained,
2					poorly graded, with a subrounded shape,
			2	1 - 2 - 2	loose compactness and no homogeneity.
3					
			3	2 - 2 - 2	
4					
			4	4 - 3 - 4	Dark brown clayey sand, medium grained,
5					poorly graded, with a subrounded shape,
			5	2 - 5 - 7	loose compactness and with quartz
6					pebbles
			6	1 Refusal: 45cm	Dark grey clay with brown sandy clay,
7					fine to medium grained size, poorly graded,
			7	1 - 1 - 1	not homogenous, medium compactness,
8					with a closely discontinuity
			8	1 - 1 - 2	
9					Dark grey clay with brown sandy clay,
			9	2 - 3 - 3	fine to medium grained size, poorly graded,
10					not homogenous, medium compactness,
			10	3 - 3 - 3	with a closely discontinuity

Regend

Alluvium		Quartzite, sandstone	
Soil		Schist	
Laterite		Sandy schist	
Clay, silt		Phyllite, quartzophyllite	
Peaty clay		Fractured schist	
Clayey sand		Ferriginized rocks	
Fine to medium grained sand		Granite	
Coarse grained sand			

Lithograthic profile

APPENDIX D

Laboratory test results

BULK DENSITY

PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE

CLIENT: JICA RWANDA

Operated by: Girbert
Verified by: Butrezi
Date: 08/01/2018

Trial Pit No	Depth (m)	Mass of wet soil + Container (grs)	Mass of dry soil + Container (grs)	Mass of Container (grs)	Volume of Container (Cm^3)	Bulk density (gr/Cm^3)	Dry density (gr/Cm^3)	Bulk density (gr/Cm^3)	Dry density (gr/Cm^3)
1	2.00 m	83.2	74.6	31.6	27.6	1.9	1.6	1.9	1.6
		84.6	75.8	32.8	27.6	1.9	1.6		
		105.0	92.4	32.6	36.4	2.0	1.6		
2	2.00 m	85.2	76.3	32.8	27.6	1.9	1.6	1.9	1.6
		84.2	74.9	32.4	26.4	2.0	1.6		
		83.7	74.6	32.7	26.4	1.9	1.6		
4	2.00 m	82.6	68.8	32.2	31.4	1.6	1.2	1.5	1.1
		77.4	65.4	33.4	31.4	1.4	1.0		
		88.6	73.4	33.4	33.9	1.6	1.2		
5	2.00 m	81.8	70.0	34.8	31.4	1.5	1.1	1.4	1.1
		79.4	67.6	33.0	32.7	1.4	1.1		
		61.6	50.8	18.6	31.4	1.4	1.0		
6	2.00 m	62.8	52.0	18.4	30.2	1.5	1.1	1.6	1.2
		72.6	58.8	15.4	35.2	1.6	1.2		
		74.4	61.2	18.6	33.9	1.6	1.3		
7	2.00 m	72.2	59.4	18.6	31.4	1.7	1.3	1.7	1.3
		67.6	55.6	18.4	30.2	1.6	1.2		
		67.2	55.2	15.8	31.4	1.6	1.3		

MOISTURE CONTENT

PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE

CLIENT: JICA RWANDA

Operated by: Girbert
Verified by: Butrezi
Date: 08/01/2018

Trial Pit No	Depth (m)	Mass of wet soil + Container (grs)	Mass of dry soil + Container (grs)	Mass of Container (grs)	Mass of water (grs)	Mass of wet Soil (grs)	Mass of dry soil (grs)	Natural moisture content (%)	Average Natural moisture content (%)
1	2.00 m	83.2	74.6	31.6	8.6	51.6	43.0	20.0	20.5
		84.6	75.8	32.8	8.8	51.8	43.0	20.5	
		105.0	92.4	32.6	12.6	72.4	59.8	21.1	
2	2.00 m	85.2	76.3	32.8	8.9	52.4	43.5	20.5	21.4
		84.2	74.9	32.4	9.3	51.8	42.5	21.9	
		83.7	74.6	32.7	9.1	51.0	41.9	21.7	
4	2.00 m	82.6	68.8	32.2	13.8	50.4	36.6	37.7	37.7
		77.4	65.4	33.4	12.0	44.0	32.0	37.5	
		88.6	73.4	33.4	15.2	55.2	40.0	38.0	
5	2.00 m	81.8	70.0	34.8	11.8	47.0	35.2	33.5	33.7
		79.4	67.6	33.0	11.8	46.4	34.6	34.1	
		61.6	50.8	18.6	10.8	43.0	32.2	33.5	
6	2.00 m	62.8	52.0	18.4	10.8	44.4	33.6	32.1	31.6
		72.6	58.8	15.4	13.8	57.2	43.4	31.8	
		74.4	61.2	18.6	13.2	55.8	42.6	31.0	
7	2.00 m	72.2	59.4	18.6	12.8	53.6	40.8	31.4	31.4
		67.6	55.6	18.4	12.0	49.2	37.2	32.3	
		67.2	55.2	15.8	12.0	51.4	39.4	30.5	

PH AND ORP TEST

PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE

CLIENT: JICA RWANDA

Operated by: Girbert
Verified by: Butrezi
Date: 08/01/2018

Trial Pit No	Depth (m)	PH Readings	ORP Readings	Average PH value	Average ORP value
1	2.00 m	5.75	104.80	5.75	104.37
		5.75	103.90		
		5.74	104.40		
2	2.00 m	5.87	101.70	5.86	101.17
		5.85	101.20		
		5.87	100.60		
4	2.00 m	6.64	89.50	6.63	90.20
		6.63	90.00		
		6.63	91.10		
5	2.00 m	6.44	70.20	6.44	70.80
		6.44	70.50		
		6.44	71.70		
6	2.00 m	5.68	103.80	5.68	104.03
		5.68	104.40		
		5.68	103.90		
7	2.00 m	7.15	10.50	7.15	11.40
		7.15	11.70		
		7.16	12.00		

PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE

CLIENT: JICA RWANDA

DETERMINATION OF ELECTRICAL RESISTIVITY

test was carried out in accordance with BS 1377:1990:Part 3: Clause 10 (procedure 10. 4)

SETUP DATA

Length of sample (mm)	*300*		
Internal diameter of sample (mm)	*83.8*	Test temperature ^{O}C	*23.0*
Cross-section area (mm^2)	*5515.4*	Sample type	*Undisturbed cohesive*
Penetration of electrodes (mm)	*40*	Volume of sample	*N/A*
Method used	*Wenner probe method*		

Operated by: Girbert
Verified by: Butrezi
Date: 08/01/2018

TEST RESULTS

Trial Pit No	Depth (m)	Density of sample [Mg/m^3]	Electrodes spacing [mm]	Resistance [Ω]	Soil resistivity [Ω . Cm]	Average Soil resistivity [Ω . Cm]	Resistivity corrected to 20 °C [Ω . Cm]
1	**2.00 m**	1.9	53.0	1,890	19,668	19,300	20,748.0
			52.0	1,785	18,933		
2	**2.00 m**	1.9	50.0	1,678	18,510	18,329	19,704.0
			53.0	1,744	18,149		
4	**2.00 m**	1.5	50.0	920	10,148	9,865	10,604.9
			51.0	886	9,582		
5	**2.00 m**	1.4	50.0	1,480	16,326	15,719	16,897.8
			50.0	1,370	15,112		
6	**2.00 m**	1.6	52.0	1,375	14,584	16,095	17,302.6
			52.0	1,660	17,607		
7	**2.00 m**	1.7	49.0	1,451	16,332	16,368	17,595.2
			50.0	1,487	16,403		

APPENDIX E

Core log pictures

JICA PROJECT: NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY

CORE SAMPLE PICTURES

BOREHOLE 1

Core sample Picture

BOREHOLE 2

Core sample Picture

BOREHOLE 3:

WE REACHED ONLY 60 Cm ON VERY HARD SOUND QUARTZITE. A S THERE IS NO ACCESS TO BH3 OF DRILLING MACHINE, WE USED DYNAMIC PENETROMETER AND TO GO DEEPER ON HARD ROCK WAS IMPOSSIBLE

Core sample Picture

BOREHOLE 6

Core sample Picture

Core sample Picture

BOREHOLE 7

Core sample Picture

Core sample Picture

Core sample Picture

BOREHOLE 8

Core sample Picture

Core sample Picture

Core sample Picture

Core sample Picture

BOREHOLE 9

Core sample Picture

Core sample Picture

BOREHOLE 10

Core sample Picture

Core sample Picture

BOREHOLE 11

Core sample Picture

Core sample Picture

BOREHOLE 12

Core sample Picture

Core sample Picture

Core sample Picture

BOREHOLE 13

Core sample Picture

Core sample Picture

BOREHOLE 14

Core sample Picture

Core sample Picture

Core sample Picture

Core sample Picture

BOREHOLE 15

Core sample Picture

Core sample Picture

BOREHOLE 16

Core sample Picture

Core sample Picture

環境社会配慮調査報告書（EIA）

Japan International Cooperation Agency

FINAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED PROJECT OF STRENGTHENING NZOVE - NTORA PRINCIPAL WATER PIPELINE IN KIGALI CITY, REPUBLIC OF RWANDA.

Prepared by:
BUREAU FOR ENVIRONMENTAL AND SOCIAL STUDIES/ BESST Ltd
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August, 2018

CERTIFICATION CONSULTANT

Name of the Project: **STRENGTHENING NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY, REPUBLIC OF RWANDA.**	
Project Owner	Government of Rwanda/Water and Sanitation Corporation Limited
Source of funds	Government of Japan/Japan International Cooperation Agency
Nature of assignment	Environmental Impact Assessment (EIA)
Name of approved EIA expert	Bureau for Environmental and Social Studies/BESST LTD
Team Leader	Mr. Théogène HABAKUBAHO/ Lead EIA Expert /RAPEP/EA/024
Water Resources management	NSHIMIYIMANA Fabien, Associate EIA Expert/RAPEP/EA/035
Ecologist	KAYIJAMAHE Charles,
Sociologist	BENEMARIYA Emma
Chief Surveyor and assets inventory	NZAMURAMBAHO Etienne
Assistant GIS Expert	Marie Ange Gisele AYINKAMIYE/ Junior Expert/EA/063

I hereby undertake that all requirements included in terms of reference provided by the client and approved by Rwanda Development Board (RDB) are complied with. I also undertake that the facts given in this EIA report are factually correct to the best of our knowledge.

Théogène HABAKUBAHO
Team Leader & EIA Lead expert
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Kigali-Rwanda

EXECUTIVE SUMMARY

Project background

The Government of Rwanda with its partners is implementing project that consist at rehabilitation and extension of Nzove Water Treatment Plant. Phase one, commissioned March 2016, increased the production from 65,000m3 to 90.000m3/day and Phase 2 which is under implementation will add 55,000m3/day to have the total capacity of 145,000m3/day. At present, Water & Sanitation Corporation(WASAC), has already maintain the principal transmission pipeline between Nzove and Ntora, but the demand for water supply is expected to be increased in the near future, and the Japanese and Rwandan Governments agreed to install a new water pipe line between the two locations.

Objectives of the EIA study

The objective of this study is to assist Water and Sanitation Corporation Limited (WASAC Ltd) project developer, to prepare an Environmental Impact Assessment (EIA) including an Environmental Management Plan (EMP) to ensure that the Project is implemented in an environmentally and socially sustainable manner and in full compliance with Rwanda's and JICA guidelines as well as other international policies and regulations such as World Bank safeguards policies.

Approach and methodology of the study

To achieve the study objectives, the consultant followed procedures stipulated in national general guidelines and procedures for EIA, JICA guidelines as well as WB safeguards Policies. The study adopted the following approach: (i) preliminary assessment and review of preliminary design of the projects, design studies and EIA reports of similar project, (ii) review of secondary data on baseline information (iii) review of policies and regulations, (iv) review of previous meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the project sites including socio-economic baseline data, flora and fauna data, (vi) laboratory test for water quality, noise and vibration measurement. Spatial data ,site locations, land cover, proposed infrastructure were described fully with clear maps using Global Position System (GPS) and Geographic Information System (GIS) tools for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts. Noise and vibration were also measures at selected project location area.

Project location and description

The proposed project is located in Kigali City in both Nyarugenge and Gasabo district. The principal pipeline will mainly follow the existing pipeline from Nzove Water Treatment Plant, located in Nzove cell, Kanyinya sector of Nyarugenge District, to Ntora water reservoir located in Ruhango Cell, Gisozi sector of Gasabo District. The proposed project will consist at installation of a new water pipeline with 900mm diameter on a distance of 9.4 km from the Nzove water treatment plant located in Kanyinya sector of Nyarugenge district to Ntora Reservoir located in Gisozi sector

of Gasabo district. The installation of such water pipeline requires associated infrastructures such water pump station, access roads, construction of bridges where the pipe crosses river, construction yard for material and construction material.

Prediction and assessment of potential impacts

The project is expected to have both positive and negative impact. Positive environmental impacts expected from the construction of principal transmission pipelines include: increased accessibility to potable water, temporary and permanent employment creation from construction works, transfer of skills from construction activity, and indirect benefits like affordability of medical insurance and education from income received from jobs. Anticipated adverse impacts range from physical environment impacts, biological impacts and social impacts and include air and noise pollution, soil erosion from construction works, water pollution and loss of biodiversity. Social impacts include loss of structures, permanent or temporally loss of lands, trees and crops but also loss of income during construction period.

Mitigation measures shall be proposed for each of the adverse impacts anticipated, to an extent that they can be avoided, reduced, limited or eliminated hence manageable. Furthermore, an Environmental Management Plan (EMP) and an Environmental Monitoring Plan indicating the mitigation measures, procedure to be followed, monitoring indicators, the responsible institutions to implement these measures and likely cost of implementing each of these mitigation measures have all been included.

Given the nature, location of the proposed project, proposed works and the potential impacts associated with the implementation of project, the consultant can conclude that the nature and extent adverse impacts identified can be avoided mitigated and eliminated by the implementation of appropriate mitigation measures. As a matter of fact, the construction of Nzove-Ntora principal transmission pipelines bound to be executed in a sustainable manner and in compliance with national environmental regulations, JICA environmental and social considerations as well as WB environmental and social safeguards policies. However, this requires full implementation of proposed mitigation measures and regular monitoring done per as the Environmental Management Plan (EMP) and environmental Monitoring plan included in this report. The total estimated budget for the implementation and monitoring the EMP is thirty two thousand three hundred fifty US dollars(32,350 US$). However, this is and indicative budget based on similar projects or consultant experience. The contractor shall prepare final budget for the implementation of proposed mitigation measures.

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ABBREVIATIONS

BESST : Bureau for Environmental and Social Studies
CITES : Convention of International Trade of Endangered Species
CBD : Convention of Biological Diversity
EDPRS : Economic Development and Poverty Reduction strategy
EIA : Environmental and Social Impact Assessment
ESIA : Environmental and Social Impact Assessment
ESMP : Environmental and Social Management Plan
GIS : Geographic Information System
GoR : Government
GPS : Global Positioning System
IUCN : International Union for the Conservation of Nature
IWRMP : Integrated Water Resources Master Plan
IWRMP : Integrated Water Resources Master Plan
JICA : Japan International Cooperation Agency
JST : JICA Study Team(KOKUSAI KOGYO Co,. Ltd)
KCC : Kigali City Council
Ltd : Limited
MININFRA : Ministry of Infrastructure
MoE : Ministry of Environment
NGO : Non-Government Organization
NISR : National Institute of Statistics of Rwanda
OHS : Occupational, Health and Safety
RDB : Rwanda Development Board
REMA : Rwanda Environment Management Authority
RLMUA : Rwanda Land management and Use Authority
RURA : Rwanda Utilities Regulatory Agency
RWAF : Rwanda Water and Forestry Authority
ToRs : Terms of Reference
WASAC : Water and Sanitation Corporation
WHO : World Health Organization

CHAPTER I: INTRODUCTION

1.1. Project background

The overall objective of water supply and sanitation policy is to ensure safe, reliable and affordable water supply services for all 100% by 2020.This will be achieved while strengthening the financial viability of the utility and ensure sustainable functionality of water supply infrastructure by developing effective management structures and well- regulated public private partnership (PPP) arrangements. To achieve this objective, the Government of Rwanda with its partners is embarked in different water supply projects including construction of new Water Treatment Plants and associated forwarding infrastructure, the rehabilitation and extension of existing Water Treatment Plants and strengthening the existing water supply network.

One of the major ongoing project is the rehabilitation and extension of Nzove Water Treatment Plant. Phase one commissioned March 2016 increased the production from 65,000m3 to 90.000m3/day in Kigali against the demand which is 120,000m3/day. Phase 2 which is under implementation add 55,000m3/day to have the total capacity of 145,000m3/day. Phase 2 involves upgrading production capacity of the existing 25,000m3day to 40,000m3/day and construction of a new treatment plant with initial capacity of 40,000m3/day with upgradable capacity of 65,000m3/day. At present, Water & Sanitation Corporation, WASAC, has already maintain the principal transmission pipeline between Nzove and Ntora, but the demand for water supply is expected to be increased in the near future, and the Japanese and Rwandan Governments agreed to install a new water pipeline between the two locations to accommodate the increased volume of water.

1.2. Presentation project developer

Water and Sanitation Corporation (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.

1.3. Presentation of the consultant

BESST LTD (Bureau for Environmental and Social Studies) is a Rwanda company Registered with Rwanda Development Board (RDB).The company is licensed by Rwanda Association professional Environmental Practioners(RAPEP) with license number RAPEP/EA/O72(list Certified experts available at www.repep.org). The company has its headquarters in Kigali City, Gasabo district, KG 182st, Martin Plaza, second Floor. The company is specialized in Environmental studies, Resettlement Actions Plans (RAP, climate change risk assessment, socio-economic assessment,

baseline surveys, waste management, water and sanitation, advisory services in sectors ranging from Agriculture, energy development, Infrastructure and housing development, transport and water supply. For this specific assignment of preparation of EIA, the company used the following consultants:

Théogène HABAKUBAHO, Team leader – He is an authorized EIA Lead expert**(RAPEP/EA/024)** . He holds a master of science in environmental science management and development and BSc in physical geography. He has over 12 years professional experience in the field of environmental assessment and management. He has worked on various projects as team leader of environmental studies. Key projects worked on include irrigation projects, green house agriculture, Water supply mining projects, road and bridge construction projects, building and house constructions, schools and hospitals, among others.

NSHIMIYIMANA Fabien, Hydrologist: He is an authorized EIA Associate Expert(**RAPEP/EA/035).** He- holds a Master of Science in Water resources and environmental science and a BSc in Chemistry. He is a Water Resources Engineer with over 7 years' experience in planning, management, design and construction supervision of water resources infrastructure. Conversant with water resources studies, Environmental and Social Impact Assessment Studies, hydrological, hydrodynamic and groundwater modelling, GIS & remote sensing. In this assessment he assessed impact related to water resources demand and use.

RUZIBIZA Marcel, Soil scientist- holds a master degree in agro-forestry and Soil management with bachelor's degree in environmental and soil science. He has over 5 years of experience in studies involving soil science. He has participated in different Environmental Impact assessment studies as soil scientist and ecologist. He assessed impacts of the project on marshlands soil and marshlands ecology.

Mrs. Emma BENEMARIYA, Sociologist- holds a Master of Development Studies and a bachelor's degree in Social Sciences. She is tasked with evaluation of social impacts associated with project and has led the socio-economist survey.

KAYIJAMAHE Charles, Ecologist-He has Master of Science in geo-information system and environment with a bachelor's of science in biology. Over the last 8 years he has worked with different institutions involved in biodiversity conservation and natural resources management, research and monitoring, conservation planning, establishment and empowerment of local conservation groups. He also has skills in institutional development and leadership, strategic planning, proposal writing and projects management. He has participated in different EIA as ecologist. He assessed impacts of the project on site ecology, flora and fauna.

NSEKANABANGA Jovine, Statistician : He is an experience data collection and analysis and he has a bachelor's degree in applied statistics with over five years in data collection and analysis. He supervised data collection, data entry and conducted data analysis.

NZAMURAMBAHO Etienne, Chief surveyor: He is an experience land surveyor with bachelors degree in land survey and diploma in topography. He coordinated assets inventory and identification of project affected people.

AYINKAMIYE M. Ange Gisele, GIS Expert: She is an authorizer EIA Junior Expert(**RAPEP/EA/063).** She holds a bachelors degree in Environmental Management and with solid knowledge in GIS and remote sensing. She assisted the team in data collection and in mapping, noise and vibration measurement. She also participated in assets inventory. The above team was supported by field enumerators and data entry officers

1.4. Objectives of the study

The overall objective of this assignment was to prepare the Environmental Impact Assessment (EIA) and a Resettlement Action Plan (RAP) including baseline studies. Specifically, the consultant prepared two standalone reports:

a) Environmental Impact Assessment (EIA) including baseline studies; and
b) Resettlement Action Plan including provisional assets inventory and estimated assets value;

1.5. Scope of the study

Scoping study was undertaken by the consultant's team with an intention of collecting enough and relevant information so as to ensure that the EIA report is prepared in compliance with national environmental regulations and JICA guidelines for environmental and social considerations guidelines. The study covered the impacts of the projects from planning phase, construction and operational phases and considered all selected sites and their surroundings.

Therefore the Scope of work is to:

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

1.6. Approach and methodology EIA study

The methodology adopted for conducting the EIA for the construction of Nzove-Ntora Principal transmission pipeline follows the conventional methods that meet the requirements of the organic law No. 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda, general guidelines for environmental impact assessment approved by REMA (REMA, 2006) and studies and JICA guidelines on Environmental and Social considerations. The collection of primary data, baseline information and secondary data on

environment and social components, relevant documents and literature sources, desktop study, impact analysis, choosing mitigation and enhancement measures using different optimization tools and developing environmental protection, monitoring and management plans were made. Focus groups discussions, meetings, questionnaires and interviews were common techniques by which local community consultations were also conducted.

The assessment followed a number of stages including scoping or preliminary assessment to understand and establish boundaries of the study, desk review of available literature, field visit to establish baseline data, analysis of all available data (secondary and primary data), prediction of positive and negative impacts, analysis of alternatives for such a project, proposal of mitigation measures leading to the preparation of an Environmental Management Plan and Environmental Monitoring Plan, incorporated in a comprehensive EIA report.

1.6.1. Preliminary assessment/ scoping study

A scoping study involved consultation with JST, WASAC Ltd, Gasabo and Nyarugenge staff and Kigali City staff. Initial a field visit with JICA study team was conducted to familiarise the study team with existing features and proposed project infrastructure was conducted. Scoping continued by visiting the site area again to understand project features and receiving environment. The scoping exercise further entailed the following:

- Identification of the likely stakeholders who eventually were involved in the public consultation;
- Preliminary findings of the existing environment; (primary, biological and socio-cultural environment)
- Preliminary predictions of likely positive and adverse impacts;
- And finally establishing clear boundaries of the study and focus on the relevant issues concerning the study.

The scoping study also involved a preliminary desk review on existing policies and strategic plans related to water supply projects. The scoping exercise was conducted using scoping matrix that was discussed with various stakeholders including regulatory agencies, district and Kigali City authorities, sector and cells authorities as well as potential project affected households. The outcome of the scoping exercise informed the final EIA terms of Reference, the methodology used in data collection and in impact the impact assessment

1.6.2. Review of Institutional, legislative and Policy framework

An intense deskwork was done of existing institutional legislation, policies, plans and programs, which are likely to influence different parts of the construction and operation of Nzove Ntora principal pipelines and its sustainability. Key legal instruments include the following;

- Organic Law no. 04.2005 establishing the modalities of protection, conservation and promotion of the environment on,
- Law N° 32/2015 of 11/06/2015 relating to expropriation in the public interest Expropriation in the
- EDPRS II,

- National Water Resources Management Policy
- Land Policy
- Gasabo and Nyarugenge District Development Plan.
- Water supply and sanitation policy,
- Environmental impact assessment conducted for Nzove Water Treatment Plant and other existing plants; and
- Preliminary project design report.

In addition to national policies and regulations influencing this project, this review paid considerable attention to JICA guidelines on environmental and social consideration, regional protocols, World Bank safeguard policies and JICA Environmental and Social consideration guidelines.

1.6.3. Public Consultation with stakeholders

Information collected from the preliminary desk review, preliminary consultation with JICA study team and WASAC helped the consultant team to identify the project key stakeholders. Without chronological priority, these stakeholders were identified in three categories. (1) First category of Government officials, (2) Second category of local government officials and (3) Third category of households that are likely to benefit or be affected the project.

1.6.4. Baseline data and information

Socio-economic data and assets inventory was collected by a team of surveyors lead by a GIS expert and using a detailed questionnaire. Furthermore water samples were taken and tested in laboratory in order to check water quality. Fauna and flora baseline data was collected by ecologist with the support of field surveyors and results were compare to IUCN status check list. More details on baseline data collection and findings are presented in chapter 4.

1.6.5. Impacts Assessment

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

- ***Geographical Information System (GIS)*** - used to show the extent of a particular project activity influence on the area by mapping it out.
- ***Checklist-*** Under this section, project activities that might affect or enhance the livelihood in the project areas were listed and drawn against environment indicators and occurrence.
- ***Cost benefit analysis (CBA)*** - Which involved analysis of project activities in terms of their financial and economic effects to establish the cost implications of the impacts and the mitigation measures. Impacts was analysed according to market costs, foregone costs or opportunity cost. The CBA was used to assign economic values where feasible to impacts both adverse and beneficial.

- ***Impact Matrix-*** under the Impact matrix, the analysis by these tools of GIS, checklist, CBA, will be tested against their significant effect on recipients in the project area of intervention. Impact matrix in tabular format will be drawn, in which impacts from project activities will be tested against their significant effect on the areas of intervention.

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

1.7. Report structure

The proposed Structure of the EIA report is as follows:
Chapter 1: Introduction and general background of the project;
Chapter 2: Project description;
Chapter 3: Policy, legal and institutional framework;
Chapter 4: Environmental, socio-economic and cultural Baseline data;
Chapter 5: Public consultation and participation;
Chapter 6: Project Needs and project alternatives;
Chapter 7: Impacts identification, evaluation and proposed mitigation measures;
Chapter 8: Environmental management Plan and Environmental Monitoring Plan;
Chapter 9: Conclusions and recommendations;
Appendices

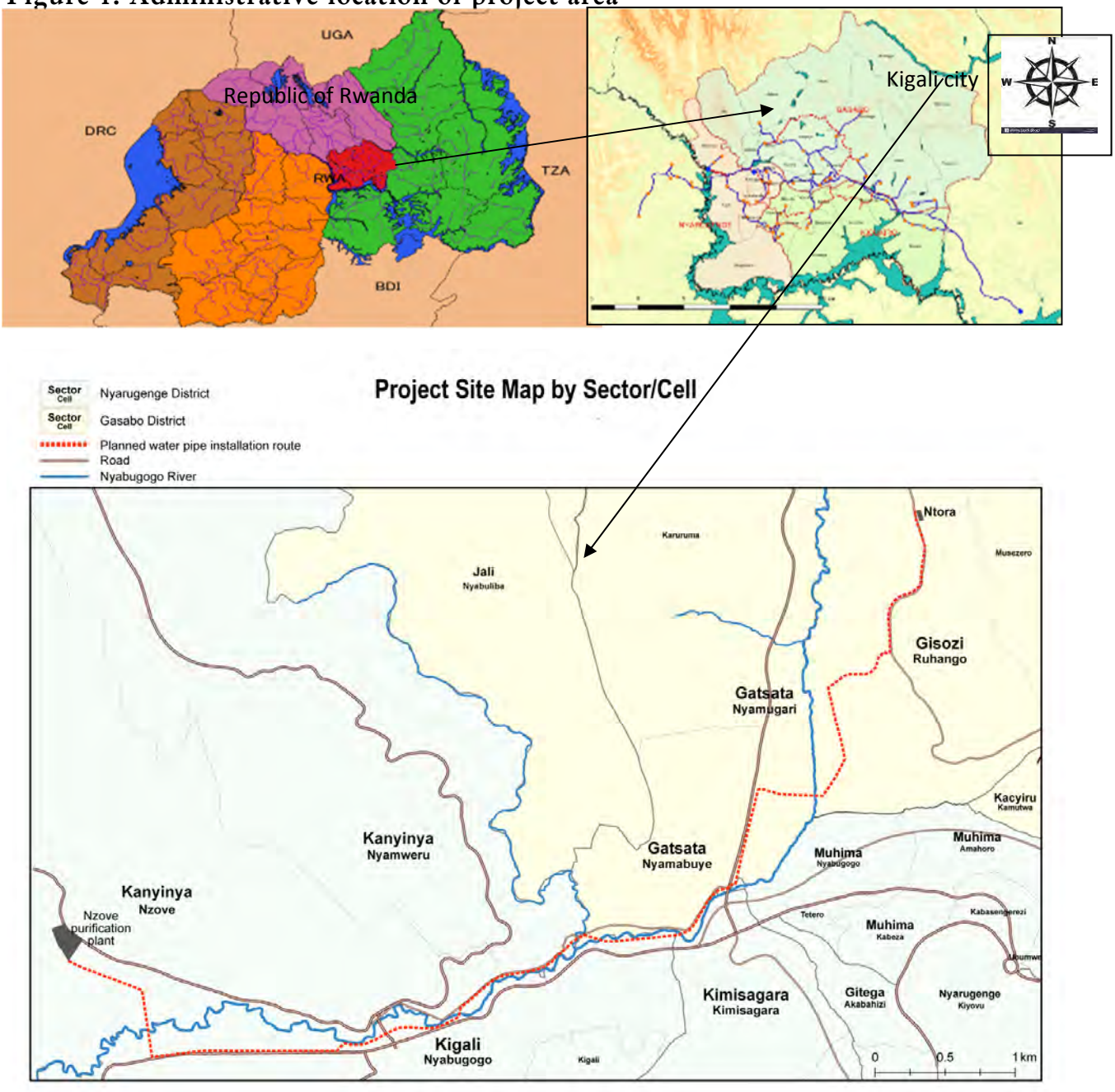
CHAPTER II: PROJECT DESCRIPTION AND LOCATION

Per as terms of reference but also best practices the EIA consultant is requested to describe the proposed project and its activities. The description of project activities shall be based on phases of project life cycle i.e. pre-construction, construction, operation, maintenance, and decommissioning phases. Therefore, this chapter provide the location of the project, projects component/activities in different phases and projects requirements in terms of material or associated facilities.

2.1. Project Location

Administratively, the proposed project is located in Kigali City in both Nyarugenge and Gasabo district. The principal pipeline will mainly follow the existing pipeline from Nzove Water Treatment Plant, located in Nzove cell, Kanyinya sector of Nyarugenge District, to Ntora water reservoir Located in Ruhango Cell, Gisozi sector of Gasabo District.

Figure 1: Administrative location of project area



Source: Project preliminary design rreport, JST, 2018

2.2. Description of the project

The proposed project of strengthening of Nzove-Ntora principal water pipeline will consist at installation of pipeline with 900mm diameter on a distance of 9.7 km from the Nzove water treatment plant located in Kanyinya sector of Nyarugenge district to Ntora Reservoir located in Gisozi sector of Gasabo district. The installation such pipe requires associated infrastructures such access roads, construction of three temporary bridges, construction yard for material, construction material and equipment. three new water pumps and new pump building is also part of the proposed projects. Initially it was proposed to use the new pipeline with the exiting one but it was decided to use the new pipeline and increase its capacity to ◘900.

2.2.1. Mobilization or Pre-construction activities;

Pre-construction activities consist at preparatory survey to provide the project orientation, project effectiveness, technical and economic validity of the Project, preliminary design, and scope of project as well as the outline of project cost and implementation plan. The pre-construction activities will results in three main output including:

- **Preliminary technical design**: The preliminary technical design provides information on size and location of project features, mapping of project area that need to be cleared, associated structure/infrastructure such as access roads, cross river bridge and construction yard, estimates of staff and duration, construction materials and its sources and storing, equipment and tools, etc.
- **Environmental Impact assessment(EIA):** the environmental impact assessment provide baseline information of the projects area both physical and Social, assess the legal requirement, identify potential impacts associated with the projects and proposes an environmental management and monitoring plan;
- **Resettlement Action Plan(RAP)**: Resettlement Action Plan provide information on project land requirements and involuntary resettlement implication. It includes socio-economic status of projects affected Households, an inventory of assets that are likely to be affected by projects and proposes mitigation and compensation measures.

Pre-construction works do not have any environmental and social impacts but provide the basis for deep analysis of potential impact during construction, operation and decommissioning phases.

2.2.2. Construction phase activities

The construction works will consist at installation of water pipe and river cross bridge as well as access road in some sections where the pipe passes far front existing road. As a result, of preliminary design, it is possible to install new pipeline in parallel with existing one, but it is difficult to physically arrange the following two areas side by side, and it is necessary to install a water supply pipeline with a new route. The proposed pipeline will cover a distance of 9.4 km and the pipe will have 800mm. Therefore, the area that would be cleared and excavated is about 9m width if we consider access road. Figure 2 presents the proposed cross-section view of water pipe installation and Figure 3 present cross section view of excavation works.

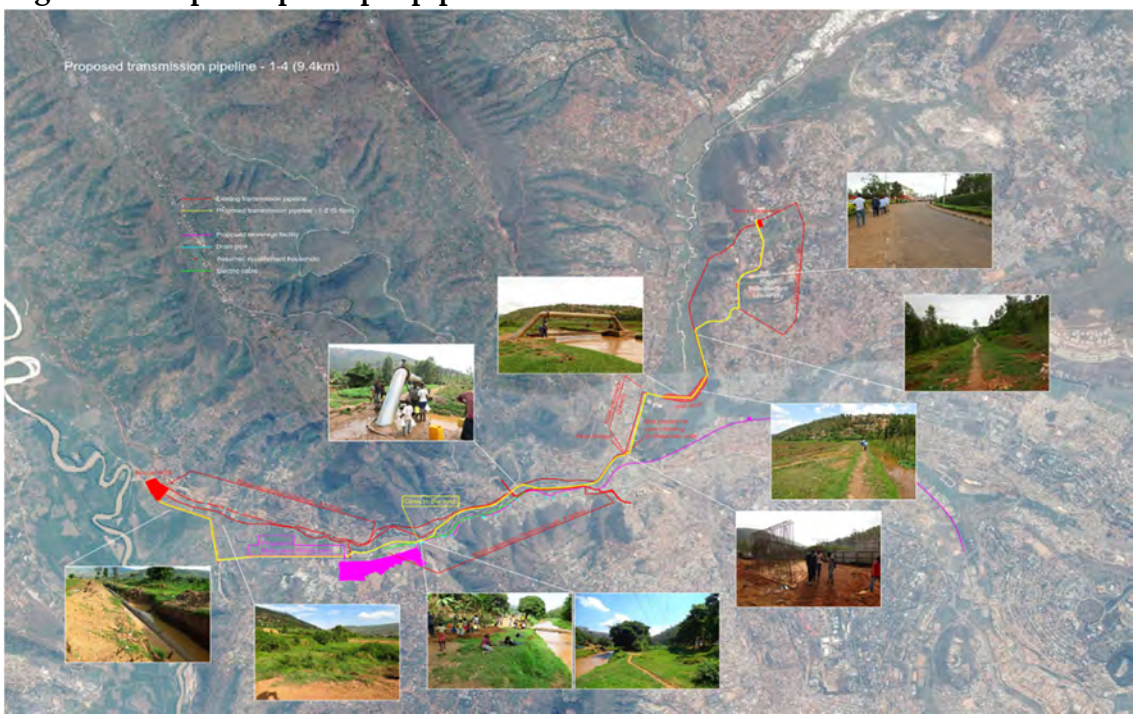
- **Pipe installation activities:**

A still pipe of 900mm of diameter will be installed on a distance of 9.4 km from Nzove WTP to Ntora water reservoir. The installation of principal water pipeline will involve different activities including:

- Manufacturing and importation of pipe;

- Site clearance and excavation;
- Construction of temporary access road;
- Construction of three temporary bridges;
- Pipe installation;
- Pipe installation under the river bed (6 places);
- Concrete placement to protect water pipe ;
- Construction of a corridor for maintenance (steps made of concrete);
- Protecting pipes by covering with concrete

Figure 2: Proposed principal pipeline route

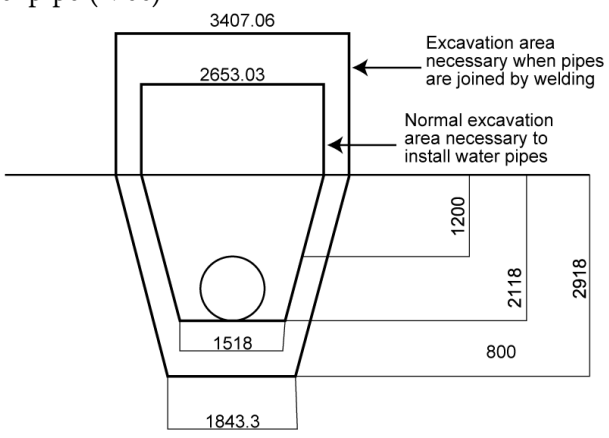


Source: Preliminary design study, 2018

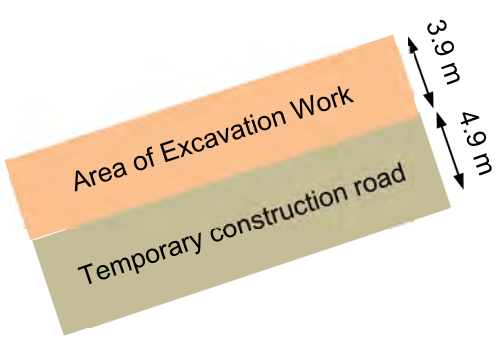
- **Installation work of water pipe at the marshland**

The proposed construction method is open cut method that will be taken by backhoe excavating by the backhoe. However, the contraction should consider careful the cutting angle not to collapse the soil because the soil is very soft.

Figure 3: Cross section view of water pipe installation in marshland



Cross section of excavation work at the marshland

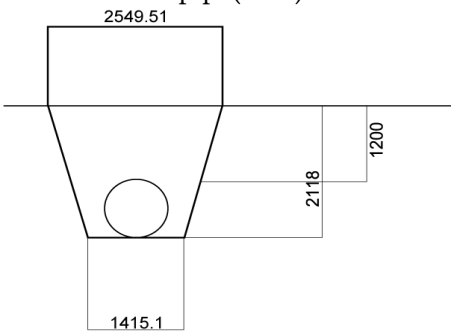
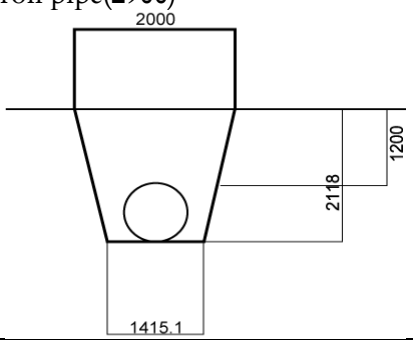


Temporary construction road is prepared along the pipe installing route

Temporary construction road

Source Preliminary design study, 2018

Figure 4: Installation of water pipe in residential areas

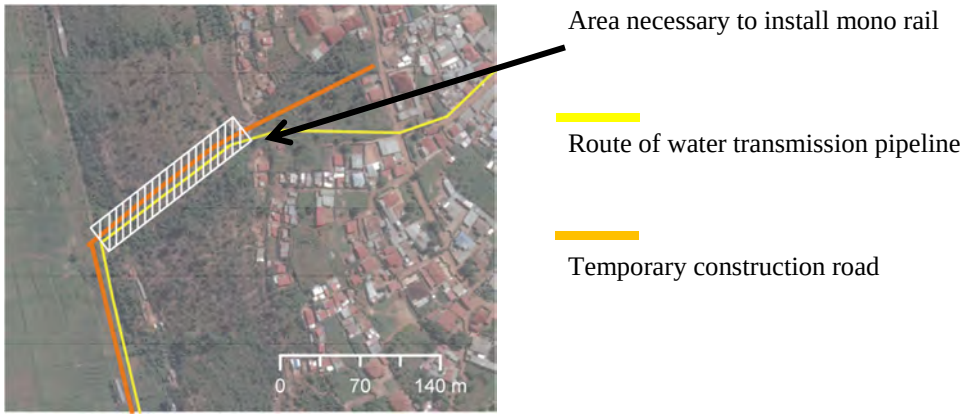
Ductile cast iron pipe(□900)	Ductile cast iron pipe(□900)
	
Cross section of Excavation work at residential area	Cross section of excavation work along the road with pavement (The ground is hard enough that width of excavation area can be reduced to 2.0)

- **Installation work of water pipes at the steep slope**

At steep slope areas such as Gisozi, the soil field survey indicated that the earth consist of rocks and is very stable. Therefore, the proposed construction methods consist of :

- Setting safety fence at bottom of the slope made by wooden/steel pile with mesh wire;
- Setting mono-rail in order to carry the dug soil out of the site;
- Manual-excavating and carrying the dug soil;
- Constructing concrete foundation and the stairs to carry the pipes on the foundation.
- Installing pipes and welding joint.
- Fixing pipes by covering with the concrete at some points.

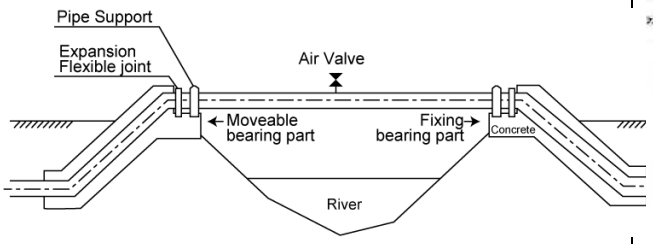
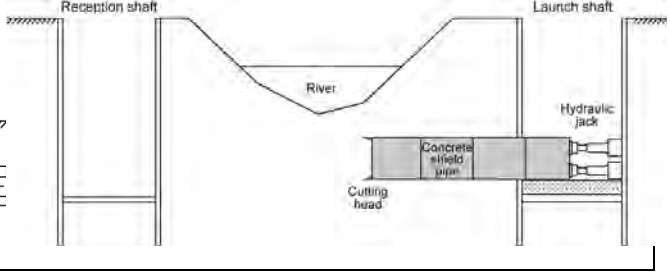
Figure 5: Installation of water pipe at steep slope



- **River crossing methods**

Six river cross places have been identified and after exploring different construction methods such as pipe beam bridge and lead-pipe jacking method, the Lead Pipe Jacking Method was selected. Pipe Jacking Method was selected by considering construction cost which is relatively low, easy to maintain and its impact on the river bank which is low compared other methods.

Figure 6: Construction methods

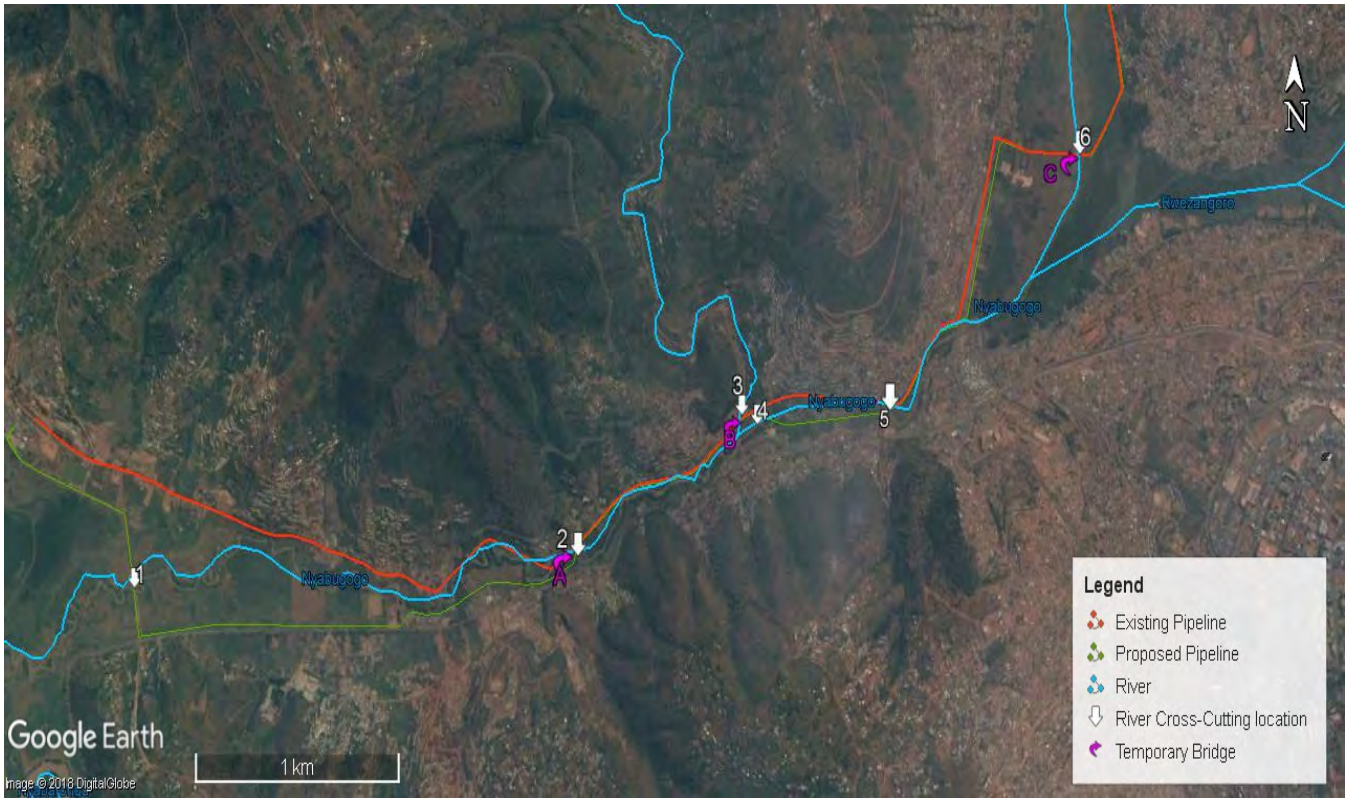
Pipe beam bridge	Lead-pipe jacking method
	

• The height of the water pipe bridges is higher than design flood level stipulated in the Rwandan regulation ion or the equivalent regulation. • After constructing abutments on both the river sides, installing the pipes by the rough terrain crane • Construction period should be during the dry season • Construction cost at the soft ground such as wetland is high, in order to take measures to prevent differential settlement. • Pipe beam bridge has a load on river bank at the soft ground	• After preparing for the Launch and Reception shafts, centrifugal reinforced concrete pipes are inserted into the ground as pipe sleeves by hydraulic jacks. • The soils inside the pipes are excavated by hand. If the ground conditions are not good, the soils are excavated using a high-pressure jet, and this makes it possible to make sure of the safety by keeping a certain distance between workers and cutting head. • After installing pipe sleeves, water pipes are inserted inside them, and aerated light-weight concrete is filled up between the pipe sleeves and water pipes in order to fix the water pipes in concrete. • Construction period should be during the dry season • At the place where groundwater level is high, it is necessary to take a measure to drain water • Its impact on river bank is limited • There is a little impact on water pollution

Table 1: Description of river crossing places

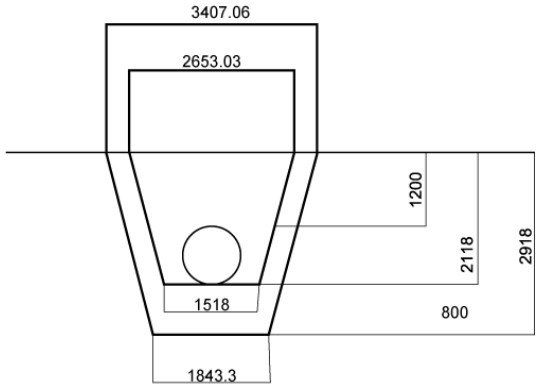
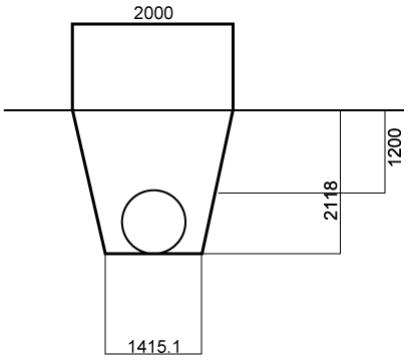
NO	Location		Result of ground/soil survey		Method
	latitude	longitude	N-value	Soil type	
1	1°56'53.59"	30° 0'23.70"	1～2	Dark brown soft clay, with a medium compactness, fine to medium grained size, with a closely spaced discontinuity	Pipe Jacking Method
2	1°56'49.57"	30° 1'36.01"	2～4	Dark brownish and brown clay, fine to medium grained size, compact, less homogenous and less spaced discontinuity	Pipe Jacking Method
3	1°56'31.90"	30° 2'2.63"	3～4	Brown compact clay and salty clay, closely spaced	Pipe Jacking Method
4	1°56'33.08"	30° 2'5.17"	1～12	Dark brown clayey sand, medium grained, poorly graded, with a surrounded shape, loose compactness and no homogeneity.	Pipe Jacking Method
5	1°56'31.37"	30° 2'26.70"	1-15, based on the value near the location.	Beige, mauve weathered schists, medium to coarse grained size, with less spaced joints	Pipe Jacking Method
6	1°55'59.26"	30° 2'57.58"	1～8	Grey brownish clay, with a dense compactness and a homogenous grading, and a closely discontinuity, fine to medium grained size	Pipe Jacking Method

Figure 7: Location of river crossing places



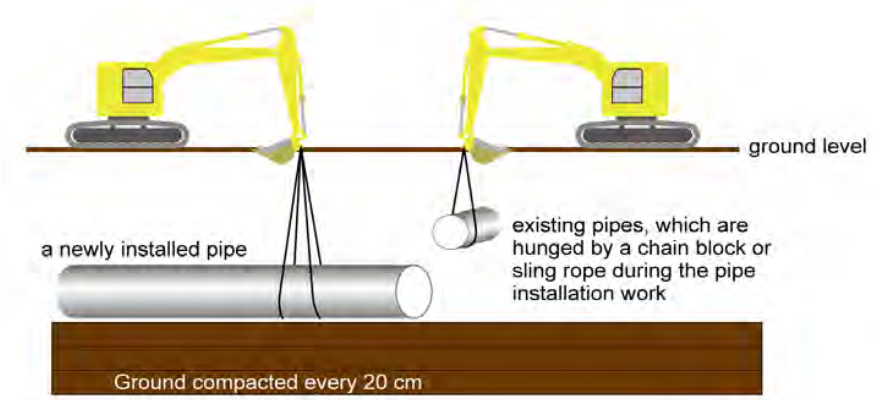
Source: Preliminary design Study, JST, 2018

Figure 8: Cross section of excavation work

Steel pipe (▯900)	Ductile cast iron pipe(▯900)
	
Excavation work in marshland	Excavation work in urban area (installing pipes under the pavement)

Source: Preliminary design, 2018

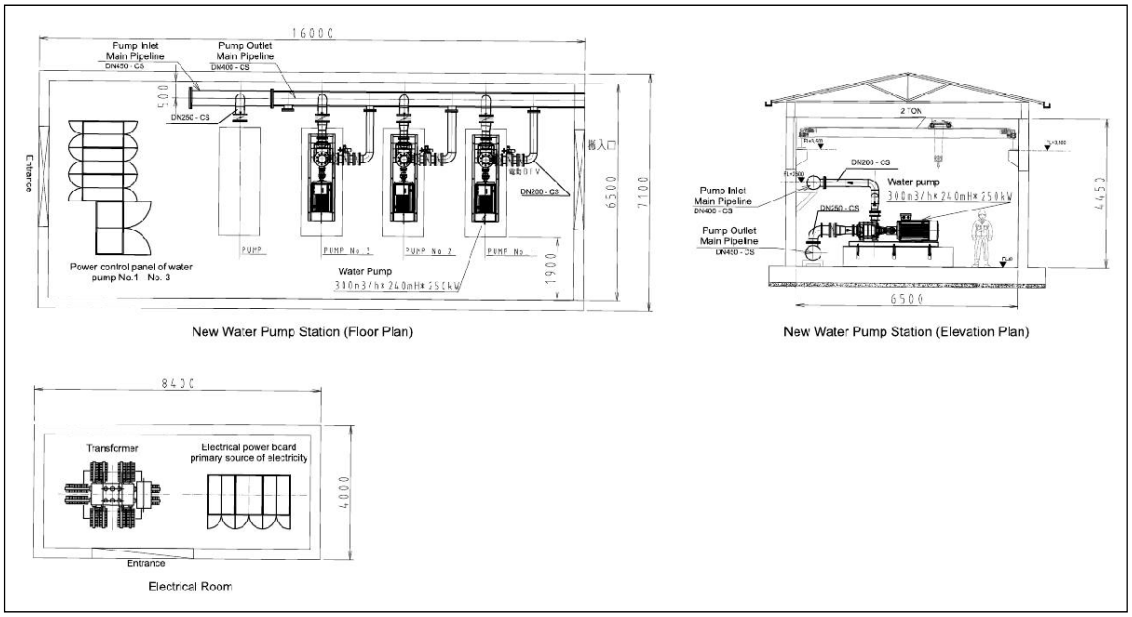
Figure 9: Representation of water pipe after installation



- **Expansion of pump system in Nzove WTP**

The existing water pump at Nzove 1 and Nzove has a capacity of 4000 m3/day while the required capacity was calculated at 62,000 m3/day. Therefore the project will expand the current capacity with additional pump system of with 22,000m3 /day. The new water pump station will be also constructed within Nzove WTP perimeter.

Figure 10: Proposed water pump station



Source: Preliminary design, JST, 2018

- **Rehabilitation of Ntora reservoir**

The rehabilitation of Ntora Reservoir will consist at installing an elevated tank with a capacity of 200m3 to supply households around Ntora reservoir, pumps for elevated tank. It will also include the replacement of outlet pipe of Ntora reservoir.

2.2.3. Operation and maintenance activities

After the installation of principal water pipe, no major works that are planned during the operation phase. Only monitoring work will be conducted to check any defect or leakage. If any defect or leakage is identified then, rehabilitation works will be undertaken.

2.2.4. Decommissioning activities

Major activities to be considered in this project include movement and demolition of construction facilities such as temporary construction yard, remove all construction debris and restoration of the area. The three temporary bridges and access roads will not be demolished unless local authority or local communities request their demolition. .

2.2.5. Project land requirement

The installation of principal water pipeline does not require much lands but it requires land clearance in construction area that may go up to 9m width where there is no construction roads. In some section such as Ntora, the excavation area have been reduced to 2m to avoid private structures such as wall and fences. The permanent land take is expected only where pipe will be installed plus maintenance area, around 2m but this land can be used under conditions. The remaining land will be used only during construction and after that owners will use it again. The land to be affected include both private and government lands especially in the marshlands and along paved roads. The following table summarises the land that will be affected by the proposed projects temporary or permanently.

Table 2: Total land to be affected by the proposed project

DISTRICT	SECTOR	CELL	Number of HHs	Number of plots affected		Size of affected land (m2)
Gasabo	Gatsata	Nyamabuye	6	Cultivate land	7	1,841
				Business/commercial	2	1,323
		Nyamugari	8	Cultivate land	22	6,174
	Gisozi	Ruhango	45	Cultivate land	26	7,585
				Housing plot	20	373
				Business/commercial	6	144
Nyarugenge	Kanyinya	Nyamweru	7	Cultivate land	6	1,621
				Housing plot	3	116
				Business/commercial	1	378
		Nzove	9	Cultivate land	14	6,397
				Housing plot	0	0
	Kigali	Nyabugogo	18	Cultivate land	28	10,936
				Housing plot	5	2,889
				Business/commercial	5	437
	Kimisagara	Kimisagara	*0	Cultivate land	1	280
Grand Total			**93**		**145**	40,493

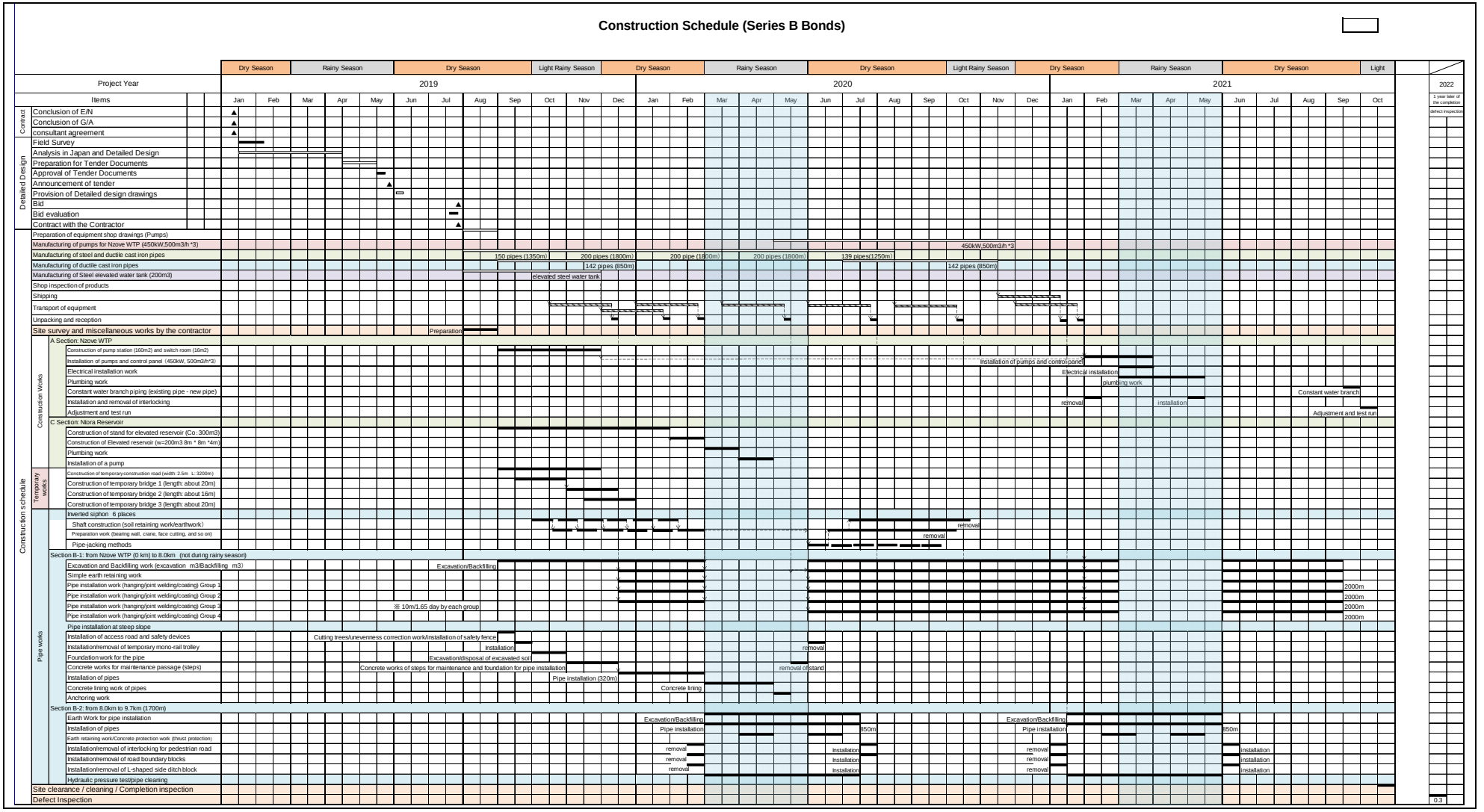
Source: Field survey, BESST Ltd, 2018

2.2.6. Project Schedule

The project schedule includes preliminary works and construction works that will be undertaken both in Rwanda and in Japan. Due to the limited length of the construction period

(2 years and 3 months), it is proposed to divide the construction area into two sections, one is the wetland and steep slope and the other is the residential area in Ruhango cell. And then the project area in the wetland is divided into 4 sections and to conduct construction work at each section simultaneously.

Table 3: Project construction schedule



Source: Preliminary design, JST, 2018

CHAPTER III: POLICY, LEGAL AND REGULATORY FRAMEWORK

The project of strengthening Nzove-Ntora Principal pipeline will be implemented by WASAC Ltd and funded by JICA. According the Rwandan environmental policy and regulations, as well as the JICA guidelines on environment and social considerations, the project developer is requested to establish an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance.

This chapter describes policies, laws, regulations and institutional framework that will govern the implementation of proposed project and the implantation of proposed mitigation measures. Both international and national regulations were reviewed in order to come up with a consolidated legal and regulatory framework to ensure that the project is implemented in compliance with national regulations and international Policies and standards.

3.1. National legal and regulatory framework

The Constitution of the Republic of Rwanda, adopted in June 2003 and revised in 2015, ensures the protection and sustainable management of environment and encourages rational use of natural resources. In consideration of the Constitution as amended to date, article 49 states that every citizen is entitled to a healthy and satisfying environment. Every person has the duty to protect, safeguard and promote the environment. The state shall protect the environment. The law determines the modalities for protecting, safeguarding and promoting the environment. To comply with this constitutional statement and to ensure that the country development is done in sustainable manner, the government has adopted different sectoral policies, laws and set up different institution. These institutions are responsible of implementation of different policies and laws enforcement...

3.1.1. Relevant policies for the Nzove-Ntora Principal Pipeline

- **The National Policy on Environment**

Adopted by the cabinet in November 2003, the environment policy has an overall objective of improving the human well-being, the judicious utilization of natural resources and the protection and rational management of ecosystems for sustainable development. The recommendation of the policy on population and land-use management is to balance the national policy in terms of population, land-use management and environment, while the recommendation on Land is to ensure that land, which is the major resource of the country, is not degraded and used in an unplanned manner. The policy operates within and towards the global concept of sustainable development. It is intended to achieve benchmarks and embrace commitment to international environmental conventions agreed upon in Ramsar (1971), Vienna (1985), Montreal (1990), Rio (1992), Kyoto (1998), and Stockholm (2001) to all of which, Rwanda is a party. The policy has resulted in the national Organic law on environment protection and conservation and different guidelines and laws related to Environmental impact assessment. The Policy seeks to achieve this through the following objectives.

- to improve the health and the quality of life for every citizen and promote sustainable socio-economic development through a rational management and utilization of resources and environment;
- To integrate environmental aspects into all the development policies, planning and in all activities carried out at the national, provincial and local level, with the full participation of the population;

- To conserve, preserve and restore ecosystems and maintain ecological and systems functioning, which are life supports, particularly the conservation of national biological diversity;
- Optimum utilization of resources and attain a sustainable level of consumption of resources;
- To create awareness among the public to understand and appreciate the relationship between environment and development;
- To ensure the participation of individuals and the community in the activities for the improvement of environment with special attention to women and the youth;
- To ensure the meeting of the basic needs of today's population and those of future generations.

➢ **National Biodiversity Strategy (NBS)**

The revised and updated Rwanda National Biodiversity Strategy (NBS) of 2015 has a long-term vision which is in line with the Convention on Biological Diversity (CBD) strategic plan to 2020 and states that: "by 2040, national biodiversity be restored and conserved, contributing to economic prosperity and human well-being through delivering benefits essential for Rwandan society in general." NBS as a 'living document', responsive, flexible and practical, including biodiversity conservation in economic decisions and turn it into a driver for national development. Relevant economic development sectors such as agriculture and animal resources, fisheries, forestry, mining and infrastructures will incorporate biodiversity conservation activities into their planning systems as well as in the annual budgets of upcoming years.

➢ **Integrated Water Resources Management Policy(IWRMP)**

The IWRMP is the latest development in Government's consistent and continuous efforts to strengthen the water resources management sub-sector. It replaces the 2004 policy and has been necessitated by the ill-alignment between the 2004 policy and water law No. 62/2008, which embraced many modern and cutting-edge principles of sustainable water resources. Additionally, the government has been introducing reforms in the water sector that have significantly changed the context for water resources management and rendered the 2004 policy out of date. With the promulgation of a law establishing the Rwanda Water and Forestry Authority (RWFA) with the mandate to lead the management of water resources across sectors, there is potential to achieve a coordinated approach to water resources management, in line with the integrated water resources management concept. In order to address the capacity limitations being faced by the sector, it will require concerted efforts in resource mobilisation, human resource development and institutional capacity building.

➢ **Land Policy in Rwanda, 2004**

The National Land Policy of Rwanda approved in 2004, seeks 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. The policy seeks to ensure this through the following objectives.

- To put in place mechanisms which guarantee land tenure security to land users for the promotion of investments in land;
- To promote good allocation of land in order to enhance rational use of land resources according to their capacity;
- To avoid the splitting up of plots and promote their consolidation in order to bring about economically viable production;

- To establish mechanisms which facilitate giving land its productive value in order to promote the country's socio-economic development;
- To focus land management towards more viable and sustainable production by choosing reliable and time-tested methods of land development;
- To develop actions that protects land resources from the various effects of land degradation;
- To establish institutional land administration arrangements that enable land to have value in the market economy.
- To promote the involvement and sensitization of the public at all levels in order to infuse land use practices that are favourable to environmental protection and good land management. To promote conservation and sustainable use of wetlands As such, this policy bears the responsibility of allocating and planning land use activities in Rwanda including housing activities. The policy dictates that:

The policy was the basis for the land law approved in 2005 and revised in 2013 and the expropriation law enacted in 2007 and revised in 2015. Both laws are applicable to Bwanya project and its implementation shall comply with.

3.1.2. Relevant Laws

- **Constitution of the Republic of Rwanda**

In consideration of the Constitution of the Republic of Rwanda of June 4, 2003 and revised in 2015, article 49 states that every citizen is entitled to a healthy and satisfying environment. Every person has the duty to protect, safeguard and promote the environment. The state shall protect the environment. The law determines the modalities for protecting, safeguarding and promoting the environment.

- **Environment Organic Law n° 04/2005 of 08/04/2005**

Chapter IV of Title II of the Organic Law n° 04/2005 of 08/04/2005 determining modalities of protection, conservation and promotion of environment in Rwanda regulates the Environmental impact Assessment. In its article 67: Every project shall be subjected to environmental impact assessment, before obtaining authorization for its implementation. This applies to programmes and policies that may affect the environment. Article 68 specifies the main points that an Environmental Impact Assessment must include. Article 69 stipulates that the environmental impact assessment shall be examined and approved by the Rwanda Environmental Management Authority or any other person given a written authorization by the Authority. The environment impact assessment shall be carried out at the expense of the promoter.

Article 70 states that an order of the Minister having environment in his attributions establishes the list of projects for which the public administration shall not warrant any authorization without an Environmental Impact Assessment describing direct and indirect consequences of the project to the environment; moreover the Article 13 states that any soil development and exploitation project for industrial, urban organization as well as any research project or the one of exploitation of subsoil raw materials is subject to authorization issued through procedures determined by the order of the Minister concerned. Currently the EIA approval process is done on line via RDB one stop centre and is done as follows**:**

- Project proponent /developer request EIA terms of reference by submission of project brief;

- RDB review the project brief and conduct field visit before issuance of terms of reference;
- Once terms of reference are approved and sent to the project developer, this one is allowed to hire one of the certified expert based on the list approved by Ministry of Natural Resources;
- The hired consultant conduct the EIA study and submit the EIA report to the developer and this one send the report to RDB if is satisfied with the report,
- RDB review the report and issues the EIA clearance letter with approval condition if is satisfied with the report. Once the conditions of approval are signed by the developer, then RDB issue the original certificate and the developer is allowed to start the project.
- If RDB is not satisfied with the report, the report is reject and the developer together with the consultant addresses comments issues by RDB,
- If the developer is not satisfied with RDB decision he/she can appeal to the Minister of natural resources having environment in his attribution..

- **Law N° 37 /2008 of 11/08/2008 on mining and quarry exploitation**

The construction of Principal pipeline requires some material including stones and sand. Therefore, the mining and quarry exploitation laws provide the process of acquiring quarries for mining activities, the licensing process and the environmental consideration in exploiting a quarry. Nevertheless the quarry component will be conducted by a contractor who will be required to fully respect strictly the process. Actually, an EIA Certificate is required for each quarry to be exploited. Thus, the contractor will be requested to acquire material from a certified mines and quarry and in respect to environmental requirement.

- **Ministerial Order N°007/2008 of 15/08/2008 establishing the list of protected animal and plant species**

Chapter II Article 2 of this order classifies protected animals in three categories as Mammals, birds, and reptiles. The list is published in Appendix 1 of this Order as follows:
Animals: Gorilla, Chimpanzee, Black rhinoceros, Elephant, Roan antelope, Sitatunga, Lions, Leopard, Klipspringer, Buffalo, Cheetah, Zool mongoose, Cephalophus, Zoolserval, Wild dog, Bushbuck, Hippopotamus, Burchell's zebra Birds: Black-headed Heron, Cattle Egret, Grauer's Swamp Warbler, Owls, All Lemoroids, Grey Crowned-Crane, wallow, Arrow-marked Babbler, Cape Robin-Chat, All pangolins, Vulture, Bee eater, Scimitar bills, Hamerkop, Sunbirds.

Reptile: Tortoises (all species), Python, Crocodile, Viper.
Plants: Ficusthonningii, Prunus Africana, Pentadesmareindersii, Myrianthusholstii, Thonningia sanguine,Hypoestestrifolia,Aloesp.,Syzygiumguineense,Erythrinaabyssinica,Fagarachalybea,Kigelia,Africana,Orchidaceae,Eulophiastreptopetala,Eulophiahorsafalli,Diaphananthebilosa,Disaemili,Disperiskilimanjarica,Euggelingialigulifolia,Polystachyiahastate,Tridactyleanthomaniaca,Entandopheragmasp,Podocarpususambarensis,Albizziasasa,PiptadeniaAfricana,Podocarpusmilinjianus,grandiflora,Strombosia,Scheffleri. The Order specifies that the listed animals and plant species shall not be destroyed without permission of the competent authorities. Although none of these species were observed in the project area, this project will endeavour to respect and protect these organisms, their habitats and the regulation enforcing the measures of their protection where they are present.

- **Environmental Impact Assessment general guidelines, 2007**

REMA has now developed the EIA regulations which provide a guide and requirements for EIA in Rwanda. According to these new regulations, Article 1 makes it mandatory for all the projects listed under schedule I to be subjected to a full scale EIA. The Article further states that no environmental authorization shall be granted by the Authority for any project in Schedule I to these Regulations if no Environmental Impact Assessment has been submitted to the Authority in accordance with the provisions of these Regulations.

The Article states that any project listed under Impact Level III of Schedule I to these Regulations shall require a full environmental impact assessment by preparation of an environmental impact report, unless the Authority refuses permission. The construction and rehabilitation of mass graves of victims of 1994 Genocide, falls in this category II and thus must be subjected to full scale EIA.

Public Hearing Process: Article 47: The Authority shall on receipt of the developer's environmental impact report, arrange for a public hearing to take place within twenty (20) working days from the first day of public notification, at which relevant Lead Agencies, local governments, civil societies and concerned members of the public may comment on the environmental impact report and express views on impacts of the proposed development. The Authority shall cover all costs incidental to the public hearing. Article 48: All projects classified under Impact Level III shall be subjected to a public hearing prior to the decision-making process.

- **Ministerial order N° 003/2008 of 15/08/2008 relating to the requirements and procedure for Environmental Impact Assessment**

Article 1 stipulates that Environmental Impact study is a systematic way of identifying environmental, social and economic impacts of a project before a decision of its acceptance is made. In article 3, the developer submits an official application which includes a project brief of the proposed project to the authority. Article 4 specifies that within thirty (30) calendar days after receipt of the project brief and after its analysis, the Authority shall submit the Terms of reference to the developer for the Environmental impact study.
In Article 7, upon completion of t h e environmental impact study, the developer shall deposit with the Authority five (5) hard copies and a soft copy of the report.

- **Organic law N° 43/2013 of 16/06/2013 governing land in Rwanda**

The land law was initially adopted in 2005 and then revised in 2013 and was gazetted in the official gazette no special of 16/06/2013. It determines the use and management of land in Rwanda: This is the law that determines the use and management of land in Rwanda. It also institutes the principles that are to be respected on land legal rights accepted on any land in the country as well as all other appendages whether natural or artificial. According to the law, land in Rwanda is categorized into two: individual land and public land. The latter is subdivided into two categories: the state land in public domain and the state land in private domain. State land in public domain includes national land reserves for environment conservation; land over which administration building are erected, state roads, land containing lakes, rivers, stream and springs. State land in private domain include swamps that may be productive in terms of agriculture, vacant land with no owner, land purchased by the State, donation, land acquired through expropriation and land occupied by state owned forests.

The Organic land law also provides two types of formal land tenure: full ownership/ freehold and long term leasehold. So far, all land in the country has been registered and land titles issued to citizens. According to article 10 of new land law of June 2013, private individual land shall comprise land acquired through custom or written law. That land has been granted definitely by competent authorities or acquired by purchase, donation, inheritance, succession, ascending sharing, and exchange or through sharing. This law offers equal protection to rights over land resulting from all channels stipulated in the preceding paragraph. All types of land tenure must be in compliance with the designated land use and environmental protection measures as outlined in the Land Use Master Plan.

- **Organic law n° 32/2015 of 11/06/2015 law relating to expropriation in the public interest**

This law determines the procedures relating to expropriation of land in the interest of the public. The law stipulates that the government has the authority to carry out expropriation. However the project, at any level, which intends to carry out acts of expropriation in public interest, shall provide funds for inventory of assets of the person to be expropriated. According to the organic law, no person shall hinder the implementation of the program of expropriation on pretext of self-centered justifications and no land owner shall oppose any underground or surface activity carried out on his or her land with an aim of public interest. In case it causes any loss to him or her, he or she shall receive just compensation for it.

Eligibility for compensation is enshrined under the Rwandan constitution (article 29) and the expropriation law. The two laws regulate and give entitlement to those affected, whether or not they have written customary or formal tenure rights. The person to be expropriated is defined under article 2(7) of the expropriation law to mean any person or legal entity who is to have his or her private property transferred due to public interest, in which case they shall be legally entitled to payment of compensation.

3.1.3. Institutional arrangement for the environmental management in Rwanda

The institutional framework for environmental management is currently enshrined in the Organic Law determining the modalities of protection, conservation and promotion of the environment in Rwanda, published in the Official Gazette RWA N° 9 of the 1st May 2005, particularly in its chapter III relating to the establishment of the institutions.

- **Ministry of Infrastructure (MININFRA)**

The mission of 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.

➢ **Water and Sanitation Corporation Limited(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 Environmental and Management Plan 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 JICA.

- **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 IV of the organic law on environmental protection, conservation and management, article 65, clearly calls for the need to subject projects to mandatory EIA. The Article 65 further specifies that every project shall be subjected to environmental assessment prior to its commencement. It shall be the same for programs, plans and policies likely to affect the environment. Specific details of projects referred to in this Article shall be spelt out by the order of the Minister in charge of environment. MoE is one of the lead Agencies / Line Ministry as provided by the General Guidelines and Procedure for EIA.

MoE Expected to perform the following functions in the EIA process:

- Participate in screening at the request of Rwanda environment Management Authority(REMA);
- Publish the list of EIA practitioners;
- At the request of REMA, review Project Briefs so as to advise on Terms of Reference;
- Ensure that their own projects adhere to EIA requirements;
- Ensure that private-sector projects in fields over which they have jurisdiction comply with EIA requirements;
- At the request of REMA, review EIA report;

- Serve on REMA's Technical Committee;
- Serve on REMA's Executive Committee;
- Provide information or advice to developers and EIA Experts during EIA process;
- Participate as panellist at public hearings held during the conduct of EIA;
- Advise developers on the requirement for EIA (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.

- **Rwanda Environment Management Authority (REMA)**

REMA was established in2004 to act as the implementation organ 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 EIA review has been delegated to Rwanda Development Board.

- **Rwanda Water and Forestry Authority (RWFA)**

The Rwanda Water and Forestry Authority 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 forests and natural water resources;
- To advise Government, monitor and coordinate the implementation of strategies related to the management of forests and natural water resources;

- To assist public and private institutions in charge of management of forests and natural water resources in a bid to fight erosion;
- To establish programmes and strategies for production of tree seeds;
- To prepare programmes of reforestation, forest promotion and appropriate management and support districts in the management of forests and natural water resources;
- To undertake research, studies and other relevant activities with regard to the importance of forests in the national economy and to the exploitation of trees and wood-based products and disseminate the findings;
- To assist in the establishment of standards and regulations relating to the management of forests and natural water resources.

- **Rwanda Land Management and Use Authority (RLMUA)**

RLMUA is responsible for putting in place and operational zing 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 protects 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.

- **Rwanda Development Board (RDB)**

RDB was created by Organic Law N° 53/2008 of 02/09/2008. It has a mission of improving the well-being of all Rwandans by fast-tracking development, catalyzing sustainable economic growth, and creating prosperity for all. 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 EIA reports was entrusted to REMA, this duty has now been transferred to the newly created Rwanda Development Board (RDB) where a department of EIA has been created and tasked with review and approvals of all EIA reports for

proposed projects and programmes before they are approved for implementation. The Key responsibility of EIA department under One Stop centre in RDB is to:

- Receive and register EIA 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 EIA documents submitted by a developer and verify that they are complete,
- Transmit copy of EIA Reports to relevant Lead Agencies, Local Governments and Communities to review and make comments,
- Review EIA 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 EIA Documents (EIA 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 EIA Certificate of Authorization if their projects are approved.

- **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.

- **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, organisation and functioning. This Law gives to RURA the mandate to regulate:

- 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;
- Sanitation;
- Transport of persons and goods; and
- Other public utilities, if deemed necessary.

- **Local Governments**

Generally, decentralized entities are responsible for the implementation of laws, policies, strategies, objectives and programmes 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 EIA Local Governments including Kigali City, Nyarugenge and Gasabo districts and its respective sectors 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 EIA Experts when consulted during EIA process,
- At the request of RDB, review EIA 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.

3.2. International legislative and policy framework

In addition to national environmental legislations, Government of Rwanda is also a party to a number of regional and international conventions and protocols on environment. Therefore, the project of strengthening Nzove- Ntora principle pipeline will be implemented in compliance with international policy and regulations particularly World Bank safeguards Policies and JICA Environmental and Social considerations.

3.2.1. JICA guidelines on Environmental and Social Considerations

The project rehabilitation of strengthening Nzove-Ntora Principal Pipeline will be funded by the Government of Japan through JICA. It is therefore, critical to ensure that the project is implemented in compliance with JICA Environmental and Social Consideration. JICA encourages host country governments, including local governments, borrowers, and project proponents, to implement the appropriate measures for environmental and social considerations when engaging in cooperation activities. At the same time, JICA provides support for and examinations of environmental and social considerations in accordance with the guidelines.

The guidelines cover five schemes: (1) Loan aid, (2) Grant aid (excluding projects executed through international organizations), (3) Preliminary studies of grant aid undertaken by MOFA, (4) Technical cooperation for development planning, and (5) Technical cooperation projects.

- **Objectives of JICA guidelines**

The objectives of the guidelines are to encourage project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for an examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavours to ensure transparency, predictability, and accountability in its support for an examination of environmental and social consideration

- **Key principles of JICA guidelines**

Key principles of JICA guidelines on environmental and social considerations can be summarized as follows:

1. Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.
2. Examinations must be endeavoured to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social, and technical analyses of projects.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seek their opinions, in order to increase accountability.

- **Responsibility of JICA in EIA process**

While project proponents etc. take the initiative to deal with the environmental and social considerations of projects, JICA provides support for and examinations of the environmental and social considerations that project proponents etc. implement in accordance with Sections 2 and 3 of the guidelines, depending on the nature of cooperation projects. Project proponents are required to incorporate the output of environmental and social considerations studies into project planning and decision-making processes. When JICA provides support for and examinations of environmental and social considerations, JICA examines the requirements that must be met.

- **Categorization of projects and JICA guidelines**

JICA classifies projects into four categories according to the extent of environmental and social impacts, taking into account an outline of project, scale, site condition, etc.

Category A: Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. These impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas.

Category B: Proposed projects are classified as category B if their potential adverse impacts on the environment and society are less adverse than those of category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily. The rehabilitation of irrigation facilities in Rwamagana can be classified as category B projects.

Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.

Category FI: Proposed projects are classified as Category FI if they satisfy all of the following requirements: JICA's funding of projects is provided to a financial intermediary or executing agency; the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment.

- **Impacts to be assessed**

The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process.

In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational. The life cycle impact of a project period is also considered. Various kinds of relevant information are needed in order to assess impacts on the environment and local communities. There are, however, uncertainties in predicting such impacts caused by the incomplete understanding of impact mechanisms and the limited information available. Therefore, if the scale of uncertainty is considered to be large, project proponents etc. provide environmental and social considerations that include preventive measures as much as possible.

3.2.2. World Bank Safeguard Policies

The World Bank Group (WBG) includes two development institutions owned by 184 member countries – the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The IBRD focuses on middle income and creditworthy poor countries, while IDA focuses on the poorest countries in the world. In addition to the IBRD and IDA, three other institutions are members of the WBG: the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA) and the International Centre for Settlement of Investment Disputes (ICSID).

The operations of IDA and IBRD members are guided by a comprehensive set of environmental and social policies and procedures dealing with the Bank's development objectives and goals, the instruments for pursuing them, and the project sponsor requirements for Bank-financed operations. These policies and guidelines, known as Operation Policies (OPs), are set out in the Bank's Operational Manual. Within the overall set of OPs, the Bank has identified ten key policies critical to ensuring that potentially adverse environmental and social impacts are identified, minimized and mitigated. These ten are known as the "Safeguard Policies" and include: Environmental Assessment (OP 4.01),Physical Cultural Resources (OP 4.11),Disputed Areas (OP 7.60),Forests (OP 4.36),Indigenous Peoples (OP 4.10),International Waterways (OP 7.50),Involuntary Resettlement (OP 4.12), Natural Habitats (OP 4.04),Pest Management (OP 4.09) and Safety of Dams (OP 4.37).

The Bank undertakes screening of each proposed project to determine the appropriate extent and type of Environmental Assessment (EA) to be undertaken. Depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts, the Bank will classify the proposed project into one of the categories (A, B, C). The project sponsor is responsible for any environmental due diligence required by the Safeguard Policies, with general advice provided by Bank staff. Further details of the Bank's environmental and social Safeguard Policies can be viewed at www.worldbank.org. The most relevant policies to the proposed projects are:

- **Environmental Assessment (OP 4.01)**

This policy requires Environmental Assessment (EA) of projects proposed for World Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve decision making. The EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. The EA process has thus taken into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property) and trans-

boundary and global environmental aspects. We have assessed and determined future potential environmental and social impacts during implementation of this project, and we have also clearly elaborated various mitigation, monitoring and institutional actions to be taken during the implementation of the project activities. This is geared towards eliminating, reducing the adverse environmental and social impacts to acceptable standards. This EIA report is therefore subject to disclosure to the general public.

The World Bank system assigns a project to one of three project categories, as defined below:

(a) ***Category "A" Projects:*** An EIA is always required for projects that are in this category. Impacts are expected to be 'adverse, sensitive, irreversible and diverse with attributes such as pollutant discharges large enough to cause degradation of air, water, or soil; large-scale physical disturbance of the site or surroundings; extraction, consumption or conversion of substantial amounts of forests and other natural resources; measurable modification of hydrological cycles; use of hazardous materials in more than incidental quantities; and involuntary displacement of people and other significant social disturbances;

(b) ***Category "B" Projects:*** Although an EIA is not always required, some environmental analysis is necessary. Category B projects have impacts that are 'less significant, not as sensitive, numerous, major or diverse. Few, if any, impacts are irreversible, and remedial measures can be more easily designed.' Typical projects include rehabilitation, maintenance, or upgrades, rather than new construction and;

(c) ***Category "C" Projects:*** No EIA or other analysis is required. Category C projects result in negligible or minimal direct disturbance of the physical environment. Typical projects include education, family planning, health, and human resource development.

- **Natural Habitats (OP 4.04)**

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long term sustainable development. World Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats. Natural habitats are land and water areas where (i) the ecosystems biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the areas primary ecological functions. All natural habitats have important biological, social, economic, and existence value. Important habitats may occur in tropical humid, dry, and cloud forest; temperate and boreal forest; Mediterranean-type shrub lands; natural arid and semi-arid lands, mangrove swamps, coastal marshes, and other wetlands; estuaries, sea grass beds, coral reefs, freshwater lakes and rivers; alpine and sub alpine Environments, including herb fields, grasslands, and paramos; and tropical and temperate grasslands.

Therefore, the natural habitats policy is applicable to the proposed project within as it may have potential adverse impacts on the river, wetlands and the catchments area. These ecosystems support varying degrees of natural complexities of flora and fauna.

- **Involuntary Resettlement (OP 4.12)**

The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. This policy covers direct economic and social impacts that both result from Bank assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally

designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. In the project site, there are no affected communities that require to be resettled since the area to be developed is already largely under cultivation. The Nzove-Ntora project is designed in a way that avoids physical resettlement. However, some structures like fence and floor as some trees and crops will be affected and compensated prior construction. Detailed asset inventory has been conducted and a Resettlement Action Plan(RAP) is being prepared together with this EIA report.

3.2.3. Framework Convention on Climate Change

This convention takes into account the fact that climate change has trans-boundary impacts. The basic objective of this convention is to provide for agreed limits on the release of greenhouse gases into the atmosphere so as to prevent the occurrence of climate change. It also aims to prepare countries to minimize the impact of climate change, should it occur.

3.2.4. Convention on Biological Diversity

The convention on biological diversity has three goals. These are:

- Conservation of biodiversity;
- Sustainable use of the components of biodiversity; and
- Fair and equitable sharing of the benefits arising from the use of genetic resources. Rwanda has ratified this convention and all project developer is urged to implement the convention during project implementation.

Based on the above assessment of legal and institutional framework both national and international, the consultant can conclude that projects of strengthening Nzove-Ntora Principal pipeline has a comprehensive legal and regulatory framework that can enable the project implement in sustainable manner id complied with. The consultant recommend to implement the proposed project in consider of both national laws and policies but also international policies and standards especially the JICA guidelines on environmental and social considerations.

CHAPTER IV: ENVIRONMENTAL AND SOCIAL BASELINE DATA

4.0. Introduction

The objective of EIA is to ascertain environmental and socio-economic baseline conditions and then assess the impacts as a result of the proposed project of strengthening Nzove-Ntora Principal during various phases of the project cycle. In order to understand the existing environmental and socio-economic conditions baseline data has been collected, compiled and analysed for the following:

- Socio-economic environment (demography, livelihood, income socio-economic etc.)
- Physical environment(land and soil-water-air & climate);and
- Biological environment (flora and fauna);

The information presented in this chapter has been collected from various sources. Majority of data have been collected from field visits and surveys, laboratory tests and from secondary data available in different reports. Formal and informal discussions were held with the local people, project affected people and local government/non-government organisations that provided very useful information for preparation of this report. Information on project facilities, size, magnitude and cost of the construction activities of the project have been taken from the draft preliminary design report done by JICA study team. Therefore, this chapter provides information on the physical, biological and socio-economic elements of the project area which shall be used as benchmarks for future monitoring.

4.1. Socio-economic baseline data

The socio-economic baseline data was conducted on households that are likely to be affected the strengthening of Nzove-Ntora principal pipeline in Kigali City. The initial identification of project Affected households (PAHs) found 87 households and 8 corporations but the survey covered 80 Households and 6 corporation. Households that was not considered are the 7HHs who have been compensated and relocated by ongoing road construction project. Furthermore, two corporations refused to disclose their information.

After the Socio-economic survey, 22 households were removed due to the result of the re-measurement, and 27 households and 2 corporations were identified as PAHs later in the RAP survey. In total, 93 households/corporations are identified as PAHs, as shown in the table below.

4.1.1. Data collection and analysis methodology

Data collection and analysis followed predefined steps including preparation of questionnaires, training of field enumerator, pre-test, and filed survey. This study is descriptive as it is describing in detail, the socio-economic characteristics of households and corporate owning or using plots in the targeted area

- **Area covered by the study**

The survey covered households who own or used the land located in project targeted area and it conducted two districts, Nyarugenge and Gasabo, 4 sector and six cells. The table below summarizes the area covered by the survey.

Table 4: District, sector and cells covered by socio-economic survey

District	Sector	Cell	Number of HH	Number of Corporate
Nyarugenge	Kigali	Nyabugogo	17	1
	Kanyinya	Nzove	7	2
		Nyamweru	6	1
Gasabo	Gatsata	Nyamabuye	6	0

		Nyamugari	13	0
	Gisozi	Ruhango	34	6
2	**4**	**6**	**83**	**10**

Source: Field Survey, BESST Ltd 2018

- **Determination of survey population**

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population usually have a common, binding characteristic or trait. In this survey, targeted population were households or corporation who own or use plots in targeted area. In total 95 units were identified including 87households and 8 corporate but the field covered 80 households and 6 corporate. However, as mentioned above, after the Socio-economic survey, 22 households were removed due to the result of the re-measurement, and 27 households and 2 corporations were identified as PAHs later in the RAP survey. In total, 93 households/corporations are identified as PAHs.

- **Reliability and Validity**

Reliability is a measure of the degree to which instrument yields consistent results of data after repeated traits. While, validity is the degree to which results obtained from the analysis of the data represent the phenomenon under study. To enhance reliability, methods such as pre-test; internal consistency and alternative form were used. In test retest method, the researcher gives the same test to a group of subjects at two different times. Internal consistency measures whether several items that propose to measure the same general construct produce similar scores. Validity was censured by conducting the pre-test and finalizing the questionnaire based on pre-test results. The pre-test was conducted on 8 households and one corporation and results confirmed the validity of questionnaire after minor correction. To ensure the quality of data collection and data entry, 8 enumerator participated in one day training and in pre-test.

- **Data processing and analysis**

After data collection and data entry, the next step is data processing and data analysis. Response obtained from field survey were interpreted and put into different specific and relevant categories. Then, data were analysed using descriptive statistics in tables and charts. Data processing and analysis was done in excel statistical analysis tool and different tables and diagrams was used to display survey findings. The results of the analysis, using samples of 58 households and 6 corporations are shown in the report.

4.1.2. Characteristics of households

Tables below provides outline of Project Affected Households/Projects Affected People including corporations

Table 5: Outline of PAHs

PAHs

District	Sector	Cell	Identified before Socio-economic survey		Identified later in the survey (no Socio economic survey)		total
			Own a part or whole land plots	Use only government land	Own a part or whole land plots	Use only government land	
Nyarugenge	Kanyinya	Nzove	6		1		7
		Nyamweru	5		1		6
	Kigali	Nyabugogo	10	1	3	3	17
Gasabo	Gatsata	Nyamabuye	2		4		6
		Nyamugali	0	5	8		13
	Gisozi	Ruhango	29		5		34
total			52	6	22	3	83

PAP

District	Sector	Cell	Identified before Socio-economic survey		total
			Own a part or whole land plots	Use only government land	
Nyarugenge	Kanyinya	Nzove	20		20
		Nyamweru	23		23
	Kigali	Nyabugogo	37	9	46
Gasabo	Gatsata	Nyamabuye	14		14
		Nyamugali		23	23
	Gisozi	Ruhango	164		164
total			258	32	290

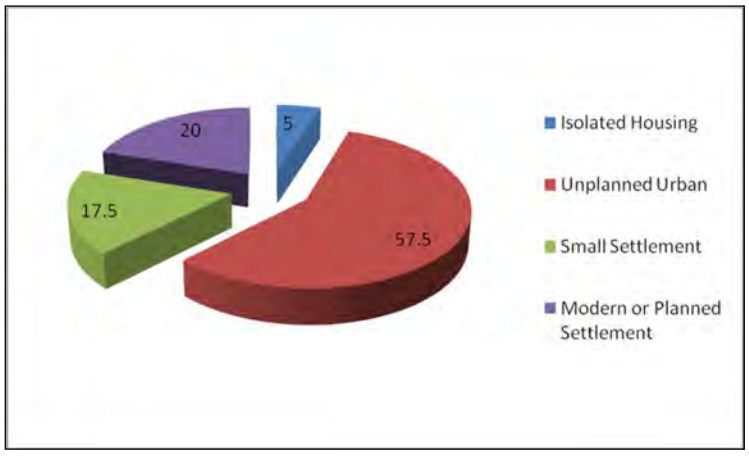
Corporations

District	Sector	Cell	Identified before Socio-economic survey		Identified later in the survey	total
			Target of socio-economic survey	Rejected the survey		
Nyarugenge	Kanyinya	Nzove	1		1	2
		Nyamweru		1		1
	Kigali	Nyabugogo	1			1
Gasabo	Gatsata	Nyamabuye				
		Nyamugali				
	Gisozi	Ruhango	4	1	1	6
total			6	2	2	10

- **Type of habitat**

Background describe type of household habitation and its members as well as nature of their land (main purpose of land or plot). This assessment at each level present a mixture of both household's characteristics and corporate characteristics where is possible.

Figure 11: Type of habitat

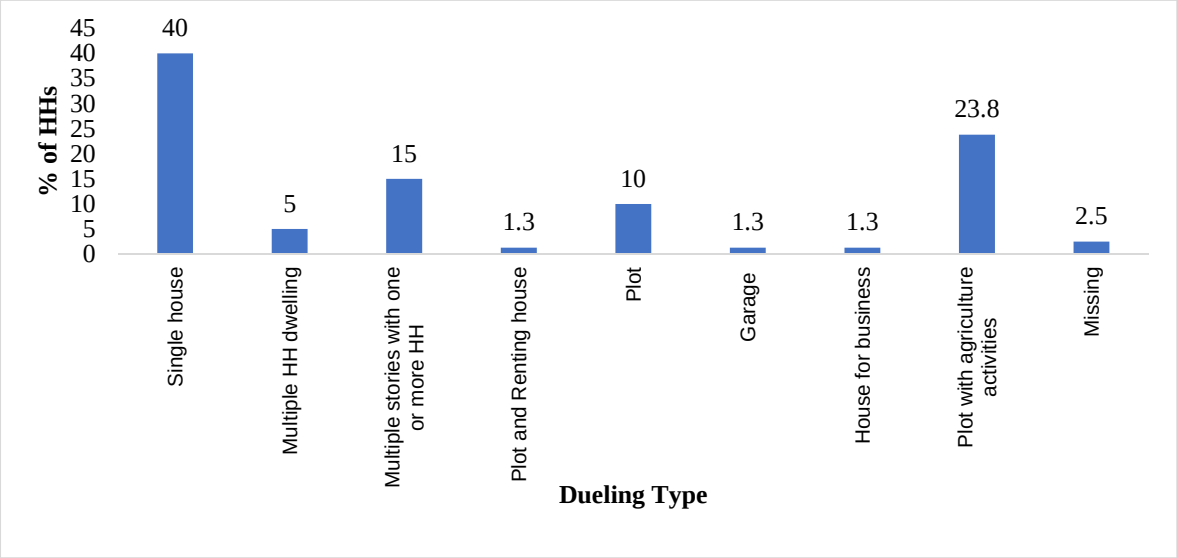


Source : Socio-economic survey, BESST Ltd 2018

From the above, diagram unplanned urban settlement dominate the type of habitat with 57.5% and this is due to the fact that most of the households are in Gisozi sector which is in urban area but its development was done before Urban master plan. On the second place we have planned settlement with 20%, small settlement with 17.5 and isolated housing with 5%. This type of habitat reflect the current situation of Kigali City where unplanned urban planning dominate other type of habitat. Modern or planned settlement seems to be high and this may due to the fact that all modern house located in area demarcated as residential are considered modern or planned even though there were

constructed before the master plan. Isolated settlement are only found in Rural areas that was annexes to Kigali City such as Kanyinya.

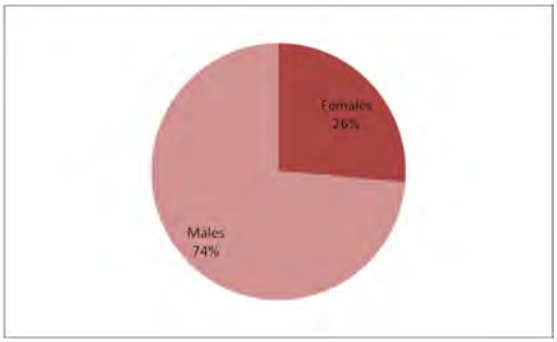
Figure 12: Type of duelling in project area



Source: Field survey, BESST Ltd 2018

From above chart 40% of households assessed, held single house type, 5% multiple household duelling, 15% multiple stories with one or more household, 1% plot and renting house, 10% are plots only, 1% is a garage, 1% house of business, 24% are plots containing agriculture activities and around 3% (2.5%) are consisted by these who failure to identify the form of their duelling. Thus, the most of them are living in single house type of duelling and other plots are still being used for agriculture development.

Figure 13: Heads of households by sex



Source: Field Survey, BESST Ltd, 2018

From the above diagram, 26% of heads of household are females and 74% males. And they are all aged between 24 to 87 years old. 33% of them are aged between 24 and 65 years old (in between working age in Rwanda) which is equivalent to 85% of the whole assessed households.

4.1.3. Characteristics of households members

This section provides baseline on household members including sex, age, education, source of income (primary and secondary), working conditions as well as the average amount or income earning per year by specific activities. In 58 assessed households, 290 family members were identified assessed which makes average of 5 members/households.

Table 6: Members of households by age and by sex

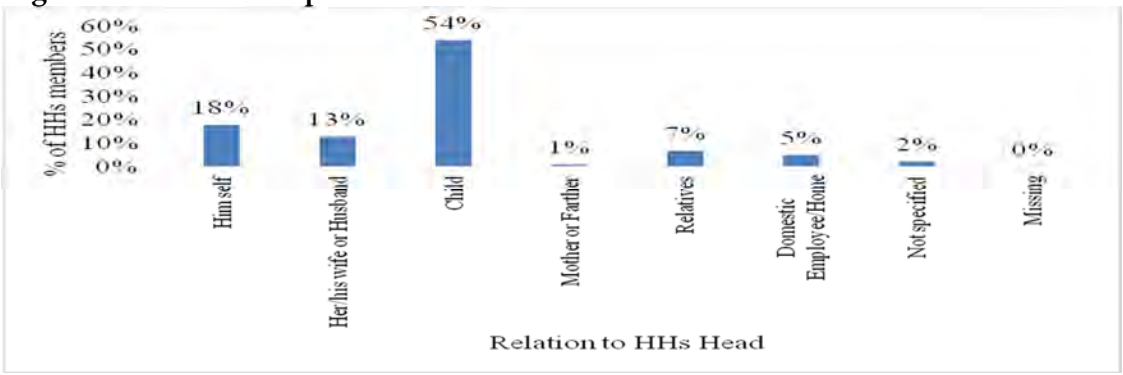
Age intervals	Female		Male		Total	
	Number HHs of members	Percentage	Number of members	Percentage	Number members	Percentage
Less than 10 years	23	17%	24	16%	47	16%
Between 10 and 20 years	30	22%	32	21%	62	21%
Between 20 and 30 years	28	20%	36	24%	64	22%
Between 30 and 40 years	19	14%	18	12%	37	13%
Between 40 and 50 years	15	11%	14	9%	29	10%
Between 50 and 60 years	11	8%	15	10%	26	9%
Between 60 and 70 years	8	6%	4	3%	12	4%
Between 70 and 80 years	2	1%	4	3%	6	2%
Between 80 and 90 years	0	0%	1	1%	1	0%
Don't their age			1	1%	1	0%
Not specified	2	1%	4	3%	6	2%
Total	**138**	**48%**	**152**	**52%**	**290**	**100%**
Median Age	**24**		**24**		**24**	

Source: Field survey, BESST Ltd 2018

The above table shows that 48% of them are females and 52% are males. In regards to the age, the big portion for both males and females are below 50 years. The table also shows that 16% of households members are below 10 years for both sex, 21% of the total males and 22% of total females are aged between 10 and 20 years old.

- **Relation of households members with heads of households**

Figure 14: Relationship in the household



Source: Field survey, BESST Ltd 2018

Reference made to the above chart, 18% are heads of household, 13% are husband or wife of the head of households, 54% represent children of the head of household, 1% represented by the mother or father of the head of household, 7% are relatives while 5% are domestic employee.

- **Vulnerability**

In total 55 vulnerable people were identified including 15 with physical disability, 17 with chronic diseases, twelve orphans, 7people with mental disability and 4 old people.

Table 7: Vulnerability in the project area

Vulnerability	Number of family members	Percentage
Physical Disability	5	1.7%
Chronic diseases	3	1.0%
Mental Disability	1	0.3%
Orphan	2	0.7%

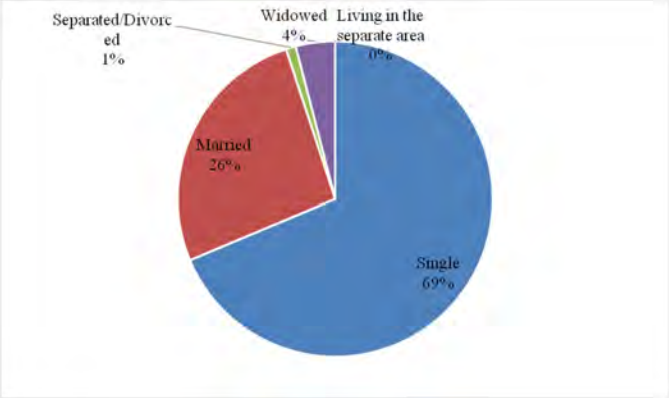
Old people	4	1.4%
Total people suffering any type of Disability	**15**	**5.2 %**

Source: Field survey, BESST Ltd 2018

- **Marital status**

The survey revealed that 69% of households members are still single, 26% are married, 1% separated and 4% are widows. The share of single is high since more than 50% of total household member are children of the household head.

Figure 15: Marital status of household members in the project area

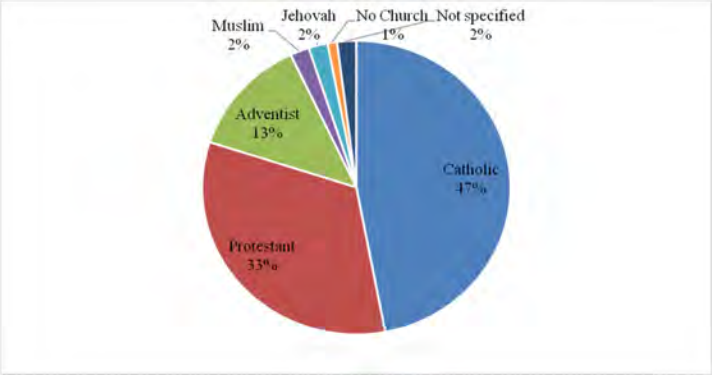


Source: Field survey, BESST Ltd, 2018

- **Members of households by religion**

In reference to the following diagram, Roman Catholic is a dominant religion with 47%, the second is protestant at 33%, 13% Adventist, 2% Muslim, 2% Jehovah and 1% do not belong to any church. This reflect the situation in the country where catholic church members are majority.

Figure 16: Religion characteristics of household members in the project area



Source: Field survey, BESST Ltd 2018

- **Education**

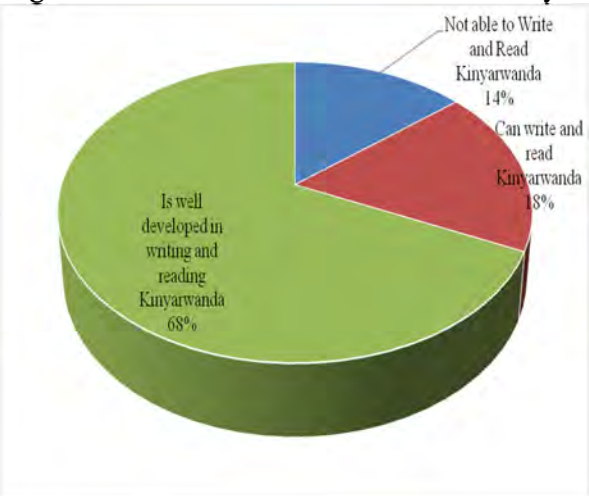
The survey revealed that 10.3% of 414 household members living in the project area do not have any formal education, 4% have only attended pre-primary education, 29.7% did primary education, 30% did high schools , 4% VTC, 22% university and 1% did high schools. Thus, only 56% of 414 have at least secondary education background.

- **Literacy among household members**

A person is qualified as literate if he/she is able to read, write and understand at least one language. According to the fourth The fourth Population and Housing Census in Rwanda conducted in August 2012 (2012 RPHC) shows that 68% of Rwandan population aged 15 years and above were literate. The field survey shows that 14% of the household members are not able to write and

read Kinyarwanda correctly, 18% can write and read Kinyarwanda while 68% can writing and reading Kinyarwanda. This concur with the national status.

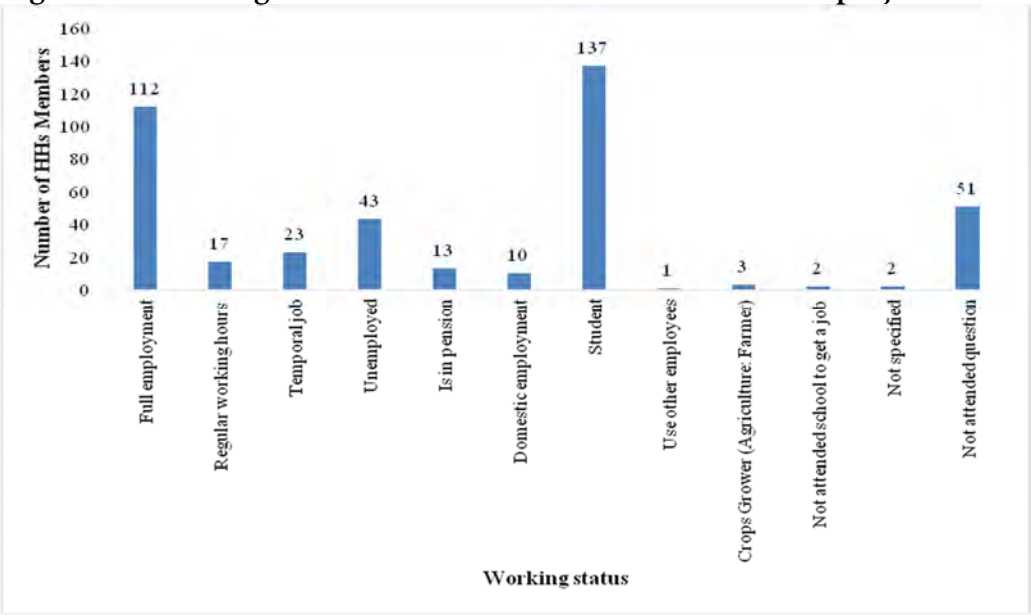
Figure 17: Households members Literacy



Source: Field survey, BESST Ltd 2018

- **Status of employment in project area**

Figure 18: Working status for the household members in the project area



Source: Field survey, BESST Ltd 2018

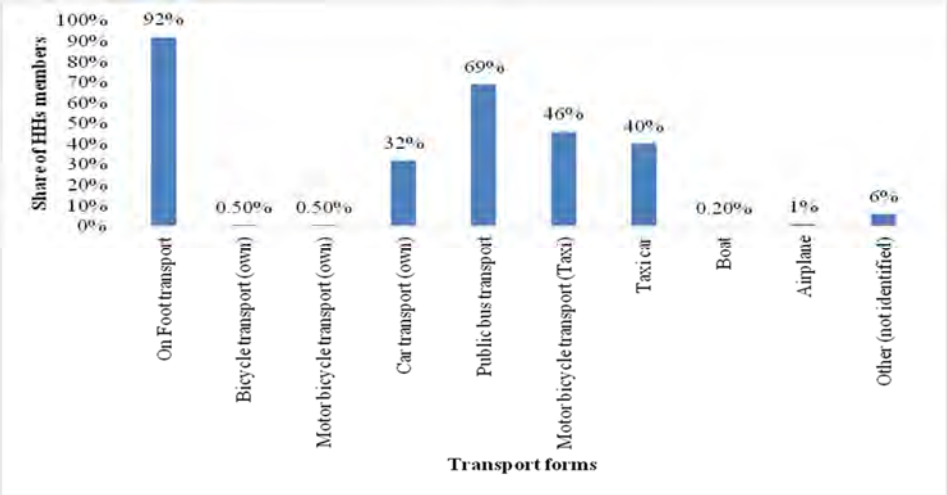
From the above chart, 27% of the total household members are full employed, 4% have regular working hours, 6% has part time(temporary) jobs, 10% are unemployed, 3% are in pension 2% domestic or home employees, 33% are students.

- **Means of transport**

People use various transport means in different period or mixed of all possible transport means. In many cases households members use different means of transport. The field survey shows that 92% has walking/foot transport as main transport means, 0.5% of the total household members use bicycle, 0.5% are own motor bicycle use it as transport means, 32% use car transport (own), 69% use public transport (bus), 46% use motor bicycle transport (taxi), 40% use tax car, 0.2% use boat,

1% use airplane and 6% other transport means not identified. It shows that many people used to use on foot and public transportation means.

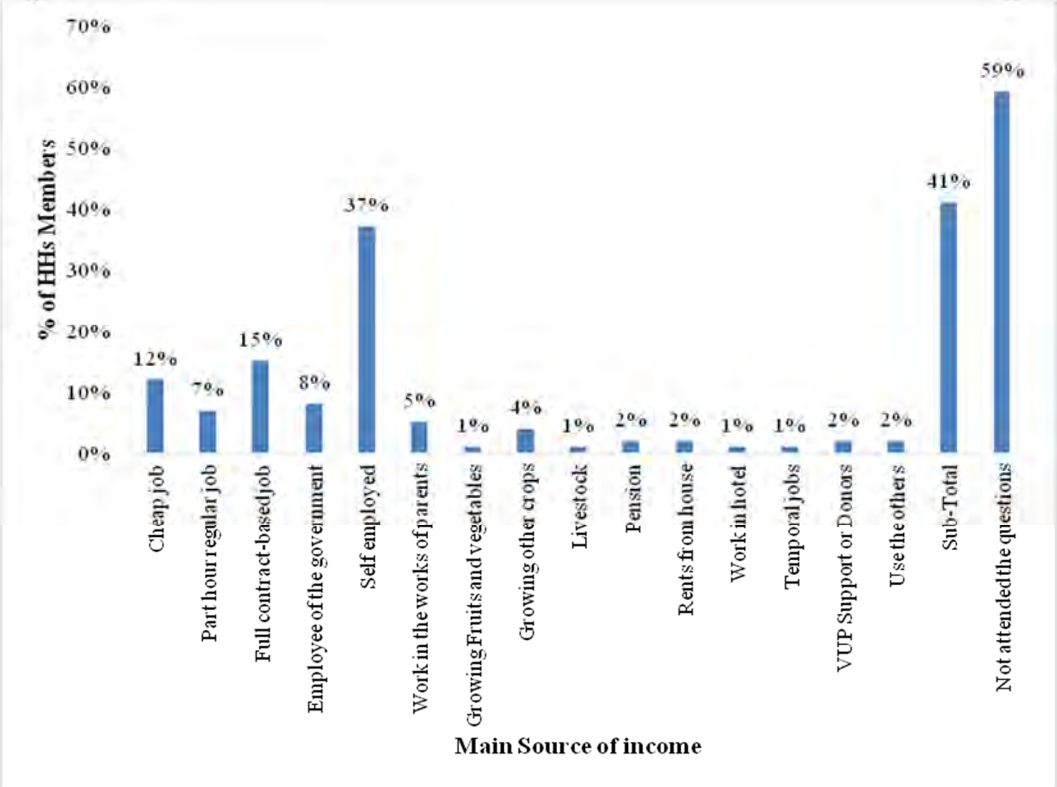
Figure 19: Means of transport used by household members



Source: Field survey, BESST Ltd 2018

- **Source of income for households members**

Figure 20: Share of main Source of income for household members in the project area



Source: Field survey, BESST Ltd 2018

In reference to the above chart, the main source of income per each household member in the project area (58 households assessed). The assessment was attempted from 114 household members (39% of total household members) since some people keep confidentially the information related to their income. From all 114 household's members who clarified their main income source, 12% their main source of income is cheap job, 7%-part hour regular job, 15% full contract job, 8% work for

the government, 37% are self-employed, 5% work for their parents, 4% are growing crops, others for livestock, pension, temporal jobs, VUP supports or other donors, work in hotel, etc. The main source of income for the people in the project area is self-employment.

- **Main income generation activities in the project area**

Key activities that generate income for members of households include agriculture, 18% , livestock 7%, construction 1%, Formal and informal commercial 29%, and remaining in different levels of activity like: industry, finance and accounting as well as management, education, arts, plays, NGOs, work the wife or husband, lawyer, consultant, pension, rents from house and ICT. Thus, in the area commerce and trade are the important activity levels to signify people's main source of income.

Table 8: Main income generation activities in the project area

Level of the activities	Number of family members	Percentage
Agriculture	20	18%
Livestock	8	7%
Construction	1	1%
Manufacturing	1	1%
Commercial	33	29%
Trading	1	1%
Financial	5	4%
Transportation	3	3%
Government	11	10%
Education	1	1%
Professional	9	8%
Others	21	18%
Total	114	100%

Source: Field survey, BESST Ltd 2018

- **Yearly income by main income source**

It is not an easy task to calculate early income for households members because some of them cannot estimate their income on do not want to disclose this information. However, surveyors managed to get this information from 79 out of 290 household members. According to this survey, 29.1% of members households has an yearly income below0.5 million per year and the average is 253,348 Rwfs. 15.2% earn income between 0.5-1 million Rwfs per year, 41.8% earn income between 1-10 million Rwfs per year. 10.1% earn an income ranged between 10-50 million, 2.5 % earn income ranged between 50-100 million and 1.3 % earn 100 million and above.

Table 9: Household member yearly income

Size of yearly income (Rwfs)	**Number of family members**	**Percentage**	**Average**
Less than 0.5 Million Rwfs	23	29.1%	253,348
Between 0.5 Million Rwfs to 1 Million Rwfs	12	15.2%	670,417
Between 1 Million Rwfs and 10 Million Rwfs	33	41.8%	3,478,398
Between 10 Million Rwfs and 50 Million Rwfs	8	10.1%	22,631,638
Between 50 Million Rwfs and 100 Million Rwfs	2	2.5%	57,615,000
100 Million Rwfs and More	1	1.3%	428,140,000
Median	**79**		**10,798,509 1,500,000**

Source: Field survey, BESST Ltd 2018

- **Income by second activities of household members**

Only 11% of household members in the project reported a second main source of income activity, from them 9% are gaining as second income from small jobs, 4% part time jobs, 9% full time

contract based jobs, 2% are employees of government, 28% are working in their own businesses (self-employed), 2% work for their parents (work in family businesses), 11% are agriculture farmers, 22% gain rents of the house, 2% gain pension, 2% enjoy supports from friends and donors, 2% are gain rents fees from their land or plots, 2% enjoy benefits from cooperatives, 2% gain from domestic worker wages and 2% are employing other employees.

Table 10: Annual income from second income generating activities

Size of income from secondary main source of income (Rwfs)	Number of family members	Percentage
0-100,000	4	10,2
100,001-500,000	4	10.2
500,001-1,000,000	4	10.2
1,000,001-2,000,000	11	28.
2,000,001-4,000,000	6	15.1
4,000,000-10,000,000	6	15.3
10,000,000-20,000,000	2	5
Above 20,000,000	2	5
Total	**39**	**100**
Average (Rwfs)	**8,587,959**	

Source: Field survey, BESST Ltd 2018

4.1.4. Land ownership in the project area.

In Rwanda all plots have been registered and given a Unique Personnel Identification(UPI) that shows the land owner. In some instance the land owner may lease his land to someone else for a given period. There also people who are using the government land especially in marshlands. The field survey team identified the land ownership and these data are very important especially during compensation exercise.

- **Time spent in current residential house**

The survey revealed that only 5 household has spent less than one year in the project area. 37.5% spent more than 20 years in the current residential houses. This is due to the fact that most of the household in the project area own their houses. All people who recently moved to the project area are from Gasabo district and one is from Kicukiro district. No one from outside Kigali City.

Table 11: Time spent in current house

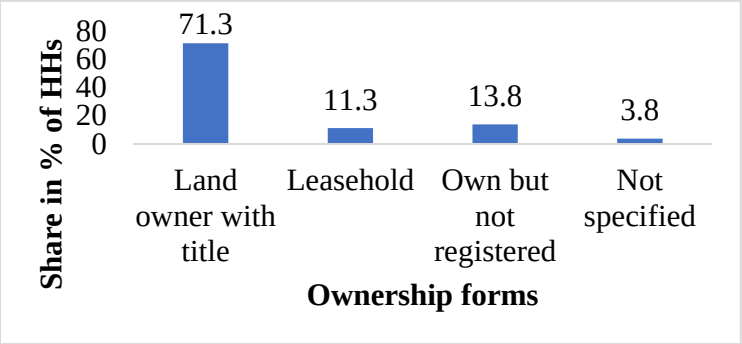
Number of years spent in the house	< 1year	1-5	6-10	11-16	16-20	> 20
Number of households	5	14	14	9	8	30
%	6.2	17.5	17.5	11.3	10	37.5

Source: Field survey, BESST Ltd 2018

- **Residential land ownership**

Results of filed survey shows that 71.3% of interviewed households are owner of the residential houses, 11.3% live in rental houses and 13.8 occupy their own house but the land is not registered. 3.8% of interviewed households failed to provide information on land ownership.

Figure 21: Residential land ownership.

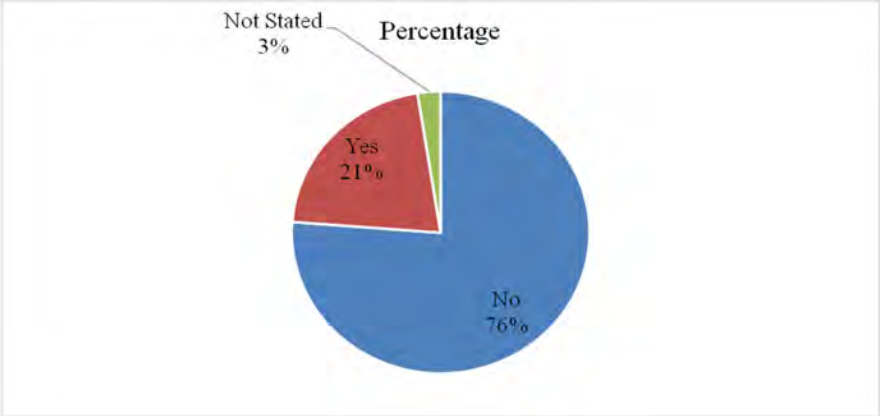


Source: Field survey, BESST Ltd, 2018

- **Other land than residential area**

Only 21%household reported that they have other plots in the project area while 76 have only residential land.

Figure 22: Households with additional lands



Source: Field Survey, BESST Ltd 2018

4.1.5. Source of income and households expenditures

In addition to the source of income by household members, it was paramount to analyse the source of income in the household and how household spend resources.

- **Household source of income**

Households were requested to provide information on their main source of income and the second source of income. Source of income includes salaries and wages, retirement income, near cash government transfers like food stamps, and investment gains. In total, 40 households are growing vegetables/crops inside the project area, but the number of households whose main income is from farming is 9.

Table 12: Main and second source of income in the project area

Household Source of income	Main source of income		Second source of income	
	No. of HHs	%	No. of HHs	%
Agriculture	9	15.5%	13	22.4%
Livestock	5	8.6%	7	12.1%
Construction	1	1.7%	1	1.7%
Manufacturing	1	1.7%	0	0.0%
Commercial	16	27.6%	3	5.2%
Trading	1	1.7%	0	0.0%
Financial	2	3.4%	1	1.7%
Transportation	0	0.0%	1	1.7%
Government	5	8.6%	3	5.2%

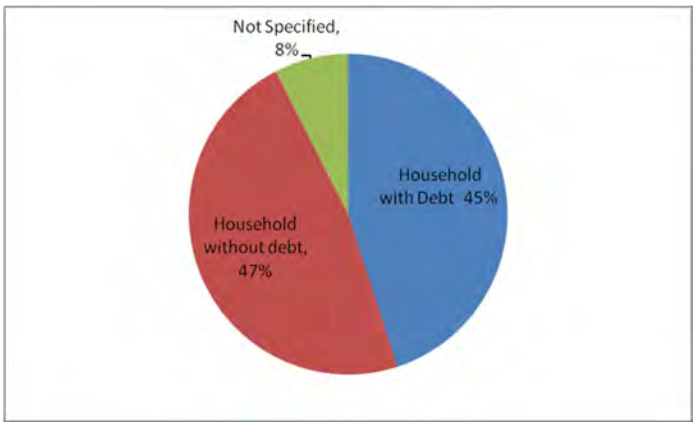
Household Source of income	Main source of income		Second source of income	
	No. of HHs	%	No. of HHs	%
Education	1	1.7%	0	0.0%
Professional	8	13.8%	6	10.3%
others	4	6.9%	7	12.1%
No reply	5	8.6%	16	27.6%
Total	58		58	

Source: Field survey, BESST Ltd 2018

- **Loans**

Household debt is defined as the combined debt of all people in a household. It includes consumer debt and mortgage loans. Household debt can be defined in several ways, based on what types of debt are included. Common debt types include home mortgages, home equity loans, auto loans, student loans, and credit cards. In Rwanda people use debt for improving household consumption, develop or improve their small or larger income generating activities, paying school fees, etc. The survey assessed the main purpose the loan, source, size, pay, payment period (agreed) of debt held by household in the project area.

Figure 23: Loan status in the project area.



Source: Field survey, BESST Ltd 2018

From the above chart, 46.6% of households have borrowed money, 46.6% did not report any loan while 7% did not want to provide information on the question.

- **Purpose of the loan**

Households reported different reasons of borrowing money and 37% borrowed for buying house or constructing houses, 18.5% for starting or increasing business (commercial activities), 7.4% to add value to existing house and expanding it, 3.7% also for commercial activities expansion 3.7% equally for both buy and renew the house. The following table summarizes different reasons of taking the loan.

Table 13: Purpose of taking loan.

Purpose of debt	Number of Households	Percentage
Buy a house	10	37.0%
Add a value to existing house and expansion	2	7.4%
Buy domestic household materials	1	3.7%
Buy Motorcycle	1	3.7%
Buy parcel of land	1	3.7%
Expanding garage	1	3.7%
Expanding house for animal rearing purposes	1	3.7%

Purpose of debt	Number of Households	Percentage
Commercial activities expansion	1	3.7%
Develop Bar business	1	3.7%
Business (Commercial)	5	18.5%
Animal Rearing	1	3.7%
Rearing caws	2	7.4%
Sub-Total	27	

Source: Field survey, BESST Ltd, 2018

- **Source of loan**

The survey revealed that have loan from commercial banks with 97,2 while only one person took the loan from his employer. 63.9 % of interviewed household acknowledge to have the loan but did not disclose the name of the Bank.. the following table summarizes the source of loan among 27 HHs who have loans.

Table 14: Source of debt for household living in the project area

Source of Debt	Number of Households	Percentage
BANK	16	59.3%
bk	2	7.4%
BPR	4	14.8%
COGEBANQUE	1	3.7%
CSS BANK	2	7.4%
Letshego	1	3.7%
Advance salary payment	1	3.7%
Sub-Total	27	100

Source: Field survey, BESST Ltd 2018

- **Size of the loan**

Only 24 household accepted to disclose the size of the loan and following table provides an indication on the size of the loan. 37.5% of households borrowed more than 20 million and this is due to the fact that most of the loans are for house construction and to construct a house in project area goes beyond 20million.

Table 15: Size of debt for households in the area covered by the project

Size of the Loan	Number of HHs	%
< 1000,000	1	4.2%
1m-5m	7	29.2%
5m-10m	6	25.0%
10-15	1	4.2%
> 20	9	37.5%
	24	100

Source: Field survey, BESST Ltd 2018

- **Loan repayment period**

Debt period range from one year to 15 years and this reflect the terms of the loan given by most of the bank in Rwanda. Only one household has short term loan that equal to six months and this is the loan from employer. The table below provide information on debt period

Table 16: Debt period of payment for household living the area covered by the project

Debt payment period	Number of Households	Percentage
6 Months < 1year	2	8.3%

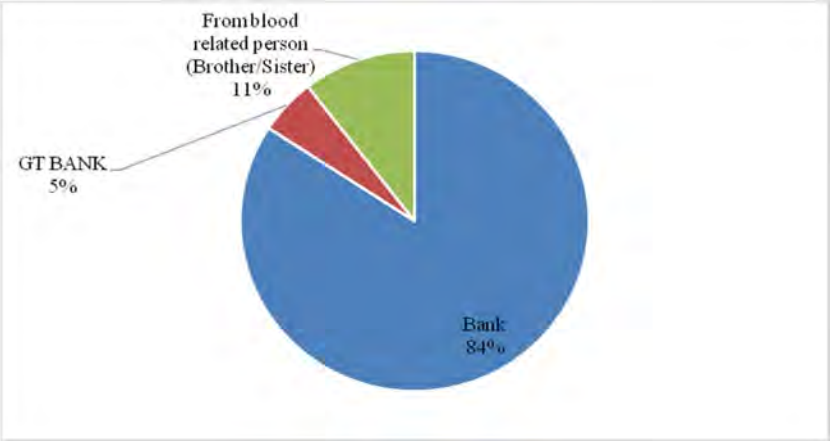
1 -3	11	45.8%
4-10	10	41.7%
Above 10	1	4.2%
General Total	**27**	100

Source: Field survey, BESST Ltd 2018

- **Additional debt**

Among the interviewed households, 9 confirmed to have additional debt the source is almost the same as the first loan but the second loan is taken in different banks.

Figure 24: Source of additional debt



Source: Field survey, BESST Ltd 2018

- **Household monthly expenditures**

The distribution of the monthly household expenditure of 52 households is shown below. The median household expenditure is RF 505,175 and much of the money is spent on food with 29%, Fuel comes at the second place with 14 % while water is the last with 1 %. The table 15 summarizes household monthly expenditures.

Figure 25: Distribution of Monthly Household Expenditure

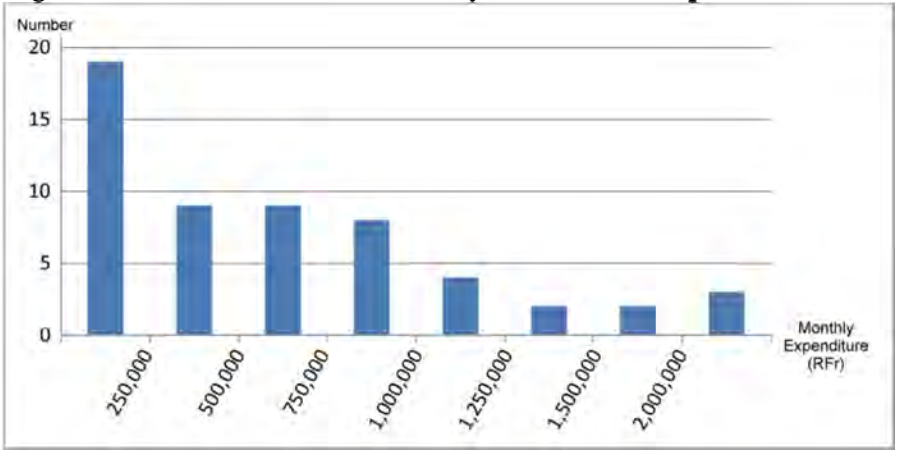


Table 17: Household monthly expenditures

Services spending for/ Monthly Expenditure on	Total households expenditure	Average expenditure per household	Share in %
Food	20,465,500	255,819	**29%**
Fuel	10,055,000	279,306	**14%**
Water	852,435	11,677	**1%**
Electricity	1,408,250	18,777	**2%**

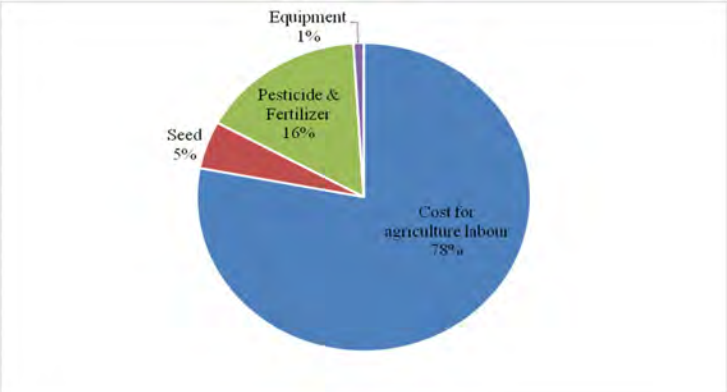
Daily Transportation	3,561,067	54,786	**5.2%**
Transportation to school	3,432,952	68,659	**5.7%**
Health	3,662,355	51,582	**5.1%**
Other education related	18,415,699	270,819	**27%**
Others	**7,634,534**	**127,242**	**11%**
General total	**69,487,792**	**120,221**	**100%**

Source: Field survey, BESST Ltd 2018

- **Yearly expenses for Rice farming**

For households where rice farming is the main source of income, the total expenditure is about 1,925,000Rwfs annually where 78% are spent on agriculture labour, 5% for seed, 16% for pesticide and fertilizers and 1% for equipments.

Figure 26: Yearly expenses of household for Rice farming.

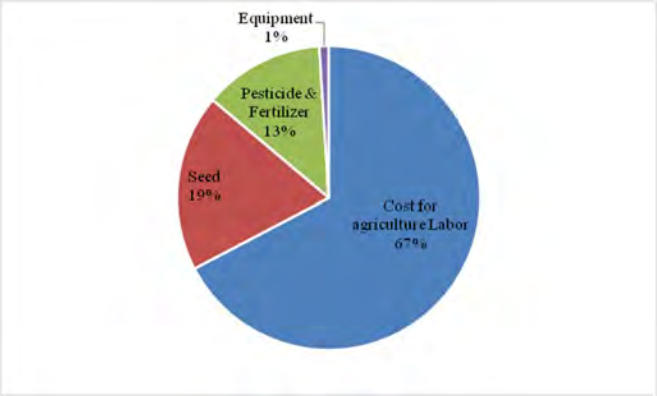


Source: Field survey, BESST Ltd 2018

- **Yearly expenditure for vegetable farming.**

For households with vegetable farming is the main source of income, households spent in average 592,500 FRW per year. The same as on the rice farming, most of money are sent on agriculture labor (68%). Other money are spent on seed costs (19%), pesticide and Fertilizer (13%), and equipment's for vegetables and fruits growing (1%).

Figure 27: Yearly expenses for vegetable and fruits farming.

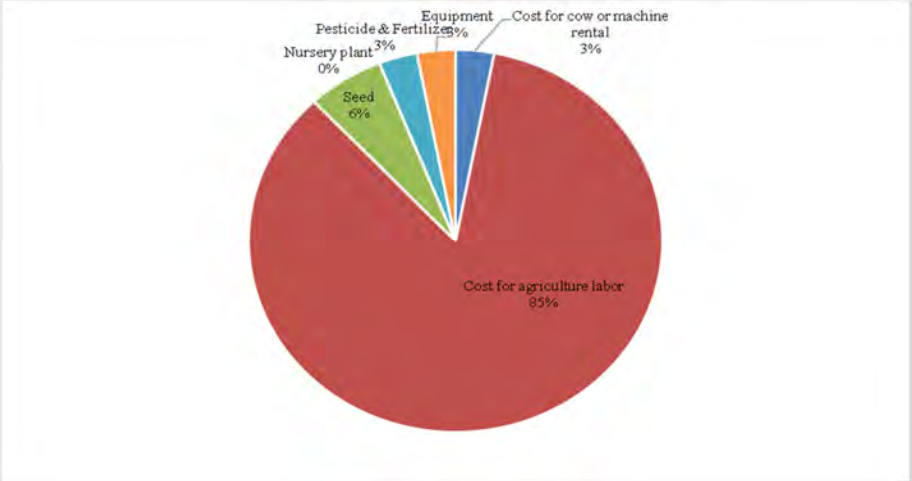


Source: Field survey, BESST Ltd, 2018

- **Expenses for farming other crops**

Though Kigali is an urban area, some households reported farming of subsistence and commercial crops s the main income source. In average, a households can spent about 1,138,389RWF for farming other crops in three season. Most of expenses are on labour with 85% of total costs. second are costs for cow or machine rental (3%), seed (6%), pesticide and fertilizer (3%) and equipments with (3%).

Figure 28: Yearly expenses for household for farming other crops.



Source: Field survey, BESST Ltd, 2018

- **Expenses for livestock keeping**

For livestock keeping in the project area, expenses are a little bit high because farmers who are relying on livestock are big farmers who secured farms in the project area. In average, total expenses is 3,870,375 rwf where animal feeding takes 76%. The rest of money spent on animal vaccination (6%) and other expenses like guards takes 18%. It worth to note that these expenses for agriculture and livestock are estimation because most of farmers do not do record their expenses on regular basis.

Table 18: Yearly expenses for household livestock keeping

Item which cause expenses/ need costs	Number of Household	Total Expenses/ per year (in Rwfs)	Average costs per year (in Rwfs)	Share in %
Animal feed	16	61,926,000	3,870,375	76%
Vaccination	16	5,150,000	1,287,500	6%
Others	16	14,652,265	610,511	18%
Total	16	81,728,265	5,108,017	100%

Source: Field survey, BESST Ltd 2018

- **Yearly expenses for trading and other small business**

Expenses for running shop and other small were reported by 22 households. In this category, households spent 44,957,500 and most of the money are spent on purchasing commodities with 95%. Other expenses are spent on labor and staff in business (3%), rental fees for working place (0.28%), electricity 0.20%.

Table 19: Yearly expenses for running shop and other small business

Item which cause expenses/ need costs	Number of Household	Total Expenses/ Costs per year (in Rwfs)	Average costs per year (in Rwfs)	Share in %
Purchasing commodity	22	989,065,000	44,957,500	95.65%
Cost for labor & staff	18	34,193,000	1,899,611	3.31%
Water	15	2,946,200	196,413	0.28%
Electricity	9	2,049,500	227,722	0.20%
Others	19	5,787,900	304,626	0.56%
Total	**22**	**1,034,041,600**	**47,001,891**	**100.00%**

Source: Field survey, BESST Ltd, 2018

4.1.6. Household domestic appliances or materials

Households were asked to list appliance or material their own. Materials and appliances are in many categories and they are used either for food preparation purposes, washing clothes or any other domestic activity and they constitute one of the measurement indicator for socio-economic

development. The next table provides detailed information on appliance owned by households in project area.

Table 20: Household properties/appliances or materials in the project area

Household Items	Number of household owning item	Total assessed household	Total number of Items
Fridge	28	48.3%	37
Cooking stove/equipment	34	58.6%	42
Micro oven	17	29.3%	17
Washing machine	6	10.3%	6
TV	45	77.6%	61
Radio	39	67.2%	54
Computer (desktop)	6	10.3%	8
Computer (notebook)	31	53.4%	66
Bicycle	11	19.0%	15
Motorbike	3	5.2%	4
Car	22	37.9%	38
Mobile Phone	46	79.3%	135
Smart Phone	46	79.3%	117
Landline Phone	2	3.4%	4
Electric fan	6	10.3%	16
Inverter	20	34.5%	28
Battery for inverter	4	6.9%	4
Solar panel	6	10.3%	6
Generator	5	8.6%	5
Tractor	1	1.7%	1
Agricultural machine	0	0.0%	0
water pump	7	12.1%	7
Others (iron)	16	27.6%	24
Total			

Source: Field survey, BESST Ltd, 2018

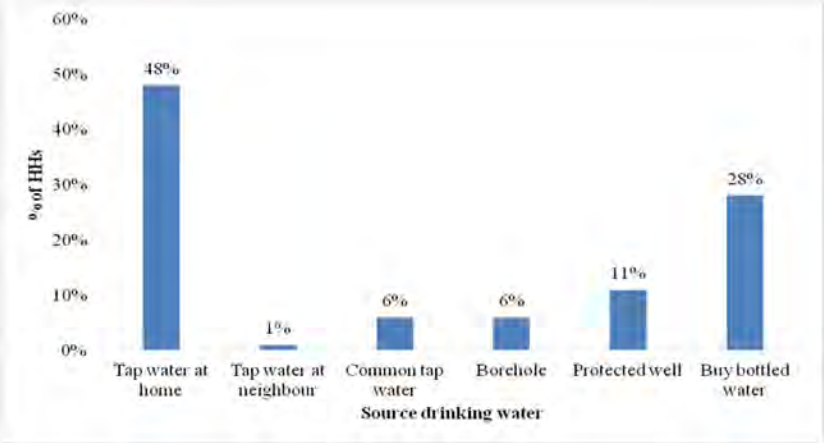
4.1.7. Household accessibility to water and electricity

Water and electricity are major component of household daily activities. This section provides information on how households access those services in project area.

- **Source of drinking water**

The survey results show that all households in the project target area have access to safe drinking water. The survey show that 48% have tap water at home, 28% buy bottled water, 11% use protected well, 6% common tap water, 6% also borehole and only 1% to tap water at neighbour.

Figure 29: Share of main source of drinking water for household in the project area

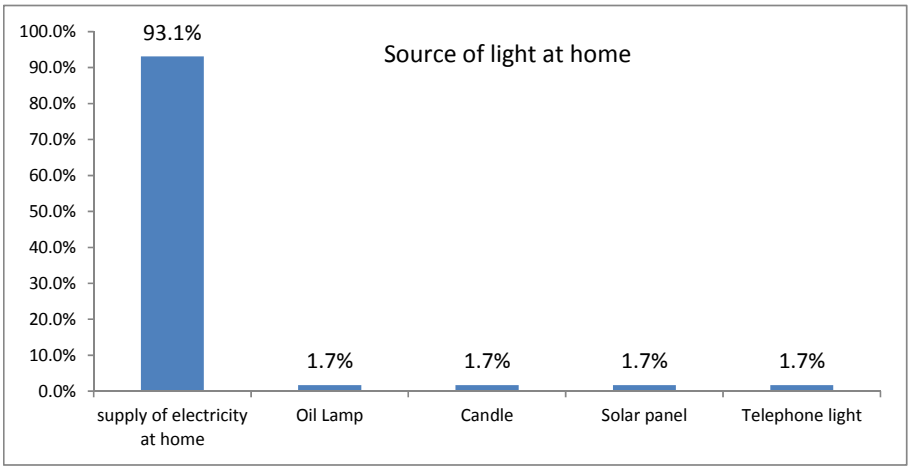


Source: Field survey, BESST Ltd, 2018

- **Source of energy for lighting**

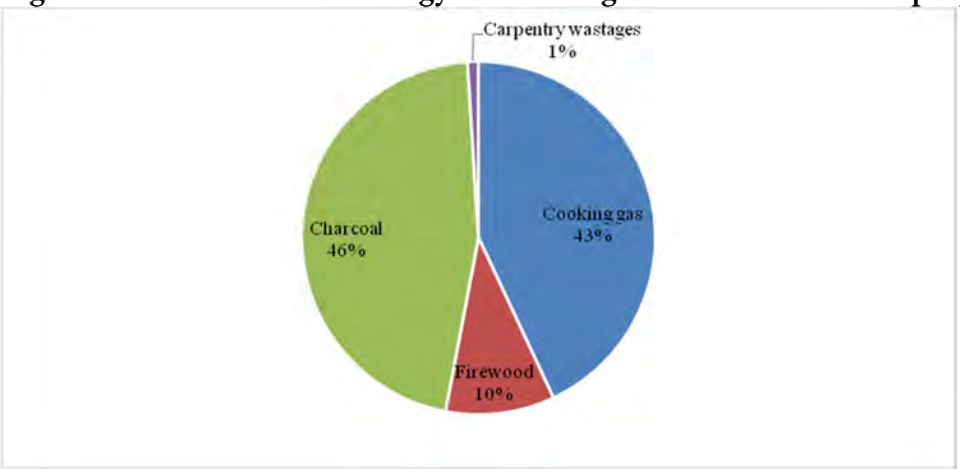
On 58 households interviewed, 93% are connected to the national grid and use electricity for lighting, 1.7% candle, 1.7% oil lamp, 1.7% solar panel and 1.7% telephone light.

Figure 30: Main source of household energy for lighting in the project area



Source: Field survey, BESST Ltd, 2018

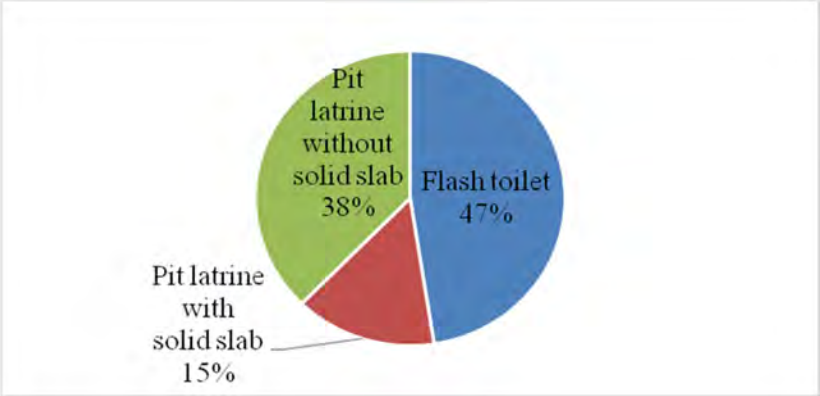
Figure 31: Main source of energy for cooking for household in the project area



Source: Field survey, BESST Ltd, 2018

- **Sanitation facilities in project area**

Figure 32: Main type of toilet used by households



Source: Field survey, BESST Ltd 2018

4.1.8. Access to health services and frequent diseases

Access to health facilities is an important indicator is socio-economic survey and is assessed by considering the time citizens use to get health services. This survey also assessed the frequent diseases in the project area. From 58 household assessed in the project area, the longest time to get health service is 60 minutes with 4% of households, 20% use 10 minutes from home to nearest health centre, 25% use 40 minutes, 18% takes 30 minutes. The average time of household (any) to nearest health centre is 25 minutes for all households owning plots in the area of the project.

Table 21: Time it takes from home to the nearest health facility.

Size	Number of Household	Percentage
<5minutes	3	5.2%
5-10	15	25.9%
10-20	10	17.2%
21-30	12	20.7%
31-40	15	25.9%
>40	3	5.2%
	58	100%

Source: Field survey, BESST Ltd 2018

Table 22: Frequent diseases that required medical treatment from last year (2017)

Disease affected household member in last year	Number of Respondents	Percentage
Malaria	27	34%
Diarrhea	4	5%
Stomach problems	10	13%
Respiratory problems	18	23%
Eye infection	15	19%
STIs/HIV/AIDs	2	3%
Blood Infection	1	1%
Diabetes	1	1%
Disability	2	3%
Skin diseases	2	3%
Child disease	1	1%
Sex disease	1	1%
Paralyse	1	1%
Hypertension	3	4%
Accident	1	1%
Typhoid	1	1%

Disease affected household member in last year	Number of Respondents	Percentage
Teeth disease	1	1%
Skin Allergy	1	1%
X-Ray services	1	1%
Humanization	1	1%
Muscles diseases	4	5%
Grippe	1	1%
Infection	3	4%
Homology in the head	1	1%
Snake	1	1%
Back	1	1%
Joints	1	1%
Polio	1	1%
Don't remember	3	4%

Source: Field survey, BESST Ltd, 2018

Table 23: Medical treatment

Households who attended Hospital for disease treatment in last year	49	86%
Households who did not go to the hospital for disease treatment in last year	8	14%
Total	**57**	**100%**

Source: Field survey, BESST Ltd, 2018

Above tables shows that 86% of interviewed households has at least one member who went to the hospital last year for medical treatment while 66% did not. The most common disease is Malaria (34%), respiratory problems (23%), Eye infection (19%), Stomach problems (13%), Diarrhea (5%), Muscles diseases (5%), Hypertension (4%), Infection (4%), Don't remember (4%), STIs/HIV/AIDs (3%), Disability (3%), Skin diseases (3%) and all other illness or diseases are fluent less than 1%.

- **Access to other socio-economic infrastructure**

In average, households use 19 minutes to access primary education facilities, 24 minutes to access high school, 21 minutes to access administrative office and 24 to access market/shop.

Table 24: Time used by Households members from home to selected infrastructures

Time range	Service							
	Access to Primary Education		Access to secondary education		Access to administrative office (cell)		Access to Food market or shop	
	Number of Household	%	Number of Household	%	Number of Household	%	Number of Household	%
<10	8	14.0%	16	28.1%	6	10.5%	13	22.8%
10-20	13	22.8%	7	12.3%	25	43.9%	7	12.3%
20-30	21	36.8%	8	14.0%	6	10.5%	8	14.0%
30-60	13	22.8%	19	33.3%	17	29.8%	23	40.4%
>60	2	3.5%	7	12.3%	3	5.3%	6	10.5%
Average		19.875		24.1875		21.625		24.3625

Source: Field survey, BESST Ltd, 2018

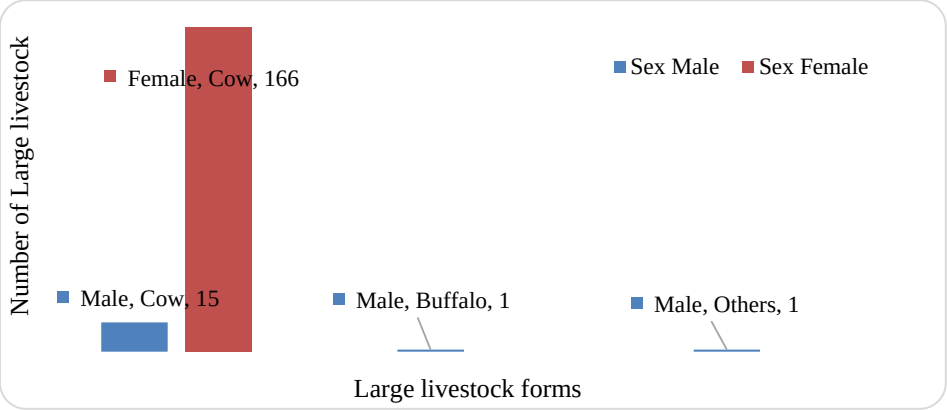
4.1.9. Livestock farming in the project area

Though the project target area is an urban area, people are still keeping livestock. In the project area, households are rearing both small and larger animals.

- **Large size livestock development in the project area**

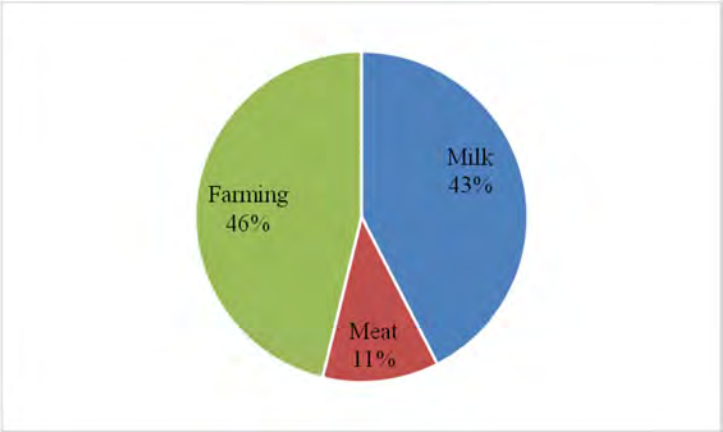
The main large livestock kept in the project area cows. Only one household reported buffalo. The purpose of cattle keep include selling, milk, meat, etc.

Figure 33: Number and sex of larger livestock in the project area



Source: Field survey, BESST Ltd, 2018

Figure 34: Purpose of rearing large animals in %



Source: Field survey, BESST Ltd 2018

- **Livestock keeping after expropriation.**

When asked whether households considers to keep large livestock after expropriation 61% are willing to continue since the proposed project will not affect the entire farms. 31% prefer to change the activity and start new business. the rest of households were not sure and they prefer to decide when they know the project impact on their farms.

- **Small livestock in the project area**

Small livestock rearing is also one of the income generating activities in Rwanda and its one of source income for some household.. In the project area only 13 households out of 58 have at least one small livestock and Chicken are the most visible in the project area with 2,046 chicken reported. Pigs, duck, rabbit and goat are also present in the project area. The following table summarizes small livestock identified in the project area and the use of them.

Table 25: Small livestock characteristics in the household living in the project area

Small Livestock	Total number	Selling		Domestic use		Both: Selling and Domestic use		others	
		Number	%	Number	%	Number	%	Number	%
Pig	16	16	100	-	-	-	-	-	-

Chicken	2,046	2,002	97.8	17	0.8	27	1.3%	-	-
Duck	11	-	-	-	-	-	-	11	100
Goat	46	-	-	20	43.5	21	45.7%	5	10.9
Rabbit	13	-	-	8	61.5	5	38.5%	-	-
Total	**2,132**	**2018**	**94.7%**	**45**	**2.1**	**53**	**2.5%**	**16**	**0.8**

Source: Field survey, BESST Ltd 2018

4.1.10. Socio-economic status of corporation in project area

- **Type of Corporate**

In Rwanda major types of corporate include Government institutions, Non- Governmental Organisation(NGOs), commercial companies and Community based organization(CBOs). in the project area 8 corporations were identified but only six provided information. Among the six corporation identified, 3 are commercial limited companies, 2 non profit organization and 1 local public institution.

Table 26: Type of Corporation

Type of Corporation	Number	Percentage
Limited Liability Company	3	50.0
Non-Profit Corporation	2	33.3
Local public body	1	16.7
Total	6	100

Source: Field survey, BESST Ltd 2018

- **Type corporation business**

The following table presents the type of organization identified in the projects area including churches, schools and commercial enterprises.

Table 27: Category of business for plots owned by the corporate

Business category	Number	Percentage
Education	1	16.7
Lodging, catering, restaurant	2	33.3
Other service	1	16.7
Professional service	1	16.7
Church	1	16.7
Total	6	100

Source: Field survey, BESST Ltd 2018

- **General information of corporation.**

Though two corporate did not disclose the information on their financial and administrate situation, the surveying team managed to get some information on corporation in the study area and these information are presented in the following table.

Table 28: Description of corporate business in the project area

Type	Starting year	Starting capital in Rwfs	Number of employees		Number of board members	Number of employees	Number of factories	Sales in 2017	Last year profits (in Rwfs)
School	2015	326,567,235	Full Time	Part Time	6	2	1	85,077,000	
			24	0					
Bar, Resto, Apartment	2012	6,000,000	5	2	2			18,000,000	
	2016	7,000,000,000	70	0	7			400,000,000	
Church	1995	5,000,000	2	3	53				
Zamura Cooperative	2000	10,000,000	2	5	5	1		Secrete	

Type	Startin g year	Starting capital in Rwfs	Number of employees		Number of board members	Number of employees	Number of factories	Sales in 2017	Last year profits (in Rwfs)
Kobil	2013	20,000,000		11	2	1		700,000,000	5,000,000
Average		1,227,927,873	21	4	13	1	1	300,769,250	5,000,000

Source: Field survey, BESST Ltd 2018

- **Ownership of the land used by corporate**

The following table provide information on land ownership , access to service like water and electricity and sanitation infrastructures.

Table 29: General information on land ownership, access to social infrastructure.

Type of corporate	Kobil Petrol station	Bar, Resto, Apartment		School	Church	Zamura Cooperative
Years/months in Using Plot House	Not Specified (16.6%)	5 Years and 7 Months(16.6 %)	1 Year and 6 Months(16.6%)	3Years and 1 Month (16.6%)	23 Years (16.6%)	18 Years (16.6%)
Land Ownership	Tenant/Rent (33.3%)		ADEPR(16.6%)	50%		
Building Structure	Tenant/Rent (33.3%)		Own (66.66%)			
Source of Drinking Water	Tap water at home (100%)					
Source of home energy for lighting	Supply of electricity at home (100%)					
Toilet Type used by the corporate	Flash toilet (66.6%)			Pit latrine with solid slab (16.6%)		Pit latrine without solid slab (16.6%)

Source: Field survey, BESST Ltd 2018

4.1.11. Assets inventory

The project of strengthening of Nzove-Ntora Principal requires the clearance and excavation work where the pipeline will be installed. For this reason, the field survey included inventory of assets that are likely to be affected. Among other assets to be affected, include structures such as fences, wall and concrete floor, perennial crops and trees. The assets inventory considered maximum 9.8 m width where access road is required, 2 to 3.9 m where access road exist width which will be required during construction. After construction all this land will not be required but it should be used under certain conditions.

Table 30: Number of Plots identified in the construction area by its use

DISTRICT	SECTOR	CELL	Number of HHs	Number of plots affected		Size of affected land (m2)
Gasabo	Gatsata	Nyamabuye	6	Cultivate land	7	1,841
				Business/commercial	2	1,323
		Nyamugari	8	Cultivate land	22	6,174
	Gisozi	Ruhango	45	Cultivate land	26	7,585
				Housing plot	20	373
				Business/commercial	6	144
Nyarugenge	Kanyinya	Nyamweru	7	Cultivate land	6	1,621
				Housing plot	3	116
				Business/commercial	1	378
		Nzove	9	Cultivate land	14	6,397
				Housing plot	0	0
	Kigali	Nyabugogo	18	Cultivate land	28	10,936

				Housing plot	5	2,889
				Business/commercial	5	437
	Kimisagara	Kimisagara	*0	Cultivate land	1	280
Grand Total			**93**		**145**	40,493

*: User of the land is counted at Nyamweru Cell, because they do business there

Source: Field survey, BESST Ltd, 2018

In conclusion, the socio-economic survey provided sufficient information on socio-economic status of households living, using or owning land in the projects area. though all households and corporate did not provide information or all information per as the questionnaire**,** the information collected can be the basis to which the project can use as baseline data for monitoring.

4.2. Physical environment baseline data

The physical environment assessed in the present environment and social impact assessment study include geological formation and soil, hydrology and water resources, climate and weather conditions and land use set up in project area.

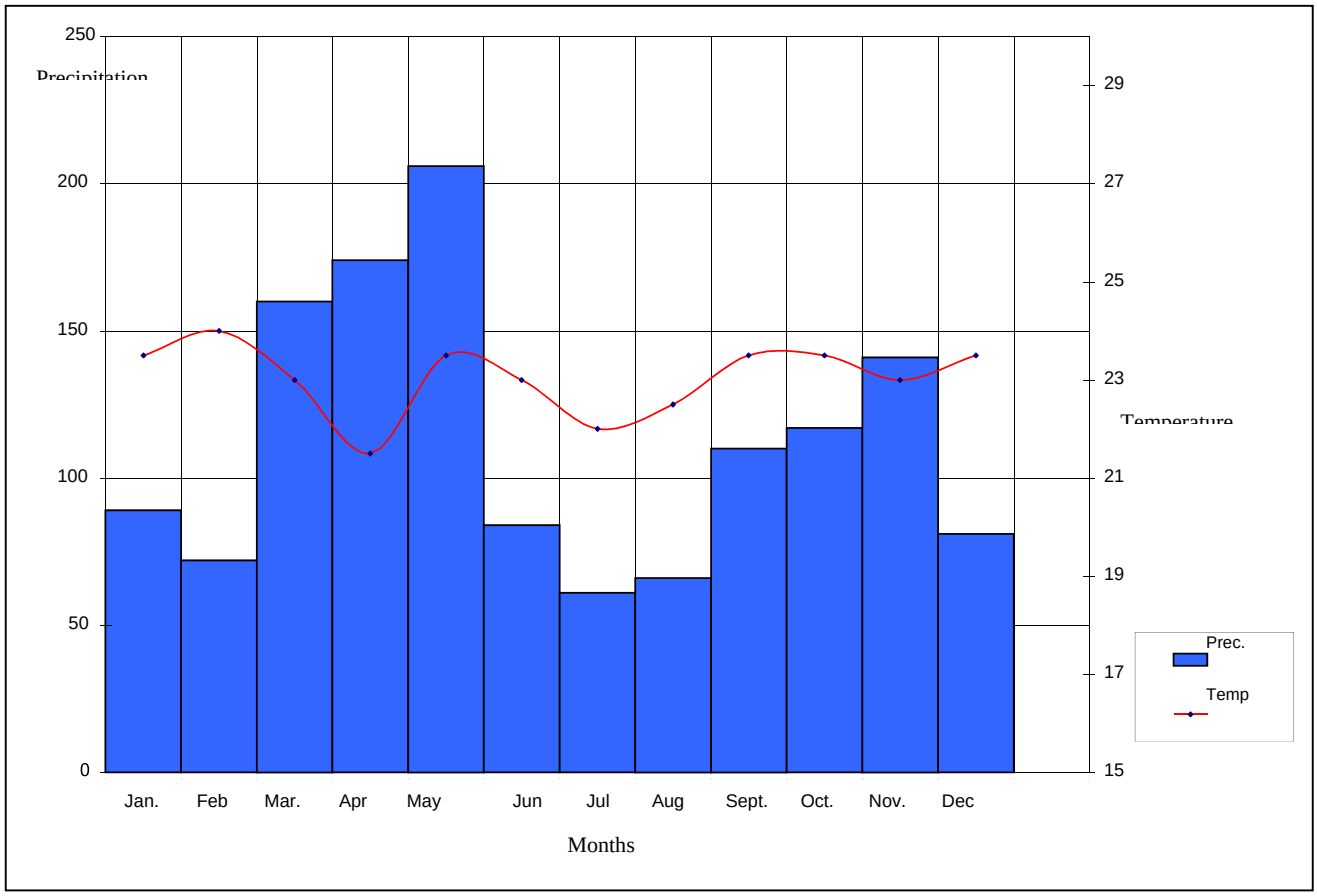
4.2.1. Soil and geological formation of project area

The project site is extended on two districts Nyarugenge and Gasabo and start at Nzove in Nyabarongo wetland and goes to Ntora in Gisozi sector, in Gasabo through Nyabugogo wetland. the pipeline in big part follow the existing Pipeline. Data on soil and geological formation was obtained from secondary data available in Rwanda Mines, Petroleum and Gas Board(RMPGB). The topography of the site is characterized by the lowest elevation point to be located at 1,377 m above sea level, and the highest point is located at 1,625 m above sea level at Ntora water reservoir. The area encounters general characteristics of Nyarugenge and Gasabo districts including areas of gentle slopes (less than 20% gradient) and alluvial plains on the ridges and along the rivers Nyabarongo and Nyabugogo, areas with steep slopes (more than 20% gradient), and linear ridges.

4.2.2. Climate

With reference to records of mean monthly temperatures and rainfall of the Kigali meteorological station, Nzove- Ntora Principal pipeline will be constructed in the zone which is characterized by a humid tropical climate. The seasons are marked by an alternate succession of rains and drought. According to three levels of drought (atmospheric dryness, pedological dryness and geological/hydrological dryness) as developed by Roger Lambert, the ICT site experiences four months of long dry season (mid-May to mid-September) followed by a short rainy season (Mid-September, October, November and mid-December), another short dry season (mid-December, January and mid- February) and finally a long rainy season (Mid-February, March, April and mid-May).Due to the current challenge of global climate change, the four seasons are sometimes irregular, and one cannot precisely fix the temporal limits of each season. The rainy season may extend for some weeks into the dry season and vice versa. In general, the mean temperature varies between 21.5°C and 24°C, while the precipitations range from 65 mm to 200 mm.

Figure 35: Monthly mean temperature and rainfall diagram of Kigali City

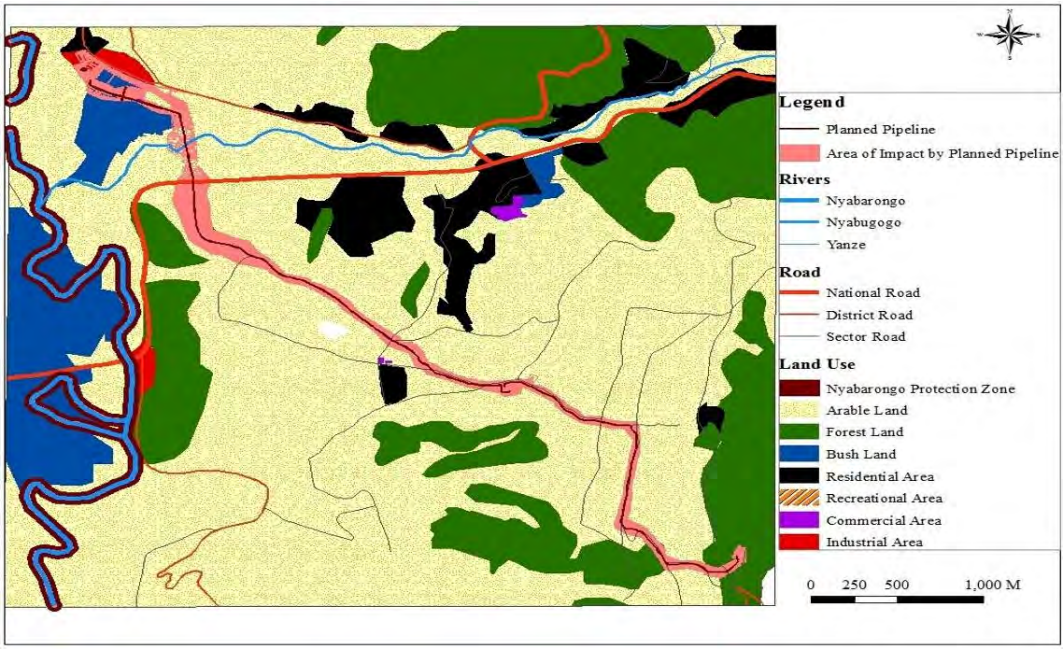


Source: Rwanda Meteorological Service, 2017

4.2.3. Land use

The land use map was generated through integrating the field data collected by surveying the area of the project development, and ortho-photos from Rwanda Land Use and Management Authority. The land use classes were produced through digitization process, and combination with the existing land use data for Kigali city. The identified land use classes include: the zone of Nyabarongo river protection, arable land, forest land, bush land, residential area, recreational area, commercial area, and industrial zone. The distribution and location of the identified land use classes around the project development is presented by the map in the following figure.

Figure 36: Land use classes identified around the project development area



The most dominant crop is sugarcane in Nyabarongo wetland, followed by forest land which dominates uphill area at Karama and Mount Kigali.

4.2.4. Soil study

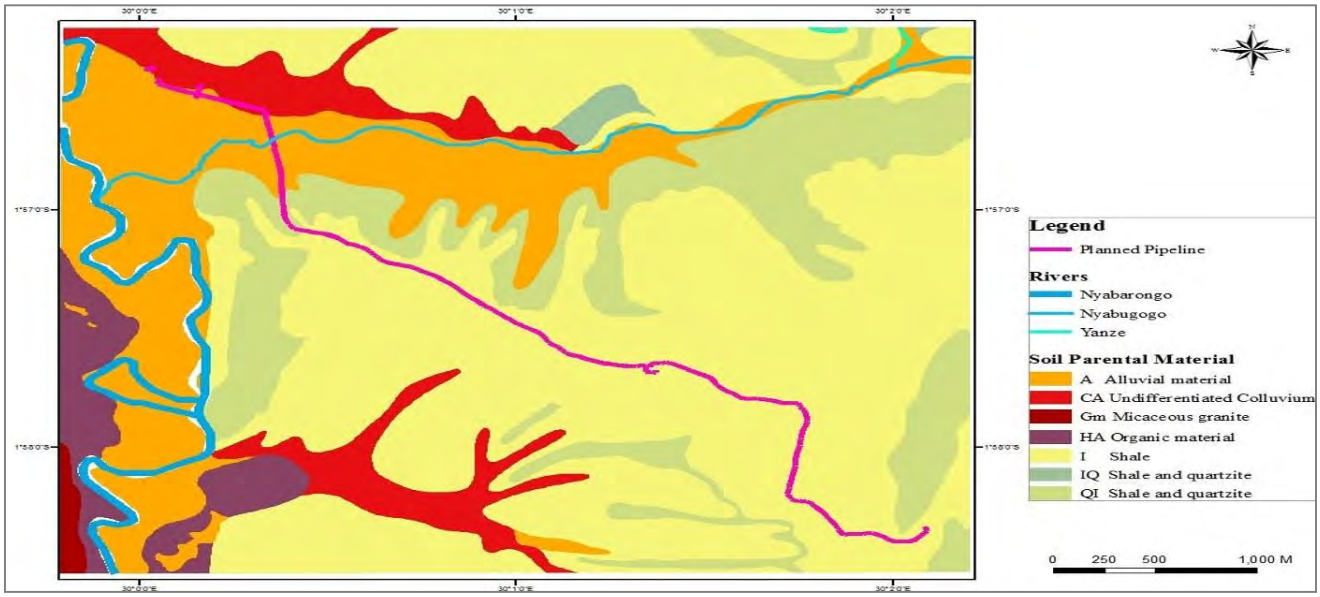
The soils found on the pipeline crossings and vicinity of new Nzove- Ntora principal are Dystric Humic and Ferralic Cambisols, Umbric Glycols, Dystric Regosols, Dystric Leptosols, Ferric Lixisols, and Humic Sombric Acrisols (WRB, 2006). Colluvium found at the bottom of hills near the valley indicate soil erosion taking place in the northern side of Nyabarongo and Nyabugogo rivers. Leptosols with a shallow entic horizon on shale point to high erosion happening on steep slopes at the southern part of Nyabugogo River. Soil reference groups to be affected by the project were described by characterizing six soil profiles along the conceptual pipeline from Nzove to Ntora crossing Nyabugogo wetland. Soil classification done in this study according to the World Reference Base for Soil Resources (WRB, 2006) by definition of diagnostic horizons and properties was quite similar to the predicted soil types from the digital soil database for Rwanda. Depths were measured using a tap meter while geographic coordinates were taken using a Garmin GPS device.

The land capability classification system used for capacity classes to be disturbed by the project is mainly based on data generated during the reconnaissance soil survey. Land, in this context, is defined by the landscape and physical and chemical soil properties (soils described on the field and the ones predicted by soil map units at scale 1:250,000). This classification system determines the capability of the land for crop production, pastures, forestry and conservation or recreation (Verdoot and Van Ranst, 2003). Capability classes 1 to 4 have been designed to classify the arable land according to its potential for the cultivation of different upland crops and according to the management techniques that are required to ensure sustainable production. The slope gradient of these units should be less than 25 %. Capability class 5 is given to soils in valleys with impeded drainage while class 6 designates land not to be used as arable due to shallow soils and very steep slopes but can be used for forests and pasture. With increasing capability class, the number of crops

that can be cultivated decreases, and the level of management increases from ordinary techniques to very careful management strategies (Verdoot and Van Ranst, 2003).

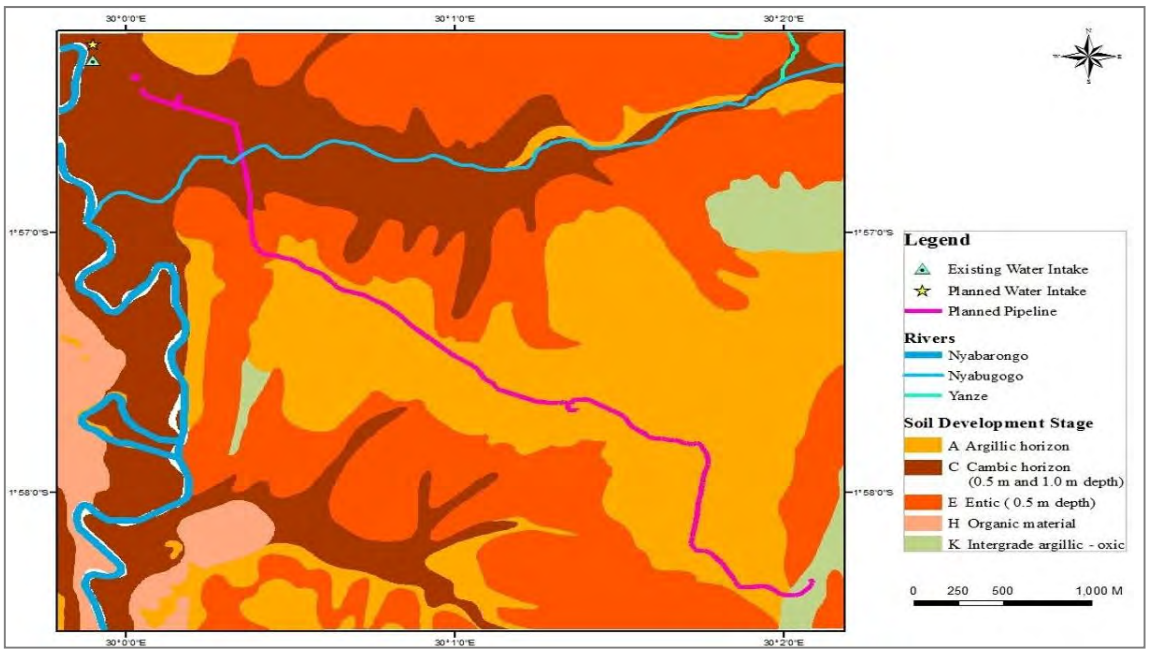
Soil erosion depends not only on rainfall erosivity but also on the soil's resistance to erosion, which is usually measured as the soil erodibility factor K. The erodibility of a soil is an expression of the inherent resistance offered by soil to both particle detachment and transport processes. The K factor was estimated in the Universal Soil Loss Equation (USLE) using the Wishmeier et al. (1969) method that takes into account silt content, very fine sand content, clay content and organic matter content, as well as the structure of the surface layer and the permeability of the profile. This equation was used here to generate the erodibility classes of soils to be disturbed by the project. The soil structure was described by five classes: crumbly, sub-polyhedral, polyhedral, coherent and single corn. The humus content was estimated from the darkness of the color of a horizon. The darker the color the more organic substance contains a soil (Reetsch, 2008) if the color is not coming from gleyification processes.

Figure 37: Soil parent material in the project development area



The following map highlights the types of soils established in the study area with six profile points used to study the major soil groups that will be affected by the project

Figure 38: Soil development stages in the project development area



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The table below outlines the soil groups, their capability and erodibility classes is presented below. The occurrence of wetland soils is also underlined. The current land uses and the ones applicable to the soils established in the study area are discussed below Table.

Table 31:Ccharacteristics of soils to be disturbed at project area

Position in the landscape	Soil types to be disturbed, their fertility and depth	Land Capability classes	Soil erodibility classes	Presence of wetland soils
Valley	Umbric Gleysols: Fertile, deep soil (>1.5 m)	-Class 5	Low	Yes
Bottom slope	Dystric Regosols (moderately deep: <1 m)/ Dystric Leptosols (shallow: <0.5 m): Low fertility	-Class 4	-Moderate to High	No
	Dystric (Humic) Cambisols, Fertile, Moderately deep soil (<1m)	-Class 2	-Moderate	No
Middle slope	Ferric Lixisols: low fertility, Shallow soil (< 1 m)	-Class 3	-Moderate to High	No
Hill plateau	Humic Acrisols (Sombric), medium fertility, relatively shallow (<1m)	-Class 3	- Moderate	No
Uphill	Ferralic Cambisols: Very low fertility, Shallow soil (< 1m)	-Class 6	- High	No

- **Umbric Gleysols**

These are wetland soils that, unless drained, are saturated with groundwater for long enough periods to develop a characteristic gleyic color pattern. This pattern is essentially made up of reddish, brownish or yellowish colours at ped surfaces and/or in the upper soil layer or layers, in combination with greyish colours inside the peds and/or deeper in the soil. These soils had a thick, dark-colored, base-depleted surface horizon rich in organic matter and therefore called umbric. Nyabarongo and Nyabugogo rivers cross the valley with gleysols and deposit sandy materials on their river banks. This valley with Gleysols that will be affected by the project is used for vegetables and sweet potatoes farming during the dry season (season C). Shallow water are used for irrigation while in parcels with stagnating water, seasonal drains are made by farmers to lower the

groundwater table. However, farmers are challenged by frequent flooding during rainy seasons. Small wet patches still sustains wetland vegetation such as papyrus.

- **Dystric (Humic) Cambisols**

This young soils developing on colluvium brought by erosion on hillside are established near the valley where Nzove Water Treatment Plant is built. Despite the shallow cambic horizon with less base saturation of these soils, they present higher agricultural potential than their associated Regosols and mostly due to the accumulation of nutrients from hillsides. Cambisols that will be affected by the project are used for construction near the existing Nzove plant and for upland agriculture along the valley.

- **Dystric Leptosols**

These are very shallow soils over continuous shale rock with a very shallow entic horizon (< 0.5 m). They are zonal soils particularly common in Rwandan mountainous regions. The shallowness of these soils shows high erosion that has kept pace with soil formation, or has removed the top of the soil profile.

These soils were found on foothills in the southern part of Nyabugogo River. They were developed on shale with few cross cutting quartzite mineralization where communities living around attempt to mine stones for construction. These soils have poor agricultural potential mainly due to its shallowness, low chemical fertility and steep slope and were hence kept under eucalyptus woodlots.

- **Dystric Regosols**

These are very weakly developed mineral soils in unconsolidated materials that do not have a mollic or umbric horizon. They are not very shallow or very rich in gravels. The parent material is the unconsolidated, finely grained material. The dystric characteristic indicates a base saturation of less than 50% in the major part of the soil surface. The low soil moisture holding capacity and the compactness of its subsoil reduce the agricultural potential of these soils to be affected by the project

- **Ferric Lixisols**

These soils have a higher clay content in the subsoil than in the topsoil as a result of pedogenetic processes (especially clay migration) leading to an argic subsoil horizon. These soils are developed on shale in the investigated site. They have a high base saturation and low-activity clays at certain depths and have a ferric horizon starting within 100 cm of the soil surface.The Ferric Lixisols that will be affected by the project are used for residential and for upland agriculture that suits a wide range of crops. However, the low absolute level of plant nutrients and low cation retention makes recurrent inputs of fertilizers and lime a precondition for continuous cultivation. Since these soils are also prone to erosion, measures to protect soils should be applied and perennial crops preferred to annual crops.

- **Humic Acrisols (Sombric)**

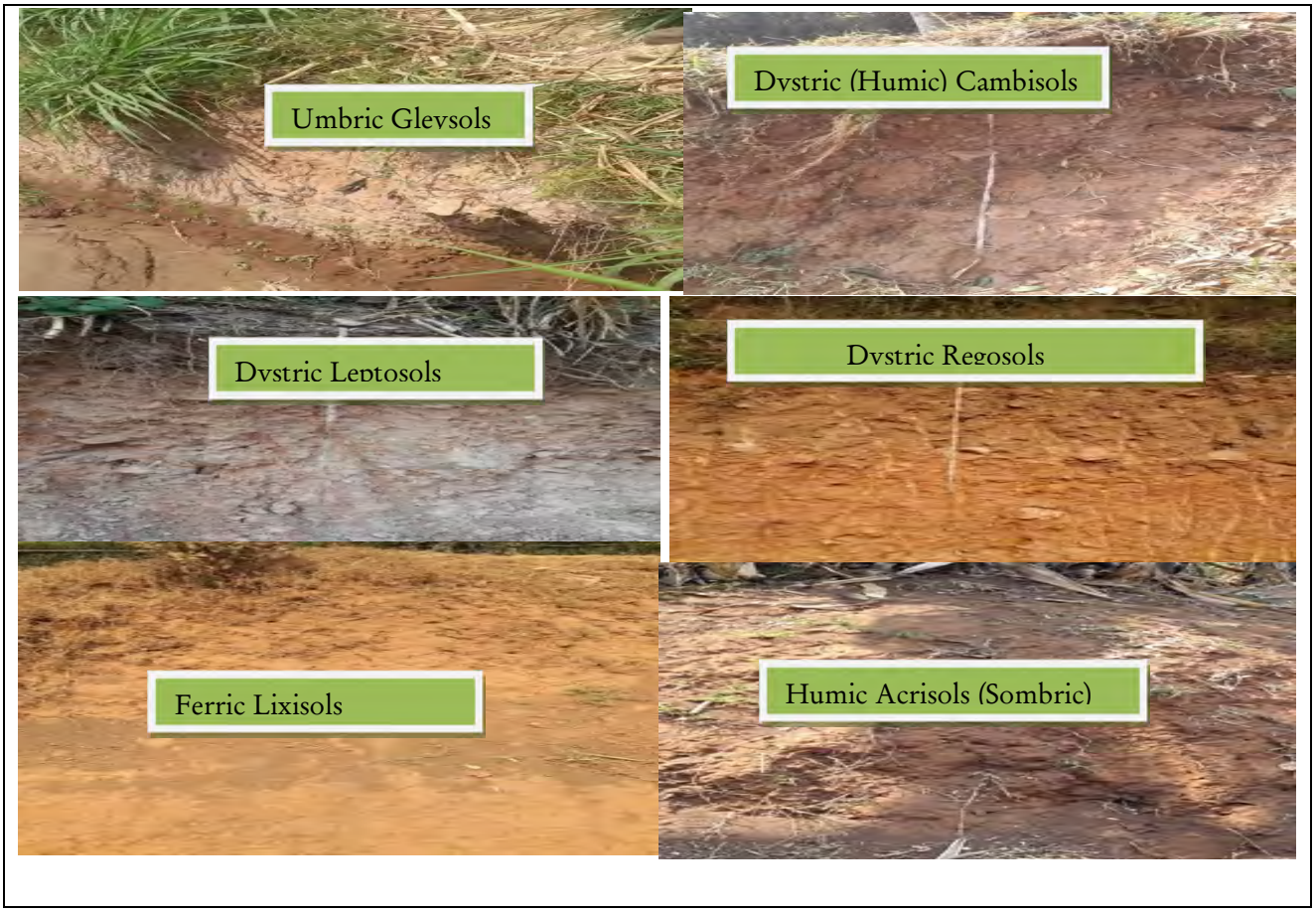
These soils have a low base saturation at certain depths and high-activity clays throughout the argic horizon. They lack the albeluvic tonguing as in Albeluvisols and have an advanced degree of weathering. They are developed on shale and occur predominantly on hilly topography in the study area. The generally unstable surface of these soils makes them susceptible to erosion.

Preservation of the surface soil with its all-important organic matter and preventing erosion are preconditions for farming on these Acrisols. The current land use involves perennials such as bananas and cassava which favor the preservation of the surface soil. Annual crops farmed are sorghum, beans and maize.

- **Ferralic Cambisols**

These soils have an incipient subsurface soil formation. Transformation of parent material is evident from structure formation and mostly brownish discoloration and increasing clay percentage. These cambisols are characterized by slight weathering of parent material and by absence of appreciable quantities of illuviated clay, organic matter, Al and/or Fe compounds. They have a ferralic horizon starting within 30 cm of the soil surface. Erosion on the steep slope of Mount Kigali where these soils were found explains the occurrence of Ferralic Cambisols. These soils are used for eucalyptus forest and presents very low agricultural potential. This is mainly due to its shallowness, steep slope and shallow oxic hardpan that impedes root penetration. In addition, these soils are excessively drained. It worsens their low water holding capacity and confer to this type of soil a poor physical and chemical soil fertility status.

Figure 39: Soil in the project area



Conclusion

Soils identified in the zone of the water pipeline crossings and the vicinity of the proposed principal pipeline are Dystric Humic and Ferralic Cambisols, Umbric Gleysols, Dystric Regosols, Dystric Leptosols, Ferric Lixisols, and Humic Sombric Acrisols. Most of these soils present good agricultural potential under different management practices. The Umbric Gleysols and Humic Cambisols present the highest agricultural potential if well managed. The soils discussed in this report would not cause unusual inconveniences to the establishment of the pipeline but due to the

frequent flooding of the valley and the sediments coming from the hillsides, care should be taken to prevent damages on pipes and other project infrastructures.

Nevertheless, the project will disturb soils with high agricultural potential. Since, access roads will be constructed adjacent the pipeline for construction of piers and delivery and lifting of lattice structures onto the piers, appropriate soils handling and rehabilitation both along the pipeline where feasible should be implemented. Prior to construction, topsoil and wetland soils should be stripped and stockpiled for restoration after construction once the rock fill and gravel is removed and the surface rehabilitated.

4.2.5. Air pollution level in project area

The proposed project of Nzove Ntora principal pipeline is located in Kigali City where the air is slightly polluted. The main sources of air pollution which are man-made relate to transportation, industry, combustion fuels, industrial processes and use of pesticides. More specifically the pollutants include suspended matter, sulfur dioxide, nitrogen dioxide, hydrocarbons and ozone due to population growth, urbanization, industrialization and increased use of motor vehicles. Rwanda has one of the lowest emissions per capita in the world, estimated at 0.65 tones CO2/person (including land use change), compared to a global average of 4.63 tones CO2/person. According to the second National Communication (SNC) to the UNFCCC, the majority of GHG emissions were CO2 (87%) at 531 Gg, dominated by transport (52%) and industrial processes (28.5%).

The air quality of the project area shows that sulphur dioxide, Nitrogen Oxides, Carbon Monoxides and Hydrocarbons may be below detectable limits. The suspended particulate matter (SPM) is in the range of 120- 140$\mu g/m^3$. The air quality of the project area is within permissible limit. The following table shows the average of different data on gases CO, SO2, NO2... that have been collected on the station IO104-1-204 near the project within Kigali City during the period September 2015(REMA 2015). The data were collected on the interval of 30 min one after another.

Table 32: Average of different data on gases

No.	Pollutant	Measurement results	Test Methods
1.	Sulphur oxides (SOx);	60μg/m3	**ISO 4221-1980**
2.	Oxides of Nitrogen (NOx)	60ug/m3	**ISO 4221-1980**
3	Suspended particulate matter(SPM)	140μg/m3	ISO 9835:1993
4	Respirable particulate matter(< 10um)(RPM)	50μg/m3	ISO 9835;1993
5	Carbon monoxide(CO)/carbon dioxide(CO_2)	2.0mg/m3	ISO 4224:2000

Source: Rwanda meteorological services, 2015.

4.2.6. Noise and vibration level in the project area

Noise and vibration is expected to be generated during construction by the operation of heavy machines, heavy trucks, right of way preparation, soil stripping, trenching, pipe stringing, welding and laying and backfilling activities. Noise and vibration impacts are of temporary nature. Baseline noise levels of the proposed project area were determined during field survey, using Digital noise level meter MS6708 which has an active range of 30-130 decibels (dB).

- **Noise characteristics**

Noise may increase to the disagreeable levels in the environment that it can threaten quality of life. Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation,

and sleep. To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds) decibels are measured on a logarithmic scale representing points on a sharply rising curve. For example, 10 decibels (dB) is 10 times more intense than 1 dB, 20 dB is 100 times more intense than 1 dB, and 30 dB is 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

- **Fundamentals of vibration**

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 vibration velocity decibels (VdB) or less. This is an order of magnitude below the damage threshold for normal buildings. Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads.

- **Noise and vibration standards in Rwanda**

In Rwanda Noise pollution is determined when sound goes beyond 80 decibels but Rwanda has adopted the East Africa Community (EAC) standards that sets the maximum permissible noise levels for residential areas at 60 dB (A).

Table 33: Noise Exposure Limits for EAC countries

No	Area	Time During Day (hours)	Limits, dB(a)
1.	Industrial Noise	07:00-21:00 21:00-07:00	60.0 55.0
2.	Neighbourhood Noise	07:00-18:00 18:00-21:00 21:00-07:00	60.0 55.0 50.0

Noise levels were recorded at two different points in nursery school named Trinity School and another point at Gatsata near the bridge under construction. Full noise level were recorded and the

maximum, minimum and the average are presented in the following table. Noise and vibration were recorded at these two point for a period of one day and the maximum, minimum and average measurement are presented in the following table. It worth to note that Noise and vibration at these two point are influenced by traffic.

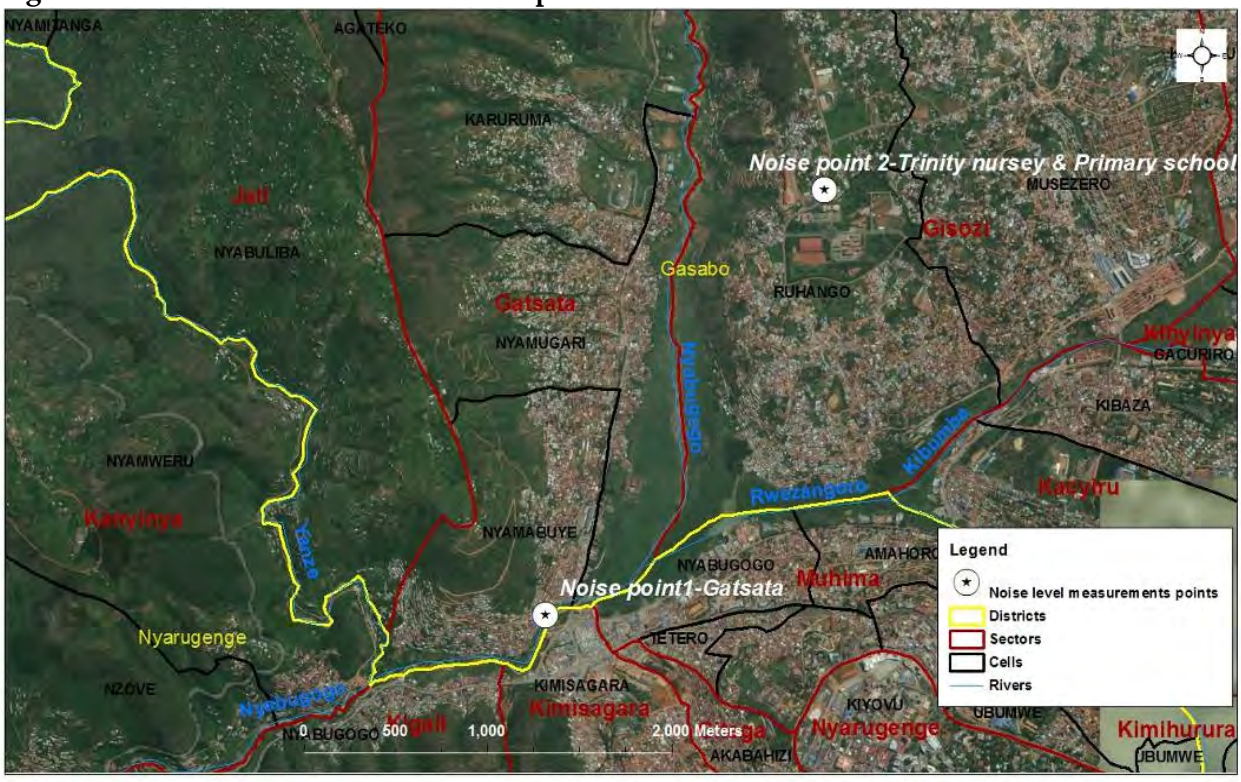
Table 34: Average noise levels determined in the project area

Full name of the feature/area	Maximum dB(A)	Minimum dB(A)	Average dB(A)	Maximum vibration (VdB)	Minimum vibration (VdB)	Average(VdB)
Trinity Nursery	66.4	48.6	55.4	3.5	0.4	2.3
Gatsata near Nyamabuye cell	64.7	42.5	51.6	2.3	0.2	1.8

Source: Field measurement

The proposed project components fall within areas with some settlements and none of them fall within a commercial area. The baseline noise levels within the proposed project area were therefore assessed based on the maximum permissible noise levels for residential areas which are set at 60 dB (A). Based on the results presented in Table 31, the maximum noise levels recorded in the project area is slightly above the permissible limits for residential and industrial areas as provided by EAC. Since the main source of noise and vibration is vehicles, truck and machines the noise level is expected to increase during construction phase with vehicles and truck that will transport the material and other equipment and machines to be used for excavation and refilling the level will may not exceed much the permissible level. the project developer will ensure that it remain in permissible limits. However construction activities should not continue during night for not disturbing people who are spending night in project area.

Figure 40: Noise level measurement points



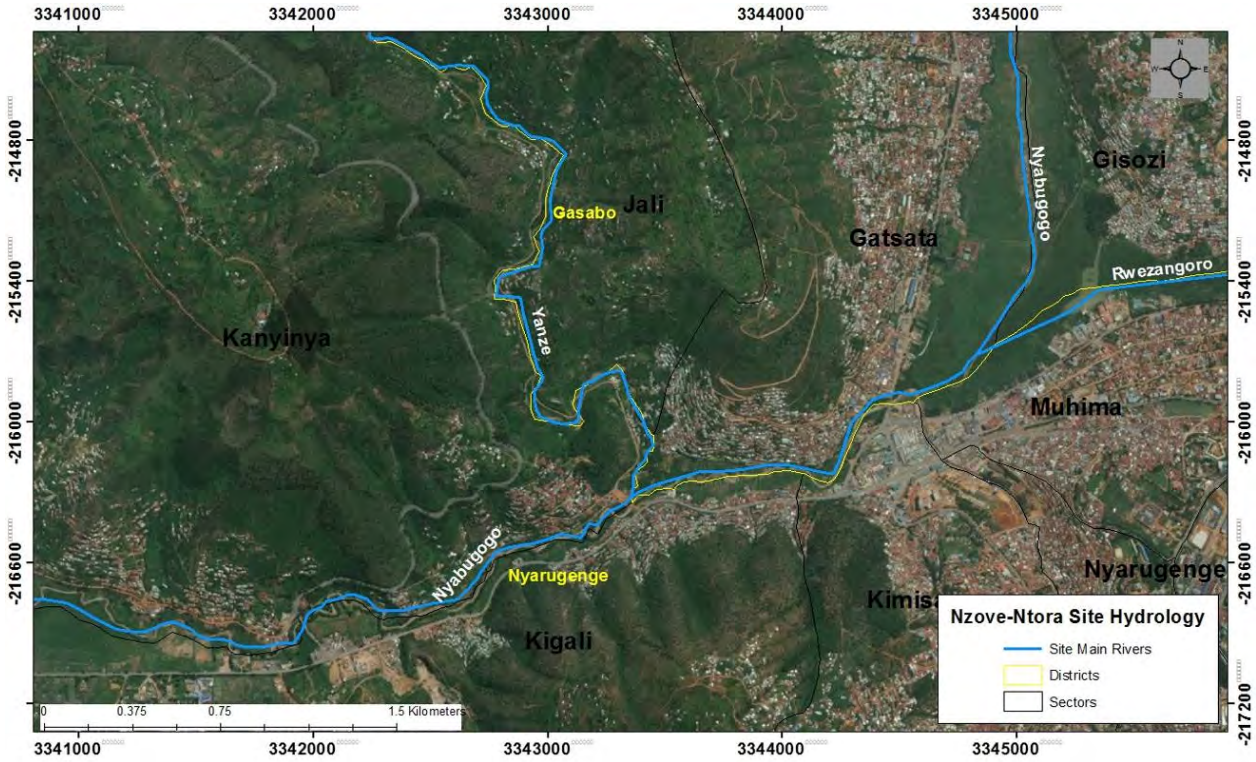
Source: BESST Ltd, 2018

4.2.7. Hydrology

Field survey and second data from Rwanda Water and Forestry Authority(RWFA) were used to obtain hydrological data in the project area. The hydrology of the study area and its vicinity is mostly made up of streams and rivers that are part of the Akagera river basin. There are many watercourses of low importance, but the main one is Nyabugogo River. Effluents of Nyabarongo River are primarily fed during rainy seasons and each year the maximum risings occur in April. Nyabugogo wetland is located in Kigali city between 1,354 m to 2,278 m above sea level and between 1°94'S and 30°04'E.

The wetland drains a total area of 1,647 km^{2}and cuts across two districts Nyarugenge and Gasabo with an estimated population of 825,767 inhabitants in 2012.The wetland is part of the Nyabugogo catchment which cuts across Eastern Province (Kayonza, Rwamagana, and Gatsibo districts), and Northern Province Gicumbi and Rulindo and other districts of Kigali city such as Kicukiro, Nyarugenge, and Gasabo district. The upstream part of Nyabugogo is regulated by lac Muhazi. Nyabugogo is crossed by one River, Nyabugogo River, which receives other inflows Rivers like the Mwange River, Rusine River and Marenge River on its upstream and later on the Nyabugogo River is joined by others inflows that cross the Kigali city urban area, those are Rwanzekuma River, the Ruganwa River, the Mpazi River and Yanze River.

Figure 41:Hydrographic map of project area



Source: BESST Ltd, 2018

4.2.8. Water quality in the project area.

Water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water related to its uses. Water can be characterized as good according to the purpose of its use, the quality may be good enough for drinking but not suitable for use in any given industry. It may be good for irrigating some crops but not well for irrigating some other crops. It may be suitable for livestock but not for good fish culture. One good way to show the quality of the water could be to list out the concentrations of everything contained in water, but according to its solvability properties water can contains a lot thing from a dissolved substance to a physical object, making the expression the water quality very difficult to explain. Water in Nyabugogo River is generally known to be of poor quality, mainly due to sediments from agriculture, mines upstream and pollution from drainage of rainwater and sewerage from Kigali settlements.

- **Sampling and water analysis**

Three sample were taken on Nyabogo river with one reference monitoring area and other two point one upstream and another downstream.

Figure 42: Water Sampling

Source: Photo taken on field

Laboratory results are presented in the following table The results obtained are also presented in the table below and their discussion are provided in the below paragraphs.

Table 35: Water quality results

	Unit	Downstream	Main point	Upstream	Mean value	National permissible limit[1]	Reference national Standards
Temperature	ºC	20.5	20.2	20.4	20.3	< 3	RS 109 (discharged industrial wastewater)
pH	-	6.63	6.86	6.84	6.7	6.5-85	RS546 (Drinking water
Turbidity	NTU	723	702	688	704	5	RS546 (Drinking water
TSS	**(mg/l)**	282	280	276	279	50	RS 109 (discharged industrial wastewater)

Source: UR/College of Applied Science and Technology, Feb 2018

- **Temperature**

[1] Rwanda does not have specific standards for surface water or ground water. Water assessment results were compared either with drink water (RS 546) or industrial wastewater discharge(RS 109).

The temperature of surface water is influenced by latitude, altitude, seasons, and time of the day, air circulation, cloud cover as well as depth of the water body. In return, temperature affects physical, chemical and biological processes in water bodies and therefore the concentration of many variables. As water temperature increases, the rate of chemical reactions generally increases together with the evaporation and volatilization of substances from the water. Increased temperature also decreases the solubility of gases in water, such as O_2, CO_2, N_2, CH_4 and others.

According to the results obtained during the survey, the temperature for all sites are normal when compared to the standard value which is 25. At all sites also the recorded values are closer to the ambient temperature of the project area (20.3 ^{o}C). This is within the acceptable range for the aquatic life maintenance. As water temperature increases, the rate of chemical reactions generally increases together with the evaporation and volatilization of substances from the water. Increased temperature also decreases the solubility of gases in water, such as O2, CO2, N2, CH4 and others. These temperature results confirm that there is no major variability of water temperature within the project area.

- **The potential of hydrogen (pH)**

The Potential of Hydrogen is an important variable in water quality assessment as it influences many biological and chemical processes within a water body. It is a numeric scale used to specify the acidity or basicity of an aqueous solution. In general the surface water is composed by water with pH ranging from 6.5 to 8.5. However, many external factors affect the pH of water depending of the soil characteristics, the land use and the liquid and solid waste generated and dumped into the water. In our case the pH values of all sampling sites meet the standard for surface water therefore favourable to aquatic life protection and drinking water production as well as for irrigation purposes.

- **Turbidity**

The turbidity of water is due to the presence of thin suspended matters such as gray, colorants, organic matters, and planktons etc. When it is less the water treatment is efficacious during purification and is analyzed on field using turbidimeter. It is expressed in NTU (Nephrometric Turbidity Units). The more total suspended solids in the water, the darker it seems and the higher the turbidity. The turbidity therefore varies seasonally according to biological activity in the water and surface run-off carrying soil particles. Concerning the odor, water for consumption must be odorless. The odour is an indicator of pollution or the presence of organic matters in decomposition in water.

On Nyabugogo River, all sites present high values according to the normal standards (5). This may general due to human activities that are being carried out upstream of the sampling points. These include mining activities in Rutongo area, road construction in Gatsata area, agricultural activities as well as rain run-off. In this case, appropriate measures need to be taken in order to increase infiltration rate of rain water on hill side to avoid surface run-off and increase measures related to river bank protection as many of the implementation measures have started in different areas of the country, (for example, Sebeya, Nyabarongo and Nyabugogo river banks protection projects).

- **Total Suspended Solid (TSS)**

The total suspended solids (**TSS**) is the dry-weight of particles confined by water. It is a water quality parameter used for example to assess the quality of wastewater after treatment in a wastewater treatment plant. The type and concentration of suspended matter controls the turbidity and transparency of the water. At Nyabugogo River, the observed values of TSS are high than the standard (50mg /L). These may be attributed to sediments carried by the water and the source of these sediments includes natural and human activities in the Nyabugogo watershed such as excessive soil erosion, agriculture activities, construction works, mining works, etc.

4.3. Biological environment baseline data

4.3.1. Methodology

The ecological survey followed 3 main steps. The first step consisted of desktop work. During this phase, a literature review was undertaken. Specie lists, species databases, existing documents, and previous studies for Rwanda were consulted to get information on species occurrence especially in the study area and especially in wetlands of Rwanda, where the project is likely to have ecological impact. The output consisted of a list of species that occur, or could occur in the study area based upon their habitat affinities and ranges. The second step consisted of field survey where data on species occurrence and diversity were collected based on standards survey methods as per animal taxa and recorded on pre-designed datasheets. The last step consisted of data entry, processing, analysis and report writing.

Regarding survey design, one reconnaissance route (recce) was established along the planned pipeline route covering 9.4 km long. This reconnaissance route was established based on the shapefiles provided by GIS survey team. Each observation was recorded using a GPS for mapping purpose. For recording data on birds, the opportunistic sampling approach was used. According to this sampling approach, all bird species seen or heard were recorded. In case the species was not identified at place, a description of the species was made and photographs were taken for further identification. Bird species identification was done using identification keys provided by Stevenson & Fanshawe (2002).

Figure 43: Reconnaissance route for flora and fauna survey

Source: Field survey, BESST Ltd, 2018

Regarding, fishes, amphibians and reptiles, Visual Encounter Sampling (VES) approach was used. According to this approach, each amphibian species encountered along the reconnaissance trail was recorded. However, for fishes and reptiles, were not able to observe them directly since they are rarely observed especially in Nyabugogo River. We asked local community members and they provided vernacular names of fish species, which crosschecked to find their equivalent in English and their species names in different reports and fish and snake database in Rwanda. The nomenclature of amphibians followed Channing & Howell (2006), that of reptiles except chameleons Spawls et al. (2002).

For insects, a 1 meter-radius circular plot was established at each 500-meter interval along the reconnaissance route. Insects were captured and recorded using direct searching approach. Given the diverse nature of insect class, the identification was limited to the level of order.

For surveying flora, we used same reconnaissance routes established during fauna survey. All plant species encountered along the reconnaissance route were recorded. 'Flore du Rwanda' in 4 volumes (Troupin 1978, 1983, 1985, 1988) was used as the main source for plant species identification. The circumscription of plant families followed APG (2009). Lastly, the conservation status of each species recorded was assessed using IUCN Red List of Threatened Species, version 2016-1 (IUCN, 2016). Any endangered or listed species on IUCN red list were highlighted and brought to the attention of the client.

4.3.2. General findings

Data were collected along an established reconnaissance trail. Animal Species recorded are birds, amphibians, and insects, which were mostly encountered in Nyabugogo swamp. Reptiles and species were not encountered during the field survey. However, the information presented here was obtained from community members who were interviewed. No mammal species was encountered and community members in the area did not report any mammal species in the area. Some few plant species were also recorded. In all sites surveyed, rice and other food crops such beans, sweet potatoes, maize, etc. were the most dominant. The area surveyed can be divided into 3 categories. The first category consists of swamp along Nyabugogo River characterized by one part of natural swamp vegetation (dominated mostly by papyrus and elephant grass) and another part by the agriculture fields. The second category is characterized by an artificial forest made of eucalyptus and grevillea trees and it is located on Gisozi hill. The last category is characterized by dense human settlement in Gisozi. Most of fauna species recorded were found in the swamp along Nyabugogo River.

4.3.3. Fauna

- **Birds**

Birds are the most fauna species found in the area. However, species diversity across the area was low since it is dominated mainly by Slender-billed Weaver. Overall, 13 birds species were found. These are divided in 5 orders and 9 Families. Detailed bird species identified in the project area is presented in annexe 14

Table 36: Bird species recorded in the study area and their iucn conservation status

No	Order	Family	Common Name	Vernacular Name	Scientific Name	IUCN status
1	Passeriformes	Ploceidae	Black-Headed Weaver		*Ploceus melanocephalus*	Least Concern
2	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	*Ardea melanocephala*	Least Concern
3	Ciconiiformes	Ciconiidae	African Open-Billed Stork		*Anastomus lamelligeru*	Least Concern
4	Coliiformes	Coliidae	Spickled Mousebird	Umusure	*Colius striatus*	Least Concern
5	Passeriformes	Motacillidae	African-Pied Wagtail	Inyamanza	*Motacilla aguimp*	Least Concern
6	Passeriformes	Ploceidae	Fan-tailed widowbird		*Euplectes axillaris*	Least Concern
7	Passeriformes	Ploceidae	Slender-Billed Weaver	Isandi	*Ploceus pelzelni*	Not assessed
8	Passeriformes	Nectariniidae	Olive-Bellied Sunbird		*Cinnyris chloropygia*	Least Concern
9	Passeriformes	Laniidae	Grey-Backed Fiscal		*Lanius excubitoroides*	Least Concern
10	Pelecaniformes	Threskiornithidae	Sacred Ibis	Nyirabarazanay'indagi	*Threskiornis aethiopicus*	Least Concern
11	Pelecaniformes	Ardeidae	Cattle Egret	Inyange	*Bubulcus ibis*	Least Concern
12	Pelecaniformes	Threskiornithidae	Hadada Ibis	Nyirabarazanay'inkara	*Bostrychia Hagedash*	Least Concern
13	Charadriiformes	Charadriidae	Grey-Headed Heron	Uruyongoyongo	*Ardea cinerea*	Least Concern

Figure 44: Birds observed in the Project area

Source: Field Survey, BESST Ltd, 2018

- **Amphibians**

2 species were recorded in Nyabugogo swamp (Table 2). However, it is important to note that they were found around the reconnaissance trail. Based on the wetland biodiversity inventory made in 2011, there are several other species that could occur in the swamp which still have natural vegetation. This 2011 inventory enumerated 10 other species including 7 endemic to Albertine Rift.

Table 37: Amphibian species recorded and their IUCN conservation status

No.	Order	Family	Scientific Name	IUCN Conservation status
1	Anura	Hyperoliidae	Afrixanus quadrivittatus	Least Concerned
2	Anura	Bufonidae	Amietophrynus kisoloensis	Least Concerned

- **Reptiles**

No reptile species was found during the survey. Local community members found at the site reported encountering frequently the African Green Snake (*Philothamnus heterolepidotus*), locally known as **Incarwatsi**.

- **Fish**

During the field survey, we did not encounter fishes. However, we encountered few community members fishing. They reported that 3 fish species are found in Nyabugogo swamp and river. These are among other: Smooth-head Catfish (*Clarias liocephalus*) locally known as **Inshonzi**, Lungfish (*Protopterus aethiopicus*) which are locally known as **Imamba** and Tilapia (*Oreochromis niloticus*). These last were introduced in a nearby artificial lake. During the rainy season, water overflows the lake and tilapia fishes flow with water and end up in water ponds in the swamp.

Figure 45: Local community members fishing in a water pond in Nyabugogo swamp

- **Insects**

Several insect species were found. However, given that, the identification was limited to the level of order; several species were grouped in orders.

Table 38:Insect species recorded

Common name	Order	No. of species
Dragonfly	Odonata	1
Butterfly	Lepidoptera	2
Grasshoppers	Orthoptera	2
Lacewing	Neuroptera	1
Beetle	Coleoptera	1
Mosquitoes	Diptera	2

4.3.4. Flora

Twenty plant species were recorded in the survey area. Among these, we were able to identify 18 species. The swap is dominated by *Cyperus papyrus* (urufunzo), *Pennisetum purpureum* (urubingo) and *Yushania alpine* (bamboo) which were planted all along Nyabugogo River. Other species include *Phoenix reclinata*, *Acacia sieberana*, *Erythrina abyssinica* and fruit trees such as *Psidium guajava*, *Persea gratissima* and *Mangifera indica*. There is also an intensive agriculture of irish potatoes and maize in the swamp. Water ponds in the swamp are affected by Water Hyacinth (*Eichornia crassipes*). Along the tarmac road, some ornamental plant species were recorded. These included *Markhamia lutea, Phytolaca dodecandra, etc.* Some *Grevillea robusta* trees were also recorded. Lastly, *Eucalyptus* sp. and *Grevillea robusta* trees dominate Gisozi Hill, which is adjacent to Nyabugogo swamp. Along the swamp, the agriculture of maize, sweet potatoes and beans is practiced. Detailed plant species identified in project area is presented in annex 15.

Figure 46: Some flora species indentified in the project area

Source: Field survey, BESST Ltd, 2018

CHAPTER V: PUBLIC CONSULTATION AND PARTICIPATION

5.1. Overview

Public consultation and stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that involves the following elements; stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and on-going reporting to affected communities.

5.2. Purpose

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

5.3. Public consultations and participation

Public participation and community consultation has been taken up as an integral part of social and environmental assessment process of the project. Consultation was used as a tool to inform project affected people, beneficiaries and stakeholders about the proposed activities both before and after the development decisions are made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. Initial Public consultation has been carried out in the project areas with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project.

As part of the project consultations, efforts were made to consult with the decision making official at central level as well as a number of local authorities, to determine their thoughts, opinions and feedback on the impact of Nzove-Ntora project.. Information and comments collected from the public early in the study process were of use. Local communities especially farmers who are the land along the proposed pipeline were also consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the project prior to its start - up.

5.3.1. Stakeholders

Discussions with decision making bodies, key stakeholders, sector institutions and specialist experts were made on the very concepts and nature of the proposed 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 authorities with whom consultations made at the project study areas were:

At national level:

- Ministry of Environment
- Rwanda Water and Sanitation Corporation Limited(WASAC Ltd)
- Rwanda Environment Management Authority (REMA)
- Rwanda Development Board (RDB).
- Kigali City

At local level:

- Gasabo district
- Nyarugenge district
- Kigali , Kanyinya, Gisozi and Gatsata sector
- Potential Project Affected People(PAPs).

List of consulted people are attached in appendices

5.3.2. Public participation – methods and process

During the Public consultation, the study team applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders consulted were informed on the proposed project and by using the key guiding questionnaires, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities.

During these consultations stakeholders and the communities were explained about the project, its benefits, social and environmental impacts. The participants were encouraged to (i) be open and make known their concerns and claims. The presentation highlighted the project background, objectives, expected upcoming activities, social economic information, environmental concerns and land acquisition process.

5.4. Consultative meeting held with stakeholders and communities

Different meeting was organized by the study team from the earliest stage of project planning so as to present to all stakeholders the proposed project. In addition to public consultation meeting with project beneficiaries or project affected persons, the study team held technical meeting and one to one meeting with stakeholders as well. The first meeting was done at scoping phase to explain the projects to stakeholders and get feedback on key areas of concern that need to be covered. The second round of consultation meeting was held before the socio-economic survey and the third round of consultation meeting was done after socio-economic survey and assets inventory to display census results and agree on compensation measures. To avoid more unnecessary meeting and on advice from local authorities all those consultations covered both environmental assessment, socio-economic survey and resettlements implication.

5.4.1. Scoping meeting

- **Consultation at central and district level**

Consultation at central and district level consisted at explaining the proposed project, legal and regulatory requirements relevant to the project as well as roles and responsibilities of different

stakeholders. It was also an opportunity to collect data and information related to the projects like existing laws, standards and policies. These consultation was done one to one interviews with guiding question institutions consulted include:

- Ministry of Environment,
- Ministry of Land and Forestry
- Rwanda Land Management and Use Authority
- Rwanda Water and Forestry Authority;
- Rwanda Environment Management Authority(REMA)
- Rwanda Development Board RDB
- Water and Sanitation Authority
- Kigali City Council
- Gasabo District and Nyarugenge District

Key issues identified during one to one consultations include:

- Pollution of water bodies during construction and from non-point sources during project implementation, soil erosion, sedimentation of river due to excavation around the river,
- Possibility of loss of property , crops and trees, disturbance of water table, loss of biodiversity.
- Likelihood of delays in compensation of PAPs, which could escalate into disputes,
- Execution period, employment for their citizen, cost and accessibility of potable water waste management and disposal,
- Source of construction material, health insurance; connectivity to the existing network, cost of land acquisition and eligibility criteria.;
- Possibility of low wages to local workers during construction works;
- Payment of water fees;
- Roles and responsibilities in implementation and monitoring of EMP/RAP;

The list of stakeholders consulted at central level is presented in annex 1 while the guiding questions are presented in annex 2.

- **Consultation with sector and cells authorities**

Before meeting potential project affected people the consulting team met with local authorities from local authorities from sector and cells. Apart from Gisozi sector where local authorities gathered at sector conference hall, other authorities were consulted at their offices. the purpose of those meetings was to introduce the consulting team. introduction of projects and likely impacts, schedule for public consultation meeting with potential affected persons. The list of people consulted at Sector an cell level is presented in annex 3

5.4.2. Scoping meetings with local communities

One meeting was held in each sector to introduce project to local authorities and local population who has land or use the land in project. These meetings were invited by WASAC Ltd and the Specialist in charge of Environment and Social attended the meeting. It was agreed that those meeting should take place in the afternoon preferably on Tuesday where local citizens have community meeting. All these meeting were chaired my sector and cells authorities and the WASAC Ltd representative presented the project while the consultant team discusses the project environmental and social impact using the scoping matrix(see annex 4). table 36 summarizes meeting held with communities at scoping stage and table 37 summarizes key issues raised in each meeting. Attendance list are presented in annexes.

Table 39: Schedule of scoping meeting with local communities

Dates	Sector	Venue	Number of participants	Category of Participants
Tuesday January 9th, 2018	Gatsata	Nyamabuye cell	82	- WASAC Representative - Nyamabuye Cell local Leaders - Nyamabuye local community
	Kigali	Nyabugogo Cell	41	- WASAC Representative - Nyabugogo Cell local Leaders - Nyabugogo local community
Tuesday January 16th, 2018	Kanyinya	Nyamweru Cell	90	- WASAC Representative Nyamweru Cell local Leaders - Nyamweru local community
Saturday January 27 th,2018	Gisozi	Ntoral Cell	92	- Representative of Ruhango cell-Leaders of four villages - Community of four villages

Table 40: Questions and Suggestions and responses provided in public consultation meet at scoping stage.

No	Names	Questions/Suggestions	Responses
Nyamabuye cell in Gatsata sector, Tuesday January 9th, 2018			
1		- How many sectors will the pipeline cross?	-The proposed pipeline will be installed in four sectors Kanyinya and Kigali in Nyarugenge, Gatsata and Gisozi in Gasabo District.
		-Will the pipeline cross through people properties? If so, is there compensation planned for?	- The project is designed to avoid people houses but where structures will be affected, adequate compensation will be provided
		- It seems that there are many partners involved in the project, who is responsible for compensation issues? To witch institution shall we send our complaints?	-WASAC Ltd is the implementing agency and will be responsible institution to provide compensation but will work with district, sector, cells and resettlement committees.
		- When assets valuation will start	- There will be a cut-off date that will be agreed on and announced to the population which means that every assets putted after the cut-off date will not be considered.
3		During the previous projects that occur, we noticed that there are lands valuated and it was marked zero (0) on the certificate, and we couldn't be compensated, what does this project expect to do about it?	The consultant explained that the 0frw marked to land titles is related to Taxes but in Compensation the value of land is calculated based on full replacement cost of market value. Anyone who own a land which does not have up to one ha (1ha) and is for agriculture does not pay taxes but when the land is affected the person receives compensation.

		-There is a pipeline from Yanze river that have exploded and the water destroyed the bridge	- WASAC Ltd Representative promised to check the issue and work with the maintenance department to address the problem.
Nyabugogo cell in Kigali sector, Tuesday January 9th, 2018			
1		-We are currently working on government land, what will happen during the valuation?	-During Valuation people will have to provide evidences of assets ownership, better search for documents before.
		Have you already planned where people will relocate after the expropriation?	The first assessment involved avoiding expropriation thus not many people will be expropriated
2		After the construction works will people continue to use their land?	- The consultant replied that during construction works, they will need buffer zone but after the construction other works will continue as usual.
		Some have assets on the land which they lease, and they don't have ownership certificate what laws says about it?	Land law says that in case of project implementation, assets on land are compensated to its owner.
			The consultant mentioned also that there is a cut-off date that will be announced, thus any assets that will be added after the cut-off date will not be evaluated. He mentioned also that everyone who has land must provide the proof of ownership
Nyamweru Cell, Kanyinya sector, Tuesday January 16th, 2018			
1.		We have a local market here, what about the pollution during the construction work?	Construction works could probably have impacts like pollution which will be analysed during the studies that will be conducted.
		We are being asked taxes buy the owner of the plot and we wonder who will be compensated if the market is affected?	The compensation will be provided to land owners but if there an agreement with users then the compensation of assets will be provided to the person who owns these assets
2		We are renting the ground to use for driving exercises, is there any compensation provided?	During assets valuation, the income loose will be also considered.
Meeting with communities in Ruhango, Gisozi Sector , January 18, 2018			
1.		We think the other planned meetings should be done in each village, so that all people concerned could be aware of the project.	The consultant agreed with that and he also mentioned that this was an introduction meeting and further meeting are planned.

2.		When do you think the project should start?	WASAC representative said that the project is planned to start in 2019. The consultant added also that survey and assets inventory should start as soon as possible on 1st February 2018

Source: BESST Ltd, 2018

5.4.3. Meetings at Socio-economic survey and assets inventory stage

Before starting socio economic survey and assets inventory, the consultant conducted the second round of consultation meetings in each cell. The meeting was attended by cells authorities and People who have been identified as project affected people. The purpose of the meeting was to announce the cut-off date but also to explain the purpose of the survey and assets inventory. It was an opportunity to introduce field surveyors and to request people who will participate in survey, to avail themselves or delegate someone in the household who can provide information on households and lands owned or used. The table 39 below presents the schedules of meeting conducted and table 40 presents key issues raised in these meeting. Attendance list are presented in annexes.

Table 41: Schedule of meeting conducted at Social Economic survey stage

Dates	Sector	Venue	Category of Participants
Tuesday February 6th, 2018	GATSATA	NYAMABUYE cell	- BESST LTD Team - Nyamabuye Cell Leaders - Nyamabuye local community
	KIGALI	Nyabugogo Cell	- BESST LTD Team - Nyabugogo Cell local Leaders - Nyabugogo local community
Wednesday 7th, 2018	KANYINYA	Nzove & Nyamweru Cell	- BESST LTD Team - Nyamweru Cell local Leaders - Nyamweru local community
Thursday 8th,2018	GISOZI	Ntoral Cell	- Representative of Ruhango cell-Leaders of four villages - Community of four villages

Table 42: Key issues raised in Consultation meeting at socio economic meeting

No	Question/comments	Answers provided by consultant
Consultative meeting in Nyamabuye Cell, Gatsata cell		
1	How are we going to know the value of our properties?	WASAC will hire an independent valuer who will agree with assets owner the compensation value.
2	When the project implementation will start so that we can plan for our agriculture activities?	It is anticipated that construction will start in 2019, but upon the completion of final design studies, farmers will be informed on construction schedule.
3	Will the project gives us the jobs or it will use machines?	Though some activities will require the use of machines, other works will be performed by people and affected people will be given priority.
4	What are the mechanisms that are you putting in place to ensure that local are provided with jobs?	First of all, locals will be provided with information on time but also during the preparation of construction contract WASAC shall emphasize the use of local resident in construction work where possible.
Consultative meeting in Nyabugogo Cell, Kigali Sector		
1	Sometimes the fees paid as	There will be compensation for land owners and Special

	compensation is not enough to buy another land. What are you planning to address this issue?	attention will be taken on these who are going to lose government land. For the person who disagrees with the value assignment to his/her property appealing measures are provided.
2	When are we going to get results of your data collection?	This exercise is the initial identification of assets and PAPs and results will be included in RAP report which will be made public. However a final asset valuation will be conducted and every PAP will sign on the valuation form after verification of his attest and its value
3	Where beacons have been installed is the last limit of the land to be acquired?	Beacons were used for land survey and will be used for assets inventory.
5	Will farmers allowed to continue to use the land after pipe installation.	Yes, but the land will be used under conditions and no permanent structure may be allowed. Again above the pipe it's not allowed to conduct activities but all land in 9 m will not be required
7	What about the water point that may be affected?	The installation of water pipe will not affect the water r source because even the first pipe did not affected. However, the final design will consider the location of water source.
9	One PAPs wanted to know the size of his land that will be taken.	All affected will be measures and communicated to land owners but in general 9m will be required during contraction for excavation but also access roads.
Consultative Nzove and Nyamweru Kanyinya sector		
1	Will our land be taken without compensation?	Private land will be compensated and care will be taken to the ones who will lose government land.
2.	What kind of compensation will you give us?	Compensation measures will be provided based on eligibility criteria and the nature of impact and the compensation may include land for land compensation or monetary compensation. Especially for crops and trees.
3	When shall the construction start?	The final date for construction is not yet fixed but construction works are expected to start in 2019. Farmers will be informed about construction schedule in due time.
4	I f one people has two plots in targeted area marshland will be counted two times?	If the land is for the same use and fall in the same category these areas are to be summed up in order to avoid double counting.
5	We cannot be against public interest, but what are the support are we going to receive from the government?	Compensation will be provided to the affected people and job opportunities will be provided during construction.
Consultative meeting at Ntora, Gisozi Sector		
1	We were living for our land. What do you think for us when the project starts?	Owners of private land will be compensated and their assets. These who live by government land in affected area will be considered for different supports and follow of their living conditions
2	If 9m will be required it's likely that some structures will be affected. If that is the case what are provisions?	The assets inventory will identify both land, crops, trees but also other structure that will be affected and adequate compensation will be provided in accordance with laws.
3	The land in Road reserve have	The land law is clear any land to be transferred from private

	been marked as government land but we have not received any compensation. What will happen to this portion of land when the project start.	to public land should be compensated. What is required is to present ownership documents.

5.4.4. Meetings at draft stage

After the preparation of draft report, another round of consultation meeting were organized and held in the four sectors. The meeting discussed the findings of environmental and social survey, impacts identified and proposed mitigation measure, compensation measures, entitlement matrix and RAP & EIA, implementation arrangements. In addition to the meeting held at sector level, additional consultation meeting were held at cell level wit project affected households to display and discuss findings of assets inventory, proposed entitlement matrix, grievance redress mechanism (GRM) and compensation measures. Key issues raised and response provided in meetings at sector level are summarized in the following tables and list of attendance are provided in the annexes 14,15,16 and 17.

Table 43: Issues and response during draft stage meeting

Names	Issues	Response
Meeting in Kigali sector, 17/04/2018		
	In the past we have seen some problems of compensation that comes after valuation and are either related to construction activities or consequence of poor water drainage. Is there any mechanism to address these issues?	If there is a new compensation issue that were not identified before or any issue that is caused by projects after construction, the resettlement committee will work with local Authority and WASAC to address the issue.
	When the construction works will start?	Construction works are expected to start in 2019 but people will be informed in due time.
	-After assets inventory what are the next steps?	A final valuation will be done and compensation shall follow before and physical works
Meeting at Kanyinya Sector, April 24th, 2018		
	Some people have the trees and crops in government land. How they will be compensated?	Trees and crops on government will be compensated but the land is not compensated because in the government properties.
	Is there any special attention to vulnerable people?	Vulnerable people identified by project will be given priority in employment and special follow up during compensation process.
	What kind of compensation is provided for land?	The expropriation law provide both monetary and in kind compensation. However, due to the lack of free land in Kigali, the cash compensation is likely to be the only alternative.
Meeting in Gisozi Sector, April 28, 2018		
	How about people who have assets in Government Land and who don't have its land title?	The land itself will not be compensated, only assets on the land will be compensated to its owners.
	What will be done if the access road destroys some infrastructures?	Infrastructures that will be affected will be compensated.

	What will happen if the pipeline passes through someone plots and she/he cannot use the rest of the plots.	The pipeline line route was selected to avoid as much as possible the centre of plots especially in residential area. however if it happens that a plot is affected in a way that it cannot be used, then the entire plot will be compensated
	How large is the protective strip, in case we would like to put some infrastructures near our home or in case there would be pipe leakage? I would like to know if there are no negative effects of the project.	The land that will be required for construction is about 9m width where there no access roads but after construction only about 2m will be required where pipe is installed and maintenance area.
	What will happen if crops that were identified in assets inventory are harvested before the final valuation?	The final valuation will be done on assets found on the land during valuation period. If crops are harvested before valuation, then there will be no impacts on these crops
	What will happen if someone is not happy with the compensation cost?	Grievance redress mechanism will be established and communicated to PAPs and the expropriation law provides mechanism by which the affected people can express his complaints including the recruitment of his own valuer.
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority
Meeting in Gatsata sector, May 8, 2018		
	What happen if people are not around during valuation?	If the land owner is not around during land valuation, the valuer carries out the valuation in the presence of local authorities.
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority

Figure 47: Photos taken during public consultation meetings

CHAPTER VI: ANALYSIS OF PROJECT ALTERNATIVES

6.1. Overview

This section describes different project alternatives that were examined in the course of designing the proposed project and identify other alternatives, which would achieve the same objective including the 'No action' alternative to demonstrate environmental and social conditions without the project, consideration of alternatives should extend to sitting, design, technology, construction techniques, phasing and schedule, and operating and maintenance procedures alternatives.

Alternatives were compared in terms of potential environmental and social impacts; capital and operating costs; suitability under local conditions; and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. For the project of strengthening Nzove-Ntora Principal pipeline alternative focused on choice of line route and the implication of each line route it terms of different criteria including environmental and social Impacts, resettlement implication and the project cost.

6.2. No- Project option

The no Project alternative option will entail leaving the population in the present situation and this option is not desirable considering the need of water supply in Kigali City. Besides, there are many significant and specific benefits that would not be accrued if the proposed development is not to be implemented.

The project of strengthening of Nzove-Ntora principal pipeline is justified by the need of increasing the capacity of water supply in Kigali City to satisfy its growing population. Kigali City has water production capacity of 82,000 m3/day from three (3) water treatment plants namely Kimisagara, Karenge and Nzove in order to respond to the current water demand. Nzove water supply system is responsible for approximately 50% of total production and Nzove water supply system is the most important facility in Kigali City. Almost all volume (about 95%) water produced in Nzove water treatment plant (hereinafter referred to as "WTP") is pumped to Ntora reservoir (5,000 m3 x 2 reservoirs). Ntora reservoir supplies water to 34 reservoirs and it covers 24 sectors of 35 sectors in total by gravity. Nzove WTP is planning to extend water supply volume to supply about 2.1 times of current volume (about 105,000 m3/day) for responding to future population increase.

Based on the above situation, the Government of Japan conducted the "Basic Data Collection Study On Urban Water Supply Systems in Rwanda " from October 2016 to February 2017, and analyzed the current state and issues of water supply services in Kigali City, and considered the priority of the required projects of the water supply sector. Before this situation, the Government of does not have any other choice rather than expending forwarding infrastructure and it requested the Government of Japan to support the Project for Strengthening of Nzove-Ntora Principal Transmission Pipeline in Kigali City" with the primary objective of strengthening of Nzove-Ntora Principal Transmission Pipeline which is highly demanded. Japan International Cooperation Agency has accepted to conduct the Preparatory Survey for considering the necessity and relevance of the Project as the Grant Aid project with related information, and roughly designing appropriate contents and plan as well as the scope of the Project to estimate the outline operation cost. For the above reasons the

consultant could not recommend No-Option alternative. Instead, the consultant is recommend the implementation of the proposed project with appropriate mitigation measures.

6.3. Project alternatives with mitigation measures

The design team has proposed different line route alternatives and based preset criteria the best line route were proposed. The EIA consultant assessed the proposed alternatives and confirmed the selected line route but proposed mitigation measures for the identified potential environmental and social impact which are discussed in chapter seven and eight.

6.3.1. Selection of water pipeline route

Table 44: Water Pipe alternative Routes.

Proposed route	1. Route parallel with the existing pipeline					
	1-2. Installation the pipe under the road from Nzove WTP to road bridge		1-3. Avoid the narrow space along the National road		1-4. Avoid the narrow space along the existing pipe.	
Total length of pipe	Approximately 9.1 km	4	Approximately 9.4 km	5	Approximately 9.4 km	5
Route composition	Paved: 1.15km Unpaved: 7.95km	4	Paved: 1.15km Unpaved: 8.25km	5	Paved: 1.15km Unpaved: 8.25km	5
Presence of narrow road	There is a narrow road, it is necessary to partially secure the road width.	2	There is a point to close river and existing pipe which has a 45° bending, the consideration of the impact to existing pipe is necessary.	3	The construction of expansion for National Road starts. However, National Road will expand to the mountainside at the river close area, no problem to install the pipe.	4
Measures against river protection	The river is partially close to the unpaved road, and river protection measures are required.	3	There is a point close to the river and existing pipe, and river protection measures will be required.	4	There is a point close to the rive and planed sewerage pipe, and river protection measures will be required depend on the design of sewerage pipe.	4
Measures against the construction in wetland	Currently, the width of path is enough to allow people pass wetland. There is no particular problem for constructing the temporally road for the construction.	3	Currently, the width of path is enough to allow people pass wetland. There is no particular problem for constructing the temporally road for the construction.	3	Currently, the width of path is enough to allow people pass wetland. There is no particular problem for constructing the temporally road for the construction.	3
Measures against river crossing	There are two river crossings. First river crossing is planned as water pipe bridge and second river crossing is planned as underpass the river. It is necessary to plan the temporary bridge etc.	4	There are six river crossings. Last river crossing is planned as underpass the river, others are considered to cross by water pipe bridge. It is necessary to plan the temporary bridge etc.	3	Six river cross places have been identified and the Lead Pipe Jacking Method will be used . Pipe Jacking Method was selected by considering construction cost which is relatively low, easy to maintain and its impact on the river bank which is low compared other methods.	3

Measures against construction at slope	Although it is a steep slope in the longitudinal direction, the transverse direction is almost horizontal and there is no problem in construction if measures such as a cableway etc. are taken.	3	Although it is a steep slope in the longitudinal direction, the transverse direction is almost horizontal and there is no problem in construction if measures such as a cableway etc. are taken.	3	Although it is a steep slope in the longitudinal direction, the transverse direction is almost horizontal and there is no problem in construction if measures such as a cableway etc. are taken.	3
Impact on traffic	Road expansion from Nzove WTP to road bridge starts, and the difficulties to install the pipe under the road are remained by MININFRA.	2	Impact on traffic is limited, only from the paved road after the steep slope.	4	Impact on traffic is limited, only from the paved road after the steep slope.	4
Resettlement	Housing and public facilities etc., the paved road after the steep slope. Not so many.	4	Housing and public facilities etc., the paved road after the steep slope. Not so many.	4	Housing and public facilities etc., the paved road after the steep slope. Not so many.	4
Land acquisition	Land acquisition accompanying expansion of road for installation pipe in narrow road.	3	Compensation for cultivating during the construction is necessary.	4	Compensation for cultivating during the construction is necessary.	4
Construction period	There are few influence to the residents' living, the construction period is not affected.	4	There are few influence to the residents' living, the construction period is not affected.	4	There are few influence to the residents' living, the construction period is not affected.	4
Project cost	River crossing is only two, the cost will be minimized.	4	River crossing is six, the Project cost will become bigger than 1-2.	3	River crossing is six, the Project cost will become bigger than 1-2.	3
Total point	40		45		46	
Remarks	The construction of road expansion from Nzove WTP to road bridge starts (width: 10m), and the difficulties to install the pipe under the road are remained, therefore the Project reject this route.		The consideration of impact to the existing pipe in narrow point is necessary.		The detail design of sewerage pipe will be started, the exact location of sewerage pipe must be confirmed in future.	

Based on the criteria presented above , the water pipeline route 1-4, emerged as the best alternative.

6.3.2. Alternatives river crossing methods

There are several river-crossing methods, and judging from the conditions of the Nyabugogo River, the following 3 methods are possible choices and the appropriateness of these methods was examined, according to the hardness/softness of the ground at the river crossing point.

Table 45: Result of the alternative analysis for River crossing bridge

	Hard Ground						Soft Ground					
	Open Cut Method (Underneath a river)		Pipe Jacking Method (Tunnel)		Pipe Beam Bridge		Open Cut Method (Underneath a river)		Pipe Jacking Method (Tunnel)		Pipe Beam Bridge	
	Under construction	In operation	Under construction	In operation	Under construction	In operation	Under construction	In operation	Under construction	In operation	Under construction	In operation

Land use	△	○	△	○	△	△	△	○	△	○	△	△
Landscape	○		○		△		○		○		△	
Approval	○		○		○		○		○		○	
Impact on the river (Water quality)	△	○	○	○	○	○	△	○	○	○	○	○
Impact on the river (Hydrology)	△	○	○	○	○	○	△	○	○	○	○	○
Construction cost	○		△		△		○		△		△	
Construction period	△		△		△		○		○		△	
Maintenance cost	○		○		△		○		○		△	
Safety	○	○	△	○	△	○	○	○	△	○	△	○
Resettlement	-		-		-		-		-		-	
Result of analysis	○		△		△		△		○		△	
Main elements for the analysis	Construction cost is relatively low		Construction cost is high		Construction cost is high		Construction cost is relatively low, easy to maintain, construction period is short		Construction cost is relatively low, easy to maintain, impact on the river bank is small		Construction cost is high and difficult to maintain	

⊙appropriate, △: a bit of a problem, x: not appropriate, - : no impact

6.4. Recommended project alternatives

Based on the proposed technical design and proposed mitigation measures, based on the social and environmental social assessment project site, the consultant can conclude that the most preferred alternative would be implementing the project with mitigation measures in place. Pipe Jacking Method was selected for river crossing method by considering construction cost which is relatively low, easy to maintain and its impact on the river bank which is low compared other methods. The selected pipeline route minimises the potential environmental and social impacts especially resettlement impacts. A pursuant of this alternative will entail going on with the activities but taking into account the potential impacts on the environment by incorporating mitigation measures. This alternative is more desirable as it will increase the capacity of water supply in Kigali and does not have any irreversible environmental and social impacts. However, potential impacts to the environment and to the community have to be assessed, mitigation measures proposed and an Environmental Management Plan and monitoring plan prepared and implemented.

CHAPTER VII: IMPACT PREDICTION, ANALYSIS AND MITIGATION MEASURES

7.1. General overview

Generally an environmental and social impact refers to the changes of existing conditions of any area or environment caused by human activities or any internal or external influence which may be positive or negative. The impacts may also be direct or indirect, long term or short term and may be local or extensive. During the process of identification of impacts of this project on the environment, it was discovered that during the project phases especially during construction and operation, a number of positive impacts on the human environment and some negatives impacts will occur.

The objective of impacts assessment is to identify and assess all the significant impacts that may arise from the undertaking of an activity and findings used to inform the competent authority's decision as to whether the activity should be either authorized, authorized subject to conditions that will mitigate the impacts to within acceptable levels, or refused.

7.1.1. Impacts types

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 do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity (REMA, 2006).

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.

7.1.2. Identification of potential impacts

In order to identify the potential impacts of this project, matrix was designed and used for the assessment of impacts associated with almost any type of development project. Its main strength is a checklist that incorporates qualitative information on cause-and-effect relationships.

Table 46:Matrix used for identification of potential impacts associated with Nzove projects

Environmental components			Physical(Land-Water-Air)								Biological					Socio-economic									
			Geology	Soil	Water				Air	Visual	Flora		Fauna			Resettlement					Quality of life				
Project activities			Geological formation	Soil pollution	Soil erosion	Water Pollution	Runoff and infiltration	Underground water	Air quality	Visual impacts	Flora species	Flora Succession	Fauna species	Fauna Habitat	Loss houses and Structure	Loss of Crops	Loss of private land	Loss of public land	Loss of income	Infrastructure and public utilities	Occupational health and	Employment	Skills transfer	Cultural and heritage	Noise and vibration
Project Phase	#	Main Activity																							
Design and Planning	1	Preliminary Survey and detailed design including EIA and RAP																				X	X		
Construction	3	Installation of a 900mm diameter steel pipe on 9.7 km	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
	4	Installation of elevated tank, pump and replacement of outlet pipe of reservoir					X		X												X	X	X		X
	5	Construction 22,000 water pump and pump station		X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X		X
	6	Construction of six river crossing tunnels	X			X		X			X		X								X	X	X		
	7	Construction of access roads	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X		X
	8	Construction of 3 temporary bridges	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X
	9	Disposal of construction wastes		X		X	X	X	X												X				X
	11	Influx of construction workers																			X	X	X	X	
Operation and maintenance	11	Operation of water Pumps																							X
	12	Maintenance and rehabilitation of water infrastructure	X	X	X	X	X	X	X													X	X		X
Decommissioning	16	Site closure	X	X	X	X	X	X	X																X
	17	Decommissioning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X		X

7.1.3. Impact analysis

Impact analysis was done by conducting risk assessment, risk evaluation and risk management (relating directly to applicable mitigation measures to be implemented. Impact analysis matrix is presented in the next table.

Figure 48: Impact analysis matrix

Nature or Status of the Impact: The type of effect the activity would have on the environment		
Status		Description
Positive:		a benefit to the holistic environment
Negative:		a cost to the holistic environment
Neutral:		no cost or benefit
Duration of the Impact: The lifetime of the impact		
Score	Duration	Description
1	Short term	Less than 2 years
2	Short to medium term	2 – 5 years
3	Medium term	6 – 25 years
4	Long term	26 – 45 years
5	Permanent	46 years or more
Extent or Scale of the Impact: The distance from source that impacts may be experienced		
Score	Extent	Description
1	Site specific	Within the site boundary
2	Local	Affects immediate surrounding areas
3	Regional	Extends substantially beyond the site boundary
4	National	Affects country
5	International	Across international borders.
Reversibility of the Impact: To what degree its influence on the relevant environment can be negated.		
Score	Reversibility	Description
1	Completely reversible	Reverses with minimal rehabilitation & negligible residual affects
3	Reversible	Requires mitigation and rehabilitation to ensure reversibility
5	Irreversible	Cannot be rehabilitated completely/rehabilitation not viable
Intensity or Magnitude of the Impact: Severity of the negative and magnitude of positive impacts		
Score	Severe/beneficial effect	Description
1	Low	Little effect - negligible disturbance/benefit
2	Low to moderate	Effects observable - environmental impacts reversible with time
3	Moderate	Effects observable - impacts reversible with rehabilitation
4	Moderate to high	Extensive effects - irreversible alteration to the environment
5	High	Extensive permanent effects with irreversible alteration
The Probability of the Impact: Describes the likelihood of the impact actually occurring		
Score	Rating	Description
1	Unlikely	Less than 15% sure of an impact occurring
2	Possible	Between 15% and 40% sure of an impact occurring
3	Probable	Between 40% and 60% sure that the impact will occur
4	Highly Probable	Between 60% and 85% sure that the impact will occur
5	Definite	Over 85% sure that the impact will occur
The Consequence (C)		= Magnitude/Intensity (M/I) + Extent (E) + Duration (D) + Reversibility (R).
The Significance (S)		= Consequence (C) x Probability (P)

7.1.4. Determination of Significance

After assessment of an impact in accordance to the criteria described above, the significance of an impact can be determined. The various ratings as indicated above are accorded to these criteria. These ratings are then used to calculate a significance (S) rating and are formulated by adding the sum of ratings given to the extent (E), duration (D), Reversibility (R) and intensity (I) and then multiplying the sum with the probability
(P) of an impact as follows:

Significance (S) = (E+D+R+I) X P

The significance rating is described as follows:

Score out of 100	Significance
1 to 20	Low
21 to 39	Moderate to Low
40 to 60	Moderate
61 to 79	Moderate to high
80 to 100	High

The following table summarizes the evaluation of impacts associated with the proposed project of strengthening Nzove- Ntora principal pipelines. It shows identified impacts and their significance during different projects phase.

Table 47: project impact analysis matrix

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Magnitude (M/I)	Extent (E)	Duration (D)	Reversibility (R)	Probability (P)	Significance (S)	Mitigation
I. Planning Phase									
Activity 1. Preliminary survey Including EIA&RAP, detailed design									
	Job creation	Positive	-	2	1	-	5	20	N
	Risk of accidents	Negative	1	1	1	1	2	15	Y
II. Construction Phase									
Activities 2.1: Installation principal water pipe 900 mm diameter, 9.7km length									
Land acquisition	Loss of houses and structures	Negative	2	1	5	3	5	40	Y
	Loss of land	Negative	2	1	5	3	5	40	Y
	Loss of income	Negative	1	1	1	3	5	35	Y
	Loss of crops and tress	Negative	2	1	1	3	5	40	Y
Soil	Risk of soil erosion	Negative	1	1	1	3	3	20	Y
Surface water	Risk of surface water pollution	Negative	2	1	1	3	3	20	Y
Ground water	Risk of ground water pollution	Negative	2	1	1	3	3	35	Y
Air quality	Risk of dust generation and emission	Negative	2	1	1	3	3	35	Y
Noise	Increase of noise levels	Negative	1	1	1	3	3	35	Y
Flora and fauna	Adversely affect local fauna and flora	Negative	2	1	1	3	3	35	Y
Quality of life	Occupational health and safety	Negative	2	1	1	3	3	34	Y
	Job creation	Positive	2	2	1	-	5	60	N
Activity 2.2: Construction of six river crossing tunnels									
Soil	Risk of soil erosion	Negative	1	1	1	3	3	20	Y

Surface water	Risk of surface water pollution	Negative	1	2	1	3	3	20	Y
Ground water	Risk of ground water pollution	Negative	1	1	1	3	3	20	Y
Air quality	Risk of dust generation and emission	Negative	1	1	1	3	2	15	Y
Noise	Increase of noise levels	Negative	1	1	1	3	2	15	Y
Flora and fauna	Adversely affect local fauna and flora	Negative	1	1	1	3	2	20	Y
Quality of life	Occupational health and safety	Negative	2	1	1	3	4	50	Y
	Job creation	Positive	2	2	1	-	5	20	N
Activity 2.3: Construction of water pump stations, elevated tank at Ntora water reservoir									
Soil	Soil compaction	Negative	1	1	1	3	3	40	Y
Surface water	Risk of surface water pollution	Negative	1	2	1	3	3	40	Y
Ground water	Risk of ground water pollution	Negative	1	1	1	3	2	15	Y
Air quality	Risk of dust generation and emission	Negative	1	1	1	3	3	20	Y
Noise	Increase of noise levels	Negative	1	1	1	3	3	20	Y
Quality of life	Employment	Positive	2	2	1	-	5	20	N
	Risk of accidents	Negative	2	1	1	3	3	25	Y
	Occupational health and safety	Negative	2	1	1	3	4	25	Y
Activity 2.3: Construction of three temporary bridges									
Soil	Soil compaction	Negative	1	1	1	3	3	25	Y
Surface water	Risk of surface water pollution	Negative	2	2	1	3	3	60	Y
Ground water	Risk of ground water pollution	Negative	2	1	1	3	2	20	Y
Air quality	Risk of dust generation and emission	Negative	1	1	1	3	3	25	Y
Noise	Increase of noise levels	Negative	1	1	1	3	3	25	Y
Quality of life	Employment	Positive	2	2	1	3	5	20	N
	Risk of accidents	Negative	2	1	1	3	3	40	Y
	Occupational health and safety	Negative	2	1	1	3	4	40	Y
Activity 2.5: Influx of construction workers									
Quality of life	Risk of social conflict with local communities	Negative	2	1	1	3	2	21	Y
	Occupational health and safety	Negative	2	1	1	3	3	35	Y
	Income generation	Positive	2	2	1	-	3	35	N
	HIV/AIDS& communicable diseases	Negative	2	1	1	3	3	35	Y
	Gender Based Violence and sexual exploitation	Negative	2	1	1	3	3	35	Y
III. Operational Phase									
Activity 3.1. Maintenance and rehabilitation of water infrastructure									
Surface water	Risk of surface water pollution	Negative	1	2	1	3	3	10	Y
Ground water	Risk of ground water pollution	Negative	1	1	1	3	2	10	Y
Air quality	Risk of dust generation and emission	Negative	1	2	1	3	3	15	Y
Noise	Increase of noise levels	Negative	2	2	1	3	2	20	Y
Flora and fauna	Adversely affect fauna and flora	Negative	1	1	1	3	2	20	Y
Quality of life	Employment	Positive	2	2	1	-	4	20	N
	Risk of accidents	Negative	2	2	1	3	3	30	Y
	Occupational health and safety	Negative	2	2	1	3	3	30	Y
	Vandalism of infrastructures	Negative	2	2	1	3	3	30	Y
IV. Decommissioning/closure and post-closure phase									
Activity 4.1: Project Closure									
Soil	Soil contamination	Negative	2	1	2	3	2	15	Y
Surface and ground water	Risk of surface and ground water pollution	Negative	2	2	2	3	2	15	Y
Noise	Increase of noise levels	Negative	2	2	2	3	2	15	Y
Visual	Improvement of the beauty of the area	Positive	3	2	4	-	3	20	N
Public safety	Risk of accidents	Negative	2	1	2	3	2	20	Y
Activity 4.2. Land reclamation and revegetation									

Soil	Soil structure and texture improvement	Positive	2	1	3	-	3	20	N
Flora and Fauna	Vegetation cover and proliferation of fauna habitats	Positive	2	2	3	-	4	20	N
Surface and groundwater	Improvement of surface and ground water quality	Positive	3	2	2	-	3	20	N
Land use	Availability of land for agriculture	Positive	3	2	3	-	3	20	N
Quality of life	Job creation	Positive	3	2	2	-	3	20	N

7.2. Impacts identified and proposed mitigation measures

Based on the above methodology, this section presents potential impacts associated with the implementation of the proposed project of strengthening Nzove Ntora Principal pipeline in Kigali city. Per as general guidelines for Environmental Impact Assessment in Rwanda(REMA 2006) and JICA guidelines for environmental and Social considerations Both positive and negative impact associated with project were assessed. A summary of impacts analysis in tabular form is also presented at the end of this section. An Environmental Management and Monitoring Plan is provided in Chapter 8.

7.2.1. Positive socio-economic impacts

The project of strengthening Nzove-Ntora principal pipeline is likely to have substantial positive socio-cultural and economic impacts in the City of Kigali. Obvious positive impacts are the provision of employment and water infrastructures that can support the country's objectives in terms of water supply and economic development. The following section highlights the potential social-cultural and economic impacts associated with the proposed projects.

- **Local employment**

The implementation of this project will provide employment opportunities for local population. The use of local labourers and skilled workers will improve the skill resource base in Rwanda through the implementation of training and development programmes. 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 solicited the access to the job. The project would therefore have a positive impact and reference made to preliminary design, the table below present the required labour.

Table 48: Anticipated workers during project implementation

Type of works	Type of workers	Man-month
Laying Pipes	Operator for heavy equipment	10.4MM
	Common worker	41.9MM
	Specific worker	57.3MM
	Foreman	36.8MM
	Driver for Dump truck	6.6MM
	Plumber	4.6MM
	Japanese instructor for welding	9.6MM
	Painter	26.8MM
	Scaffold worker	9.0MM

	X-ray Inspector(qualified person)	1.9MM
Installing pumps at Nzove WTP	Fore man	3MM
	Mechanic	1MM
	Electrician	1MM
	Operator for heavy equipment	1MM
	Plumber	2MM
Interlocking	Masonry	1MM

It is anticipated that the projects will also need casual labor and for a such project we can estimate at 100 workers for the entire duration of projects. Additional labour income will be generated from extraction or supply of construction material such as stones and sand.

Contractor employment

The use of local contractors will increase the capability of local contractors to carry out their work competently. There will also be an influx of skilled contractors to the project site. This will help to set up economic diversification.

- **Access to potable water and reliability of water supply system**

The strengthening of Nzove-Ntora principal pipeline will increase the capacity of water supply in Kigali City and extend the number of people with access to clean water. The improvement and expansion of water supply system will enable greater responsiveness to the demand, increasing also the reliability of the operating system. The reliability of the system will allow adequate planning for water supplies. Furthermore, The elevation of a 200m3 tank at Ntora reservoir will also allow water supply to the community around Ntora reservoir which is not the case today.

- **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.

- **Economic Diversification and Improved local socio-economy**

It 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.

- **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 water. Therefore, the proposed project will be highly beneficial to women and girls.

- **Healthcare for Employees**

Employees and their immediate families will be provided with basic healthcare. This will benefit the overall health of the local population. HIV/AIDS information will be dispersed to employees to prevent the spread of the disease amongst the project employees and their families.

- **Possibility of savings for the employees**

The increase of the project's employee's revenue will lead to the possibility of savings in local banks and micro-finances.

- **Increase to public revenue/taxes**

The implementation of the project will increase revenue and taxes for both the central and local authorities. The project will fully participate in increased payments of taxes from suppliers of the clean water in Kigali city.

7.2.2. Potential negative socio-economic impacts

It is anticipated that the project will have also some socio-economic adverse impacts as detailed in the present section.

- **High expectation of the local communities in relation to job posts**

There is within the local population, high 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 is 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.

- **Expectations of short-term solution to all problems of water supply**

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.

- **Resettlement implications**

The project was designed in a way that avoided or minimise physical resettlement. Unfortunately two households are likely to be physically resettled. Furthermore other 21houholds will be partially affected by losing either ground floor, wall or fence. Other households/Corporations will lose both temporally land while others will lose crops and trees. Income loss is also anticipated for some farmers and one driving school. In total 93 HHs including 10 corporation will be affected by the project and e detailed Resettlement Action Plan was prepared together with this EIA. The RAP report provided details on affected assets and proposed mitigation and compensation measures.

- **High expectations of getting great compensation in cases of resettlement**

It is highly likely that people who will stand to lose land, infrastructure or business due to the project will have very high expectations of compensation to their loss.

- **Conflicts among workers and the local population in the project area**

Though it is anticipated that the project will make an effort to employee 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 behaviours are generally related to socially unacceptable behaviour 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.

- **Injuries or fatalities from improper manual handling**

The most common injuries or illnesses as a result of 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.

- **Proposed mitigation measures:**

- Health and safety measures should be observed including provision of Personnel Protective Equipment(PPE),
- First aid kit,
- Occupational Health and Safety(OHS) and,
- Training and health insurance to all workers
- Working conditions should respect the minimum requirement per as Rwandan law (N°13/2009 of 27/05/2009 regulating labour in Rwanda) and international rules such as OHSAS
- Measures are taken to oblige workers to wear safety boots and helmets and to manage waste properly, in order to prevent accidents during the construction work
- The safety and sanitation plan will be prepared and regular safety education will be implemented, in consultation with a district work safety inspector
- Security guards, who are provided with training of health and safety, are assigned and measures are taken such as installation of fence and signboards in order to prevent accidents and troubles involving local residents near the construction site

- **Traffic congestion and injuries or fatalities**

The principal pipeline is mostly designed along the existing roads and at some point it crosses both paved and unpaved roads. During construction period there will be increase in traffic due to moving machineries and vehicle traffic for material supply. This may cause both congestion and accidents.

- People struck or run over by moving vehicles (e.g. during reversing), causing minor to major injuries (fractures, wounds) or death;
- Falling from vehicles, causing injuries or death;
- Injuries or death because of vehicles overturning.

- **Proposed mitigation measures include:**

- Provision of training to train drivers
- Preparation of traffic management plan and
- Provision of safety people to guide traffic especially where the works will be undertaken near paved road with busy traffic and during busy traffic.

- **Work related Health issues**

Health related issues are mainly resulted from emission of dust, noise and vibration which can result in possible respiratory irritation, discomfort, or illness to workers and local communities.

- **Proposed mitigation measures**

in addition to the safety measures mentioned above, the following additional measures should be implemented:

- PPE should be provided to workers who are exposed to dust, noise and vibration for a prolonged period.

- Water should be splayed in working area especially near business places and schools at least two time a day.
- watering regularly to suppress excessive dust during construction, use of gas masks and goggles for dusty sections is strongly recommended;
- The contractor together with local authorities is required to enforce acquiring medical insurance "mituelle de sante" for all workers as a means of affordability of treatment.
- The safety and sanitation plan will be prepared planned and regular safety education will be implemented, in consultation with a district work safety inspector.

- **Possible increases of HIV/AIDS and communicable diseases**

Risk of increase of HIV/AIDS and other Sexually Transmitted Diseases(STD) Due to the increase of people from outside of the project zone, there is a risk of increase of HIV/AIDS and other sexual transmitted diseases. Though there is no workers camps planned for this projects Communicable diseases are anticipated among workers.

➢ **Mitigation measures**

- Regular sensitization on ways of HIV/AIDS prevention, importance of proper hygiene is important during execution of this project.
- The contractor is requested to arrange a health and hygiene training for workers and local communities in cooperation with health centre near the construction site, in order to prevent infectious diseases

- **Disruption of Public Utilities**

At several points, small domestic water supply pipe lines and electricity and communication cables were observed. During construction, these infrastructures are likely to be affected by the construction activities.

➢ **Mitigation measures**

- The contract will avoid as much as possible these infrastructure but were are affected they will be rehabilitated.

- **Project impacts on public utilities/ infrastructures**

During construction some social infrastructure like water point, spring and water supply infrastructure will be affected especially in submerged area. Two springs and one water well were identified in the project area. Construction activity may affected the quality and the quantity of these springs. Furthermore, in Gisozi some water pipe and electrical cables were identified in the construction area and are likely to be affected during excavation.

➢ **Proposed mitigation measures**

- Rehabilitation of affected structures and infrastructures;
- Identification of new water source and construct alternative water spring.

- **Child labour, forced labour , discrimination and abusive dismissal**

The implementation of Nzove-Ntora Principal pipeline should be done in compliance with national and international standards in terms of child labour forced labour and discrimination.

- **Proposed Mitigation Measures**

- Protect workers' rights and provide contract to each employee
- Establish, maintain, and improve the employee–employer relationship;

- Promote compliance with national legal requirements and provide supplemental due diligence requirements where national laws are silent;
- Comply with international Labour Organization, and the UNICEF Convention on the Rights of the Child, where national laws do not provide equivalent protection;
- Protect the workforce from inequality, social exclusion, child labour, and forced labour;

7.2.3. Adverse impacts on physical environment

Project's adverse impacts during project phases (pre-construction, construction, operation and decommissioning phases) are described in this section. The significance and probability of occurrence of each impact can be reduced through the application of environmental preventive and mitigation measures. Potential environmental issues associated with this project, which may require management, are discussed below.

- **Soil erosion**

Soil damage includes compaction and disturbance of the profile. Soil erosion involves transport of the soil down slope by running water or, more rarely but still a significant factor, away from the site by wind. Soil compaction and disturbance, usually accompanied by vegetation and litter layer damage, are preconditions for accelerated soil erosion. Most soil damage occurs as the result of movement of machine, trucking, and to some extent through felling of trees during excavation works. Soil erosion depends not only on soil damage but also soil type, rainfall, and angle and length of slope.

Soil erosion is mostly anticipated on steep slope of Gisozi, cross river point and river. Without adequate water management on site, soil erosion will persist and result in loss of soil and sedimentation of nearest Nyabarongo and Nyabugogo rivers affecting rivers characteristics as well as aquatic ecology. Contamination of soil may occur from the spillage of oils and lubricants during construction and operation activities. Degradation of the surrounding soil will affect flora and fauna and may restrict the future land use.

- **Mitigation measures proposed:**
  - **Pipe installation in cross river sections**

Six river cross places have been identified and after exploring different construction methods such as pipe beam bridge and lead-pipe jacking method, the Lead Pipe Jacking Method was selected. Pipe Jacking Method was selected by considering construction cost which is relatively low, easy to maintain and its impact on the river bank which is low compared other methods. The potential negative impacts are health and safety related because the ground is soft and the groundwater level is high . The proposed mitigation measures include:

- to dewater from shafts by a pump. For the sake of safety,
- use plural pumps
- Where necessary sandbags are needed to be installed near the Launch shaft to divert river water to the opposite side of the river

  - **Pipe installation on steep slop**
    - Setting safety fence at bottom of the slope made by wooden/steel pile with mesh wire
    - Setting mono-rail in order to carry the dug soil out of the site.

- Manual-excavating and carrying the dug soil.
- Constructing concrete foundation and the stairs to carry the pipes on the foundation.
- Installing pipes and welding joint.
- Fixing pipes by covering with the concrete at some points.

- **Changes of landscape - Visual impact**

Impacts on the physical environment will consist of landscape transformation causing visual impacts. Installing water pipe, river cross bridge and water pump station will alter slightly the landscape at some localities. These impacts will remain during operational phase. 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.

➢ **Mitigation measures**

- to clear only the area demarcated for construction;
- Rehabilitation of construction sites.

- **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.

Limited construction activities may have to continue on a 24 hour basis increasing the exposure time of the workers and community people to noise. These impacts are of temporary nature.

➢ **Proposed mitigation measures include the:**

- limitation of heavy works in daytime 6am to 7pm;
- Provision of PPE to workers;
- If necessary, local residents should be given notice of intended noisy activities so as to reduce degree of annoyances.
- Workers operating equipment that generates noise should be equipped with noise protection gear.
- A regular monitoring of noise will be conducted as to check the compliance of noise pollution with permissible level.
- As most of the expected noise is from vehicles, truck and machines, the contractor will be requested to use equipment in good condition and certificate of technical control will be required.

- **Air Quality / dust releases and nuisance**

Exposed surface areas with loosened topsoil combined with the operation of plant and machinery will increase dust raised from the site, especially during initial levelling and preparation required under each phase of the project. Dust will also be raised by haulage vehicles delivering materials to the site; this is expected to pose a problem off-site as access roads are not paved. The dust raised during construction can pose a nuisance to workers although the impact of this is considered relatively small and localized. Dust levels are likely to be higher at certain strategic locations on the site such as stockpile areas during the off loading of gravel and aggregate. Dust raised by construction activities can also pose a nuisance to adjacent settlements especially under dry and

windy conditions. The impact of this affecting some parts of the settlements around the construction sites is potentially significant although intermittent.

It can be anticipated that a certain amount of air borne particulate matter (dust) will be generated by earth moving activities during construction phase of water treatment plant and water reservoirs. This situation will be worse during the dry season and during the afternoons when the winds are most prevalent. Air borne particulates may pose a hazard to residents in the vicinity or downwind of the construction site that suffer from upper respiratory tract problems.

- **Mitigation**

- Access roads and exposed ground should be regularly wetted in a manner that effectively keeps down the dust.
- Workers on the site should be issued with dust masks during dry and windy conditions.
- Most of the emissions are expected to come from vehicles, tractors and machines to be used. The contractor will be required to present technical control certificate for all vehicles, machines and trucks. Those certificates are issued by National police and are issued only when the vehicle emission is below the maximum permissible limit.
- A regular monitoring on ambient air will be conducted to check the level of air pollution. In the case the level exceeds the minimum permissible air pollution level, the developer will be required to reduce his emissions

- **Water pollution**

Laboratory test shows that Nyabugogo river is already heavily polluted with a lot of sediments(see baseline data in Chapter 4). During the installation of pipeline especially at river crossing section, additional sediment are likely to go to the river.

- **Mitigation measures**

- in addition to the respect of 10 meter river buffer zone where possible the same technical design used to avoid soil erosion apply here including ;
- Before starting to use heavy equipment near the river side, the soils of the riversides have to be replaced with the durable materials in order to prevent it from falling into the river;
- Construction period: should be during the dry season;
- After preparing for the Launch and Reception shafts, centrifugal reinforced concrete pipes are inserted into the ground as pipe sleeves by hydraulic jacks;
- The soils inside the pipes are excavated by hand. If the ground conditions are not good, the soils are excavated using a high-pressure jet, and this makes it possible to make sure of the safety by keeping a certain distance between workers and cutting head;
- After installing pipe sleeves, water pipes are inserted inside them, and aerated light-weight concrete is filled up between the pipe sleeves and water pipes in order to fix the water pipes in concrete.

- **Alteration of hydrology and wetland**

The installation off the pipeline below the wetland will alter the features of the wetland and therefore alter their hydrology (flow and water turbidity). Temporary loss of habitat and

component species within the construction corridor. The construction phase will involve the use of heavy machines and vehicles and increase of circulation of people. For different purposes laydown yards will be needed, as for storage of parts and construction material, storage of pipes, parking of trucks and construction machines etc. and work camps have to be installed.

- **Proposed mitigation**

- Construction yard, equipment maintenance area should be placed far from water bodies and wetlands;
- For the installation of water pipe in the marshlands appropriate construction method is considered and consist at open cut method that will be taken by backhoe excavating by the backhoe, however, the contractor shall be careful the cutting angle not to collapse the soil because the soil is very soft.

- **Solid waste management**

Solid waste generated during site preparation and construction work would include cut vegetation and typical construction waste. This waste would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Cleared vegetation burnt onsite would generate smoke, possibly impacting negatively on ambient air quality and human health.

- ✓ **Mitigation**

it is anticipated that about 41,000m3 of construction waste will be generated. To manage this amount of waste it is proposed:

- A temporary storage place is established
- Transporting to the Dump site where 14km away from the construction site is.
- Waste recycling is also an option whereby construction companies can use recycled soil and concrete debris as road bed materials, but they have to inform the sources of materials to the City

- **Quarries and burrow pits**

It is anticipated that the project will need construction material such as sand and stones. Therefore, it is appropriate to give consideration to the environmental implications in selection of quarry sources since poorly run operations create dust problems, contribute noise pollution, Occupational health and safety of their employees, or environmental degradation in general.

- ✓ **Mitigation measure**

- To ensure adequate mitigation of potential adverse impacts, only licensed quarrying operations are to be used for material sources. Efforts should be made to use material commonly found along the roadway as a construction material.
- Burrow pits areas shall preferably be selected from high land and/or waste land. Although locations of the borrow areas are negotiated between contractor and landowners. The excavation and restoration of the burrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Supervising Engineer, is required before final acceptance and payment under the terms of the contract.
- All borrow pits areas will be properly dressed maintaining drainage to outwards. The side slopes shall be provided with surfing. Topsoil from the opening of burrow pits from agriculture land shall be saved and reused in re-vegetating the pits to the satisfaction of the

Engineer/land owner. Additional borrow pits will not be opened without the restoration of those areas no longer in use.

- **Contamination of soil and water bodies due to oil spillage**

During the construction of proposed structure no heavy machinery is required but tracks, bulldozer and other equipment require re-fuelling, maintenance works and repair works, which in effect result in oil spillage. At point sources, contamination of soils and run-off ending in the receiving bodies could cause water quality degradation, if no mitigation measures are implemented. This impact can be considered of low magnitude, duration and spatial extent since it shall only be experienced during the early construction phases and few tracks will be used.

Mitigation Measure(s)

- Re-fuelling, oil change, maintenance works, repair works will need to allocated a restricted area, far from the water stream and marshland and preferably positioned in an area that have no adverse effects if degraded. E.g. site position for the guard's house construction.
- The area allocated for fuels shall need to have a cemented floor and a sand stock for use in the absorption of spilled oil.
- Water quality will be regularly monitored so as to compare the baseline and monitoring results. If during monitoring process water is contaminated, then additional measures will be taken.

7.2.4. Adverse impacts on biological environment

- **Loss of flora and fauna**

Some crops and trees established in the project area will have to be cleared where the pipeline and pump station will be installed. There is no plant or animal species of special conservation purpose surveyed that will be affected

✓ **Mitigation**

- This impact is unavoidable and will be mitigated through compensation measures which will include compensation of land, crops and trees.
- The site clearance should be only done on an area demarcated for construction;
- rehabilitation of construction site should include tree planting.

- **Disturbance of ecosystems habitats**

The clearing of existing vegetation will result in the complete loss of associated ecological habitats and their fauna, within the project area. Noise, vibrations, and intrusive activities related to construction works will tend to scare away any animals remaining on the site after vegetation clearance.

✓ **Mitigation**

Clearing and construction activity should be restricted to within the area of the development.

- **Impacts on bird habitat**

The project will be implemented near Nyabarongo marshland which is classified in Important Bird Area(IBA) and Construction works especially in the swamps may have adverse impact on bird's habitat. During the field survey we have seen that some birds are nesting in bamboos and under bridge. Construction and maintenance activities of the project can impact other nesting areas such as trees. This focuses on stream enhancement and re-vegetation, mowing, removal and maintenance of

structures and water-level management. The removal of live trees or standing dead trees (snags), native or non-native invasive vegetation removal, grubbing and clearing may disrupt bird nesting as birds can be found nesting anywhere.

✓ **Mitigation measures**

Basic mitigation principles include avoiding or minimizing habitat and species loss and any degradation to habitats and species populations. This will preferably comprise the avoidance of the key habitat areas, if at all possible. Mitigation measures should also consider periods times of the year that birds are more likely to be present or nesting in a project area. Actions that minimize the risk of taking an actual bird or disturbing a nest without stopping a project are also provided below.

- **Timing**

The best way to avoid disturbing birds is to schedule activities outside the nesting season. The nesting season is not the same for all species, and not all sites will have nesting birds present during the entire nesting season.

- **Non-nesting Season: August 1 – January 31** is the best time to plan for tree removal, invasive plant species management, and grubbing and clearing.
- **Nesting Season:** The nesting season can be divided into two major time- frames:

Primary Nesting Season: April 15 – July 31 is the primary nesting season. Disturbance to vegetation should be avoided during this time. This includes songbirds and the majority of species. Willow flycatchers are late nesters, often extending to the end of August. As they leave the nest, young birds go through the fledgling phase. They are often seen on the ground, flightless and unable to fend for themselves, however the adults are nearby and tending to them. June and July are peak months for fledgling activity. They often take shelter in low vegetation and are highly vulnerable to a variety of human disturbances at this critical time.

Note: If birds are not present during nesting season, vegetation removal and other disturbance activities may proceed

- **Nesting Habitats**
  - **Trees:** Stick nests of hawks, crows, and jays placed in tree canopies are among the most conspicuous and familiar signs of nesting birds. These are the easiest to detect and the easiest to avoid.
  - **Shrubs:** The majority of nesting birds build a cup nest in dense vegetation in the shrub layer, often close to the ground. These species – sometimes called "tangle nesters" – complicate reasonable efforts to avoid taking protected birds. Willow flycatcher, a species in decline.
  - **Ground:** Many species place a well concealed nest on the ground in either open areas or forested habitats. Examples include meadowlarks, harriers, killdeer and Wilson's warblers.
  - **Cavity:** Rather than concealing a nest in vegetation, dozens of local species use cavities. These are often in dead or dying trees, but can also be in the ground or in a variety of structures in the urban environment. Tree swallows, Bewick's wrens and downy woodpeckers are common cavity nesters.
  - **Stream banks:** The northern rough-winged swallow and the belted kingfisher are "cut bank" nesters, meaning they use holes excavated in stream banks for nesting. Sometimes they even use holes on steep slopes of dirt stock piles.

- **Structures:** Many birds use human-made structures for nesting. In addition to using bird boxes that are intended for such use, birds will nest on bridges, under house eves, on building ledges, utility and light poles, on railroad tracks and even on gravel roads.

➢ **Mitigation measures:**

- Working areas should be zoned out to reduce ecological destruction
- The contractor should only clear the area indicated for construction and avoid to spread soil in the wetland
- The contractor will keep the top soil and will use it to restore disturbed natural sites through environmental rehabilitation; restoring top soils and (re-) introduce genetic species similar to those destroyed in order to re-establish the natural local ecology where these no permanent infrastructure.

CHAPTER VIII: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The Environmental Management and Monitoring Plan (EMMP) are broadly divided into two parts one is the Environmental and Management Plan (EMP) and an Environmental and Monitoring Plan**.** The Environmental Management Plan translate the proposed mitigation measures into actions and provides management measures to be undertaken during the construction and operational phases of the project. The Environmental Monitoring Plan details monitoring activities and measures to be undertaken during construction and operation. WASAC Ltd should designated an environmental officer who will make day to day follow up (e.g. supervision and liaising with stakeholders). The EPC contractor will also required to have an Environmental, Social. Health and Safety on the implementation team to follow up the implementation of EMP. The estimated costs for implementation of the mitigation measures are just indicative. Appropriate bills of quantities should clearly give actual figures. In any case the consultant used informed judgment to come up with these figures.

8.1. Environmental Management Plan (EMP)

The EMP is presented in tabular form and provides the activity that leads to the adverse impact, the anticipated impact, the proposed mitigation measures, the implementation schedules, responsibility.

Table 49: Environmental Management Plan

Environmental concerns	Suggested mitigation measures	Responsible	Monitoring	Estimated Cost(US$)
CONSTRUCTION, OPERATION PHASES AND DECOMMISSIONING PHASES				
- Overall environmental management	- Designated an Environmental Supervisor to oversee environmental management, environmental training, and the implementation of environmental policies; - Appoint ESHS Manager in EPC contractor team to assist with sampling, monitoring and daily environmental compliance; - Provide environmental training to all employees.	WASAC Ltd Contractor	REMA/WASAC	15,000
- Occupational health and Safety (OHS)	- The safety and sanitation plan is formulated and safety trainings are provided for workers - Ensure all employees have health insurance; - Provide workers and visitors with the necessary personal protective equipment (PPE); - First aid Kits	Contractor	REMA/WASAC/Districts	4,500
- Child labour, forced labour and discrimination	– Protect workers' rights; – Establish, maintain, and improve the employee–employer relationship; – Promote compliance with national legal requirements and provide supplemental due diligence requirements where national laws are silent; – Comply with international Labour Organization, and the UNICEF Convention on the Rights of the Child, where national laws do not provide equivalent protection; – Protect the workforce from inequality, social exclusion, child labour, and forced labour;	Contractor	REMA/WASAC/Districts	NA

- High expectation of the local communities in relation to job posts	- Disclosure the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work; - Involvement of local leaders; - 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 authorities	Contractor	Local authorities WASAC	NA
- High expectations of getting great compensation in cases of resettlement	- Expropriation and compensation mechanisms should be implemented in all justifiable cases	WASAC Ltd	- WASAC, - MININFRA, - Local authorities	RAP budget
- Conflicts among workers and the local population in the project area	- Keeping a good relationship with local communities - Establishment and implementation of set of rules for the workplace	Contractor and WASAC	Local authorities	Operational Cost
- Impacts on public utilities such as spring water/wells or water supply pipe and electrical cables	- Rehabilitation of affected structures and infrastructures; - Identification of new water source and construct alternative water spring.	Contractor and WASAC		Construction cost
- Risk of destruction or disruption of infrastructure and social and economic loss infrastructure	- Minimize the affected population by occasional changes in the route of pipelines; - Providing a due compensation in coordination with local authorities and project proponent;	WASAC Ltd	- Local authorities	Budget provided in RAP
- Health related issues due to dust emissions	- Use of wet processes; - Use of Personal Protective Equipment	Contractor	WASAC/Local authority	-
- Risk of increase of HIV/AIDS and other Sexually Transmitted Diseases	- Providing surveillance and active screening and treatment of workers - Providing health and hygiene training - Preventing illness among workers in local communities - Providing health services	Contractor	Ministry of Health/Local Authority	4,000
- Gender based violence and sexual Exploitation and Abuse(GBV/SEA	- Preparation and implementation workers Code of conduct - Conduct GBV/SEA awareness	Contractor	WASAC/Local authority	3,000
- Safety and security	- Install safety and warning signage as appropriate - Provide safety training to all workers	Contractor	WASAC, / Local Authority	2000

- Soils erosion and compaction	- Restrict the activities to the minimum possible; - Use appropriate machinery and/or protective boarding during soil stripping; - Remove and stockpile topsoil, sub-soils and any parent material separately;	Contractor	REMA/WASAC	Construction cost
- Changes of landscape - Visual impact	- Rehabilitate working area with trees and grasses	Contractor	REMA/WASAC	2,000
- Noise and vibration emissions management	- Restrict construction and operation of heavy machines to daylight; - Ensure noise emissions are kept within the Rwanda standards; - Reduce needed truck movements by careful planning of needs of construction material; - Regular and effective equipment maintenance in order to ensure all machinery is in good working order and use does not generate excess noise/vibration.	Contractor	- REMA; - WASAC, - Local authority	Operational cost
- Risk of Alteration of hydrology and wetland	- Watercourse crossing must be designed to avoid affecting the stability and long-term performance of riverbanks and flood defences; - Consider the seasonal sensitivity of ecological resources when planning river crossings; etc.	Contractor	- REMA, - RWFA, - Local authority	Construction budget
- Disturbance of wildlife by noise	- Restrict construction activities and operation of heavy machines to daylight, when most wildlife is active and can react to noise.	Contractor	- REMA, - district	-
- Loss of vegetation cover and plant diversity	- Align the excavations to follow existing parallel water pipeline in order to minimize the loss of vegetation cover; - In areas of dense vegetation cover, the removal of vegetation must be restricted to the minimum necessary width; etc.	Contractor	REMA,/WASAC	-
- Disturbance and mortality of terrestrial fauna	- Restrict construction activities do the daylight; - Inspect the area to be cleared for any terrestrial fauna before bush clearing and digging; - Protect any trench left overnight with a net fence to block fauna from being trapped inside; - Capture and release fauna away from the direct influence zone (including species trapped in the trenches);	Contractor	- REMA, - Self-monitoring by WASAC	-

- Disturbance of ground Water Quality	- Consider measures to prevent pollution of ground water while designing the sludge storage site; - Storage site shall follow the appropriate regulation of Waste Management	Contractor	- REMA, - WASAC	-
Air Quality Management	- Minimizing dust from open area sources, including storage piles; - Managing emissions from mobile sources,	Contractor	- REMA, - WASAC	-
	- Dust suppression techniques should be implemented, such as applying water or non- toxic chemicals to minimize dust from vehicle movements,	Contractor	- REMA, WASAC	3,000
	- Avoiding open burning of solid.	Contractor	REMA, WASAC	-
- Solid wastes management	- 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; etc	Contractor	REMA, WASAC	2,500
- Management of Hazardous Materials and Oils	- Waste separation must be conducted on site; - Maintenance of trucks and machines should be done far from water sources	Contractor and WASAC	- REMA, - WASAC	-
Total estimated Cost				36,000

8.2. Environmental Monitoring Plan

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. Monitoring includes:

- Visual observations;
- Selection of environmental parameters/indicators at specific locations;
- Sampling and regular testing of these parameters.

Environmental monitoring programs for this project should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents and resource use. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored.

- **Water Quality Monitoring**

Construction and operation phases of this kind of project are often a source of significant surface and groundwater pollution if not managed and sited properly. It is recommended therefore that WASAC undertake monitoring of groundwater and any effluent or wastewater discharged from the present project activities. Parameters to be monitored includes: PH, TSS and turbidity

- **Noise and vibration level monitoring**

Periodic sampling of equipment and generally around the project site should be undertaken. Noise level monitoring could be supplemented by consulting with Project Affected People to identify the level of monitoring and impact of noise.

- **Soil erosion monitoring**

The project is not likely to have major impact on soil quality but soil erosion is anticipated and regular monitoring is required. Soil stability, riverbank protection, soil stockpiling and step soil protection should be monitored.

- **Monitoring of Accidents/incidence**

WASAC and Contractor must make sure that appropriate signs are posted at appropriate locations/positions to minimise/eliminate risk of accidents.

The following parameters could be used as indicators:

- Level of awareness of communities pertaining to dangers/risks associated with the project; and
- Accident reports: records on actual accidents associated with the project.

- **Monitoring of Social impacts**

The monitoring of the social impacts of the project is based on the experience of the communities and households. Through survey and/or focus-group information gathering techniques the following impacts should be monitored with the help of local authorities and households.

- Employment and procurement: impact on the community of the jobs offered and material bought locally by the project
- Quality of life: impact of noise, vibration, dust, etc. related to Nzove- Ntora Principal Pipeline project on the daily life of households.

- **Community relationship**:

Impact of arrival of workers in the community on relationships in the community and with the workers. Number of workers should be recorded by sex/origin and age

- **Accident and incident**: Accident and incidence should be also monitored to ensure that mitigation measures are effective

The following table summarize all parameters to be monitored and the monitoring plan

Table 50: Environmental Monitoring Plan

Environmental items	Monitoring item	Parameter /Indicator	Location	Frequency	Responsible	Budget
Pre-construction and site mobilization phase						
Land expropriation, compensation payment and other support	Compensation for land and houses lost	Number of houses expropriated Area of land expropriated	Project area	Once before construction	WASAC Ltd	RAP monitoring
	Priority in employment	Number of PAPs who receive support such as priority in employment	Project area		WASAC/ local government	RAP monitoring
	Complaints resolutions	GRM log book	Project area		Districts/GRM Committees	RAP monitoring
Air pollution	Equipment and automobiles in good shape	Number of Automobiles with certification on site		As appropriate	Contractor	No cost applicable to monitor.
Water pollution	Surface water quality	(temperature, pH, TSS, Turbidity)	Upper site/ lower site of the river	Once	Contractor	500US$
Noise and vibrations	Noise and vibrations		WPT, Ntora, and 6 construction sites	Once	Contractor	1000US$
Construction phase						
Accident and incident	Complaint (in general such as noise, traffic jam, and accidents)	Records of complaints	Project area		Contractor WASAC	Operational Cost
Air Pollution	Equipment and automobiles in good shape	Regular inspection and maintenance	WPT, Ntora, and 6 construction sites	Daily	Contractor	No cost applicable to monitor.
	Spraying of water to reduce dust.	Records on water spay Level of dust (observation)	WPT, Ntora, and 6 construction sites	Daily	Contractor	Operational cost
	Regular inspection of electrical installations, Fire	Number of fire extinguishers and	WPT, Ntora, and 6	Quarterly through the construction	EPC contractor	150US$/ trip to

Environmental items	Monitoring item	Parameter /Indicator	Location	Frequency	Responsible	Budget
	extinguishers, water tanks	water tanks Records of inspection	construction sites	phase		inspect.
Water pollution	Surface water quality	temperature, pH, TSS, Turbidity	Upper site/ lower site of the river	Quarterly	Contractor	3,500
Noise and vibrations	Restriction of noise/vibration emitting activities to working hours.	Noise level Vibration level	WPT, Ntora, and 6 construction sites	At the time of earth works or concrete vibrations.	Contractor	Cost of a sound meter level is about 350 US$. Vibration meter 500US$
Soil pollution	Check prevention measures of oil contamination	Keep records or not	WPT, Ntora, and 6 construction sites	Monthly	Contractor	Operational Cost
Soil erosion	Check the conditions of river bank and steep slope along the pipeline route	Keep records of conditions	Steep slopes 6 river crossing places	Monthly	Contractor	Operational Cost
Waste	Management of excavated soil Management of concrete debris and others	Reuse or not Proper management or not	WPT, Ntora, and 6 construction sites	Monthly	Contractor	Operational Cost
Ecosystem	Reforestation to offset lost grasses and trees Management of top soil	Number of planted hectares (ha) Number of trees planted	WPT, Ntora, and 6 construction sites	Every quarter of a year	Communities/Districts / Contractor	Operational Cost
Work conditions	Occupational Safety and Health plan	Availability of OHS Plan		Quarterly through the construction phase.	Contractor	Operational Cost
	Meetings and trainings	Number of meetings and trainings				
	Safety gear for workers	Number of workers with safety gear	WPT, Ntora, and 6 construction sites			
	Noise and vibrations	(from noise and vibrations)	WPT, Ntora, and 6 constructio	(from noise and vibrations)		

Environmental items	Monitoring item	Parameter /Indicator	Location	Frequency	Responsible	Budget
			n sites			
	Occurrence of accidents and injuries	Records of accident and injuries	Project area	Monthly		
Accident/ Traffic congestions	Traffic management Plan and traffic signage	Availability of TMP Number of traffic signage	Project area	Monthly	Contractor	Operational Cost
HIV and other diseases	Health and sanitation for labor workers and local communities	Number of trainings		Quarterly through the construction phase.	Contractor	Operational Cost
Water use	Check springs and well along the construction route	Conditions of springs and wells	Targets springs and wells	Quarterly through the construction phase.	Contractor Community/ Local government	Operational Wells
Child and forced labour	Minimum working age and working condition	Employment record by age	Construction areas	Monthly	Contractor /Local government	Operational Cost
Operation phase						
Noise and vibrations	Noise/vibrations	Noise and Vibration level records	WPT	Once/year	WASAC	Operational cost
	Total cost for monitoring					**5,850 US$**

8.3. EMP implementation arrangements

8.3.1. Overall implementation responsibility

The overall responsibility of implementation of this EMP is under Contractor and Water and sanitation Corporation. WASAC will designate one of its officers to act as Environmental and Social Safety Officer (EO), to formally address environmental and social issues on a routine basis, who will have an oversight of environmental aspects of the construction contracts, including the enforcement of all monitoring provisions, the locations of construction and labour camps, etc. The Contractor will also have an Environmental Health and Safety Manger (ESHS)and Social management officer to oversee the implementation of project during construction. The main duties of the designated Environmental officers will include:

- Review designs to ensure their adherence to the environmental and social specifications and the requirements of the Environmental and Social Management Plan (EMP).
- Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by REMA.
- Co-ordination with government departments on environmental and social issues and obtaining the necessary clearances from the regulatory authorities.

- Monitoring the environmental aspects during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the ESMP are implemented.

8.3.2. Environmental and social training

The training program will cover measurement techniques in the field, tools for the prediction of pollutants, conservation of water bodies including marshy lands, etc. Rwanda Environmental Management Authority, Rwanda Bureau of Standards and Rwanda Development Board may be consulted for such training. The need for additional and specialised training will be examined and appropriate training will be undertaken as required. Training of personnel to be deployed on the proposed project during construction and operation, with regard to environmental requirements should be the integral part of the planning. In addition all employees will be trained on safety, methods of disaster prevention, action required in case of emergency, fire protection, environmental risk analysis etc. Capacity to quantitatively monitor water sediments or turbidity (by suitable portable test equipment) and noise is always advantageous, but monitoring will primarily involve ensuring that actions taken are in accordance with contract and specification clauses, and specified mitigation measures. Training will be provided to the Contractor personnel to ensure the project is implemented in compliance with this EIA/EMP provision.

8.3.3. Monitoring and reporting procedures

The WASAC designated ESHS officer will visually assess contractor's practices and, if high pollutant levels are suspected instruct the contractor to make corrections. Photographic records will be established to provide useful environmental monitoring tools. A full record will be kept as part of normal contract monitoring. All applicable regulations need to be enforced by the Project Manager and designated ESHS manager. Under the environment organic law (2005) water quality discharge standards, air pollution emission standards and noise standards have been established. It is a legal obligation of the Contractor that any discharges from the work sites meet these standards. Steps will be taken by the Project Manager and designated ESHS manager to ensure that regular monitoring of water quality parameters such as pH, suspended solids, turbidity, Magnesium, oil and grease be carried out as provided in the contract. Regular monitoring of noise and dust will also be carried out as provided in the environmental monitoring program.

8.3.4. Record keeping

Monitoring form should be devised for documentation, analysis and record of parameter. The form should focus attention on environmental issues and provide feedback for the future stages of the work. Mitigation and enhancement measures adopted in final design will be explicitly under the Bill Of Quantities (BOQ) so that performance and completion is readily documented. Daily project diaries would record environmental problems (spills, dust, noise, etc.) as well as safety incidents and will be retained as part of accepted modern contract management and summarized in Quarterly Environmental Reports.

8.3.5. Implementation schedule

The most important aspects of the implementation is the appointment of the Environmental Officer at WASAC level and at Contractor level to oversee the implementation of the environmental mitigation measures incorporated in the design and contract specifications. Most of the planned mitigation measure will be implemented along with project activities and is provided in Environmental Management Plan and Environmental Monitoring Plan.

CHAPTER 9. CONCLUSIONS AND RECOMMENDATIONS

9.1. Conclusions

The Scoping exercise has identified a number of issues pertaining to the proposed Kigali Bulk Water Supply Project. The issues/impacts have been assessed and described in some detail to gain an adequate understanding of possible environmental effects of the proposed project – from design to decommissioning, in order to formulate mitigation measures in response to negative aspects which have emerged. The Environmental Management Plan (EMP) provides a way forward for implementation of the identified mitigation measures. The EMP should be implemented as a prerequisite for a positive Record of Decision (RoD) by the appropriate authorities. The estimated costs of implementing the mitigation measures are just indicative. Appropriate bills of quantities should clearly give the actual figures. In any case the consultant has used informed judgment and cost for similar project to come up with these figures.

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

Based on the study, the Consultant is of the opinion that most of the potential environmental impacts identified can be mitigated. The proposed Environmental Management Plan and Environmental Monitoring Plan if implemented will safeguard the integrity of the environment. Given the nature and location of the development, the conclusion is that the potential impacts associated with the proposed development are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures.

9.2. Recommendations

In addition to the Environmental Management Plan and the proposed mitigation measures the EIA team came up with the following recommendations:

- Before the implementation, WASAC shall discuss with land owners and compensate the Person to be affected by permanent infrastructure,
- Affected people and local communities should be given priority in works;
- WASAC Ltd should connect the local communities so as to take advantages of this project;
- Where possible all project activities should be implemented beyond a buffer zone of 5m from river banks as to avoid any contamination between river and the project. Where the buffer zone is not possible, the proposed river cross method should be implemented
- A joint monitoring team should be established including representative of REMA, WASAC, City of Kigali, Nyarugenge and Gasabo district to regularly monitor the implementation of EMP.

- The implementation of the EMP should be integrated in overall project implementation and the reporting be the same.
- Mid-term environmental audit should be conducted to evaluate the effectiveness of proposed mitigation measures and provide corrective measures as appropriate.

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ANNEXES

Annex 1: Consulted people at central and district level

No	Institution	Contact person	Position	Contact
1	Rwanda Environment Management Authority		Environmental Inspector	
2	Rwanda Water and Forest Authority		In charge of Water Quality	
3	Water and Sanitation Corporation		In Charge of Planning	
4	Gasabo District		Land Survey & GIS	
5	Gasabo District		Environmental Officer	
6	Nyarugenge District		Land Management Team Leader	
7	Nyarugenge District		Environmental Officer	

Annex 2: People consulted at sector and cell level

No	Institution	Contact person	Position	Contact
1	Gisozi Sector		Land & Infrastructure Officer	
2	Gisozi Sector		In charge of development of Umurava village	
3	Gisozi Sector		Ubudehe President	
4	Gisozi Sector		In charge of communication and training in Ntora village	
5	Gisozi Sector		Leader of village in Gisozi Sector	
6	Gisozi Sector		In charge of development in Kanyinya village	
7	Gisozi Sector		SEDO/Masezero	
8	Gisozi Sector		In charge of social affaires	
9	Gisozi Sector		C/o In charge of development	
10	Gisozi Sector		Leader of Rukeli village	
11	Kigali Sector		Executive Secretary	
12	Kigali Sector		Executive secretary of Nyabugogo cell	
13	Kanyinya Sector		Executive secretary of Nzove cell	
14	Kanyinya Sector		Executive secretary of Sector	
15	Kanyinya Sector		Executive secretary of Nyamweru cell	
16	Gatsata Sector		Executive secretary/ Nyamabuye cell	
17	Gatsata Sector		SEDO/Nyamugali cell	
18	Gatsata Sector		Executive secretary of Sector	
19	Gisozi Sector		Executive Secretary of Sector	
20	Gisozi Sector		Executive Secretary/ Ruhango cell	

Annex 3: Participants to the scoping meeting Kanyinya sector, January 16th, 2018

No	Names	Institution/cell	Position/profession	Contact
1		Nyamweru	Photograph	
2		Nyamweru	Farmer	
3		Nyamweru	Farmer	
4		Nyamweru	Farmer	
5		Nyamweru	Farmer	
6		Nyamweru	Farmer	
7		Nyamweru	Farmer	
8		Nyamweru	Farmer	

9		Nyamweru	Trader	
10		Nyamweru	Trader	
11		Nyamweru	Motorcycle conductor	
12		Nyamweru	Farmer	
13		Nyamweru	Village representative	
14		Nyamweru	Housewife	
15		Nyamweru	Housewife	
16		Nyamweru	Trader	
17		Nyamweru	Housewife	
18		Nyamweru	Housewife	
19		Nyamweru	Housewife	
20		Nyamweru	Trader	
21		Nyamweru	Socio development officer	
22		Nyamweru	Security in village	
23		Nyamweru	Security in village	
24		Nyamweru	Housewife	
25		Nyamweru	Trader	
26		Nyamweru	Trader	
27		Nyamweru	-	
28		Nyamweru	Farmer	
29		Nyamweru	Farmer	
30		Nyamweru	Housewife	
31		Nyamweru	Housewife	
32		Nyamweru	Housewife	
33		Nyamweru	Housewife	
34		Nyamweru	Farmer	
35		Nyamweru	Commercial	
37		Nyamweru	Student	
38		Nyamweru	Agricultural	
39		Nyamweru	Executive Secretary	
40		WASAC	Planning	

Annex 4: Participant to the scoping meeting in Gatsata sector, January 9th, 2018

N0	Names	Institution/cell	Position/Profession	Contact
1		Nyamabuye	Technician	
2		Nyamabuye	House wife	
3		Nyamabuye	Security	
4		Nyamabuye	House wife	
5		Nyamabuye	Commercial	
6		Nyamabuye	House wife	
7		Nyamabuye	Commercial	
8		Nyamabuye	House wife	
9		Nyamabuye	chef of village	
10		Nyamabuye	Commercial	
11		Nyamabuye	Film player	
12		Nyakabande	Security	
13		Nyakabande	-	
14		Nyakabande	Commercial	
15		Nyakabande	-	
16		Nyakabande	Commercial	
17		Nyakabande	Commercial	

18		Nyakabande	House wife	
19		Nyakabande	House wife	
20		Nyakabande	Security	
21		Nyakabande	Commercial	
22		Nyamabuye	Technician	
23		Nyamabuye	Commercial	
24		Nyakabande	Technician	
25		Nyamabuye	House wife	
26		Nyakabande	-	
27		Nyakabande	Cell communication	
28		Nyakabande	-	
29		Nyamabuye	-	
30		Nyamabuye	-	
31		Nyakabande	Commercial	
32		Nyakabande	Commercial	
33		Nyamabuye	Umwunzi	
34		Runyonza	Umujyanama	
35		Nyakabande	-	
36		Kibaya	Social affairs	
37		Nyakabande	House wife	
38		Kanunga	-	
39		Nyamabuye	Commercial	
40		Nyamabuye	Farmer	

Annex 5:Participants to the scoping meeting with leaders in Gisozi sector , January 18th, 2018

NO	Names	Institution/cell	Position/Profession	Contact
1		Gisozi sector	Land and infrastructure officer	
2.		Gisozi sector	Social development	
3.		Gisozi sector	Executive secretary	
4.		Gisozi sector	Communication and training	
5.		Gisozi sector	Chef of village	
6.		Gisozi sector	Ubudehe President	
7.		Gisozi sector	Social development/Kanyinya village	
8.		Gisozi sector	SEDO/MASESERO	
9.		Gisozi sector	In charge of Social affaires	
10.		Gisozi sector	C/O Development	
11.		Gisozi sector	Chef of Rukeri village	
12.		BESST LTD	Consultant	
13.		BESST LTD	GIS	
14.		BESST LTD	EIA	
15.		WASAC	Planning	

Annex 6: Participants to scoping meeting with local community in Gisozi, 27, 2018

Number	Names	Telephone
1		
2		
3		
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Annex 7: Participants to the scoping meeting Kigali Sector, Nyabugogo cell, January 9th, 2018

No.	Names	Institution/ Cell	Profession/ Position	Contact
1		Nyabugogo	E/S	
2		Nyabugogo	Pension	
3		Nyabugogo	commercial	
4		Gatare	commercial	
5		Nyabugogo	Agriculture	
6		Kamenge	Information	
7		Nyabugogo	Agriculture	
8		Kamenge	Agriculture	
9		Kamenge		
10		Kamenge		
11		Kamenge		
12		Nyabugogo		
13		Nyabugogo		
14		Nyabugogo		
15		Kamenge		
16		Kamenge		
17		Kamenge		
18		Kamenge		
19		Nyabugogo	Agriculture	
20		Nyabugogo	V&C	
21		Kamenge	Agriculture	
22		Kamenge	Soudure	
23		Kamenge	Agriculture	
24		Kamenge	Agriculture	

25		Kamenge	Agriculture	
26		Kamenge	Agriculture	
27		Kamenge	commercial	
28		Nyabugogo	Agriculture	
29		Kamenge	Agriculture	
30		Nyabugogo	commercial	
31		Nyabugogo	Agriculture	
32		WASAC	Planning	

Annex 8: Participants the meeting before survey and assets inventory Ruhango cell, Feb.5th 2018

No	Names	Cell	Village	Contact
1		Ruhango	Umurava	
2		Ruhango	Umurava	
3		Ruhango	Umurava	
4		Ruhango	Umurava	
5		Ruhango	Umurava	
6		Ruhango	Umurava	
7		Ruhango	Umurava	
8		Ruhango	Rukeri	
9		Ruhango	Umurava	
10		Ruhango	Umurava	
11		Ruhango	Umurava	
12		Ruhango	Umurava	
13		Ruhango	Kanyinya	
14		Ruhango	Kanyinya	
15		Ruhango	Kanyinya	
16		Ruhango	Kanyinya	
17		Ruhango	Kanyinya	
18		Ruhango	Kanyinya	
19		Ruhango	Kanyinya	
20		Ruhango	Kanyinya	
21		Ruhango	Kanyinya	
22		Ruhango	Kanyinya	
23		Ruhango	Kanyinya	
24		Ruhango	Rukeri	
24		Ruhango	Rukeri	
26		Ruhango	Umurava	
27		Ruhango	Kanyinya	
30		Ruhango	Ntora	
31		Ruhango	Ntora	
32		Ruhango	Ntora	
33		Ruhango	Ntora	
34		Ruhango	Ntora	
35		Ruhango	Ntora	
36		Ruhango	Ntora	
37		Ruhango	Ntora	
38		Ruhango	Ntora	
39		Trinity Nusery and Primary School)	Ntora	
40		Ruhango	Ntora	

Annex 9: Participants to the meeting before survey held in Nyabugogo Cell, February 6th 2018

No	Names	Cell	Village	Contact
1		Nyabugogo	Kamenge	
2		Nyabugogo	Kamenge	
3		Nyabugogo	K amenge	
4		Nyabugogo	Kamenge	
5		Nyabugogo	Kamenge	
6		Nyabugogo	Kamenge	
7		Nyabugogo	Kamenge	
8		Nyabugogo	Gitikinyoni	
9		Nyabugogo	Gitikinyoni	
10		Nyabugogo	Gitikinyoni	
11		Nyabugogo	Gitikinyoni	
12		Nyabugogo	Gitikinyoni	

Annex 10: Participants the meeting before survey held in Nzove cell, February 7th 2018

No	Names	Cell	Village	Phone
1		Nzove	Rutagara I	
2		Nzove	Rutagara I	
3		Nzove	Ruyenzi	
4		Nzove	Rutagara I	
5		Nzove	Rutagara I	
6		Nzove	Rutagara I	
7		Nzove	Rutagara I	
8		Nzove	Ruyenzi	
9		Nzove	Ruyenzi	

Annex 11: Participants the meeting before survey heldin Nyamweru& Nyamabuye cell,9th 2018

No	Names	Cell	Village	Contact
1		Nyamweru	Bwimo	
2		Nyamweru	Bwimo	
3		Nyamweru	Bwimo	
4		Nyamweru	Bwimo	
5		Nyamabuye	Agakomeye	
6		Nyamabuye	Nyakabande	
7		Nyamabuye	Agakomeye	
8		Nyamabuye	Nyakabande	
9		Nyamabuye	Agakomeye	
10		Nyamabuye	Nyakabande	
11		Nyamabuye	Agakomeye	
12		Nyamabuye	Nyakabande	
13		Nyamabuye	Agakomeye	
14		Nyamabuye	Nyakabande	
15		Nyamabuye	Agakomeye	
16		Nyamabuye	Nyakabande	
17		Nyamabuye	Agakomeye	
18		Nyamabuye	Nyakabande	

Annex 12: Participants the meeting before survey held in Nyamugali cell, Feburay 14th 2018

1		Gatsata	Nyamugari	Karubimbura
2		Gatsata	Nyamugari	Akarubimbura
3		Gatsata	Nyamugari	Akarubimbura
4		Gatsata	Nyamugari	Akarubimbura
5		Gatsata	Nyamugari	Akarubimbura
6		Gatsata	Nyamugari	Akarubimbura

7		Gatsata	Nyamugari	
8		Gatsata	Nyamugari	
9		Gatsata	Nyamugari	
10		Gatsata	Nyamugari	
11		Gatsata	Nyamugari	
12		Gatsata	Nyamugari	
13		Gatsata	Nyamugari	
14		Gatsata	Nyamugari	
15		Gatsata	Nyamugari	
16		Gatsata	Nyamugari	

Annex 13: Participants to the meeting held in Kigali sector, at draft stage

N	NAMES	Position/Profession	Sector	Cell	Contact
1		Farmer	Kigali	Nyabugogo	
2		Farmer	Kigali	Nyabugogo	
3		Farmer	Kigali	Nyabugogo	
4		Commercial	Kigali	Nyabugogo	
5		Farmer	Kigali	Nyabugogo	
6		Farmer	Kigali	Nyabugogo	
7		Farmer	Kigali	Nyabugogo	
8		Self-employment	Kigali	Nyabugogo	
9		Farmer	Kigali	Nyabugogo	
10		Commercial	Kigali	Nyabugogo	
11		Commercial	Kigali	Nyabugogo	
12		Farmer	Kigali	Nyabugogo	
13		Driver	Kigali	Nyabugogo	
14		Farmer	Kigali	Nyabugogo	
15		Farmer	Kigali	Nyabugogo	
16		Farmer	Kigali	Nyabugogo	
17		Commercial	Kigali	Nyabugogo	
18		Farmer	Kigali	Nyabugogo	
19		Commercial	Kigali	Nyabugogo	
20		Farmer	Kigali	Nyabugogo	
21		Farmer	Kigali	Nyabugogo	
22		Farmer	Kigali	Nyabugogo	
23		Leader Nyabugogo village	Kigali	Nyabugogo	
24		Farmer	Kigali	Nyabugogo	
25		Farmer	Kigali	Nyabugogo	
26		Leader Kamenge village	Kigali	Nyabugogo	
27		Executive Nyabugogo cell	Kigali	Nyabugogo	

Annex 14: Participants to the meeting held in Kanyinya sector at drafting stage April 24,2018

No	NAMES	Position/Profession	Sector	Cell	Contact
1		Leader of Village	Kanyinya	Nyamweru	
2		Farmer	Kanyinya	Nyamweru	
3		Farmer	Kanyinya	Nyamweru	
4		Commercial	Kanyinya	Nyamweru	
5		Farmer	Kanyinya	Nzove	
6		Farmer	Kanyinya	Nyamweru	
7		Farmer	Kanyinya	Nyamweru	
8		Self-employment	Kanyinya	Nyamweru	
9		Farmer	Kanyinya	Nyamweru	
10		Commercial	Kanyinya	Nyamweru	

11		Commercial	Kanyinya		
12		Farmer	Kianyinya	Nzove	
13		Driver	Kanyinya	Nyamweru	
14		Farmer	Kanyinya	Nyamweru	
15		Commercial	Kanyinya		
16		Farmer	Kanyinya		
17		Farmer	Kanyinya		
18		Commercial	Kanyinya		
19		Farmer	Kanyinya		
20		Farmer	Kanyinya		
21		Commercial	Kanyinya		
22		Farmer	Kanyinya		
23		Farmer	Kanyinya		
24		Farmer	Kanyinya		
25		Farmer	Kanyinya		
26		Commercial	Kanyinya		
27		Commercial	Kanyinya		
28		Farmer	Kanyinya		
29		Farmer	Kanyinya		
30		Commercial	Kanyinya		
31		SEDO CELL	Kanyinya		

Annex 15: Participants to the meeting held in Gisozi sector at draft stage, April 28, 2018

No	Names	Position/profession	Cell	Village	Contact
1		Chef of Village	Ruhango	Rukeri	
2		Agent de l'Etat	Ruhango	Rukeri	
3		Engineer	Ruhango	Rukeri	
4		Teacher	Ruhango	Rukeri	
5		Law	Ruhango	Rukeri	
6		Commercial	Ruhango	Rukeri	
7			Ruhango	Rukeri	
8		Accountant	Ruhango	Rukeri	
9		Engineer	Ruhango	Rukeri	
10		Technician	Ruhango	Rukeri	
11		Construction	Ruhango	Rukeri	
12		Agent de l'Etat	Ruhango	Rukeri	
13		Teacher	Ruhango	Rukeri	
14		Commercial	Ruhango	Rukeri	
15		Construction	Ruhango	Rukeri	
16		Construction	Ruhango	Rukeri	
17		Construction	Ruhango	Rukeri	
18			Ruhango	Ntora	
19			Ruhango	Kanyinya	
20		Construction	Ruhango	Rukeri	
21		Commercial	Ruhango	Rukeri	
22		Agriculture	Ruhango	Rukeri	
23		Construction	Ruhango	Rukeri	
24		Security	Ruhango	Rukeri	
25		Security	Ruhango	Rukeri	
26		Technician	Ruhango	Rukeri	
27		Soudure	Ruhango	Rukeri	
28		Driver	Ruhango	Rukeri	
29		Driver	Ruhango	Rukeri	
30		Construction	Ruhango	Rukeri	
31		Government official	Ruhango	Rukeri	

Annex 16: Participants to the meeting held in Gatsata sector at drafting stage, May 8, 2018

No	Names	Sector	Cell	Village	Contact
1.		Gatsata	Nyamabuye	Mpakabavu	
2.		Gatsata	Nyamabuye	Rubonobono	
3.		Gatsata	Nyamabuye	Kibaya	
4.		Gatsata	Nyamabuye	Gisiza	
5.		Gatsata	Nyamabuye	Rubonobono	
6.		Gatsata	Nyamabuye	Mpakabavu	
7.		Gatsata	Nyamabuye	Mpakabavu	
8.		Gatsata	Nyamabuye	Mpakabavu	
9.		Gatsata	Nyamabuye	Mpakabavu	
10.		Gatsata	Nyamabuye	Kibaya	
11.		Gatsata	Nyamabuye	Mpakabavu	
12.		Gatsata	Nyamabuye	Mpakabavu	
13.		Gatsata	Nyamabuye	Mpakabavu	
14.		Gatsata	Nyamabuye	Mpakabavu	
15.		Gatsata	Nyamabuye	Mpakabavu	
16.		Gatsata	Nyamabuye	Mpakabavu	
17.		Gatsata	Nyamabuye	Mpakabavu	
18.		Gatsata	Nyamabuye	Mpakabavu	
19.		Gatsata	Nyamabuye	Mpakabavu	
20.		Gatsata	Nyamabuye	Mpakabavu	
21.		Gatsata	Nyamabuye	Mpakabavu	
22.		Gatsata	Nyamabuye	Mpakabavu	
23.		Gatsata	Nyamabuye	Mpakabavu	
24.		Gatsata	Nyamabuye	Mpakabavu	
25.		Gatsata	Nyamabuye	Mpakabavu	
26.		Gatsata	Nyamabuye	Rubonobono	
27.		Gatsata	Nyamabuye	Mpakabavu	
28.		Gatsata	Nyamabuye	Mpakabavu	
29.		Gatsata	Nyamabuye	Mpakabavu	
30.		Gatsata	Nyamabuye	Mpakabavu	
31.		Gatsata	Nyamabuye	Mpakabavu	
32.		Gatsata	Nyamabuye	Mpakabavu	
33.		Gatsata	Nyamabuye	Rubonobono	
34.		Gatsata	Nyamabuye	Mpakabavu	
35.		Gatsata	Nyamabuye	Mpakabavu	
36.		Gatsata	Nyamabuye	Mpakabavu	
37.		Gatsata	Nyamabuye	Mpakabavu	
38.		Gatsata	Nyamabuye	Mpakabavu	
39.		Gatsata	Nyamabuye	Mpakabavu	
40.		Gatsata	Nyamabuye	Mpakabavu	
41.		Gatsata	Nyamabuye	Mpakabavu	
42.		Gatsata	Nyamabuye	Mpakabavu	

Annex 17: List of birds species identified in the project area

No	X	Y	Order	Family	Common Name	Vernacular Name	Scientific Name	IUCN status	Species protected in Rwanda
1	168520	9784307	Ciconiiformes	Ciconiidae	African Open-Billed Stork		Anastomus lamelligeru	LC[2]	No
2	166960	9784306	Passeriformes	Motacillidae	African-Pied	Inyamanza	Motacilla aguimp	LC	No

[2] **LC: Least concerned**

					Wagtail				
3	171914	9786328	Charadriiformes	Charadriidae	Black-Headed Heron	Uruyongoyongo	Ardea melanocephala	LC	Yes
4	166396	9784785	Passeriformes	Ploceidae	Black-Headed Weaver		Ploceus melanocephalus	LC	No
5	166737	9784718	Pelecaniformes	Ardeidae	Cattle Egret	Inyange	Bubulcus ibis	LC	Yes
6	171471	9786058	Passeriformes	Ploceidae	Fan-tailed Widowbird		Euplectes axillaris	LC	No
7	170032	9784937	Passeriformes	Laniidae	Grey-Backed Fiscal		Lanius excubitoroides	LC	No
8	171875	9786229	Charadriiformes	Charadriidae	Grey-Headed Heron	Uruyongoyongo	Ardea cinerea	LC	Yes
9	166668	9784749	Pelecaniformes	Threskiornithidae	Hadada Ibis	Nyirabarazanay'inkara	Bostrychia Hagedash	LC	No
10	171527	9786055	Passeriformes	Nectariniidae	Olive-Bellied Sunbird	Umununi	Cinnyris chloropygia	LC	No
11	166668	9784749	Pelecaniformes	Threskiornithidae	Sacred Ibis	Nyirabarazanay'indagi	Threskiornis aethiopicus	LC	No
12	166617	9784764	Passeriformes	Ploceidae	Slender-Billed Weaver	Isandi	Ploceus pelzelni	LC	No
13	166953	9784352	Coliiformes	Coliidae	Spickled Mousebird	Umusure	Colius striatus	LC	No

Annex 18: List of plant species identified in the project area

No	Order	Family	Scientific Name	Vernacular Name	IUCN status	Species protected in Rwanda
1	Commelinales	Pontederiaceae	Eichornia crassipes	Amarebe	Not assessed	No
2	Lamiales	Bignoniaceae	Markhamia lutea	Umusave	Not assessed	No
3	Proteales	Proteaceae	Grevillea robusta	Gereveriya	Not assessed	No
4	Laurales	Lauraceae	Persea gratissima	Avoca	Not assessed	No
5	Fabales	Fabaceae	Erythrina abyssinica	Umuko	Not assessed	Yes
6	Lamiales	Verbenaceae	Lantana camara	Umuhengeri	Not assessed	No
7	Poales	Poaceae	Yushania alpina	Umugano	Not assessed	No
8	Fabales	Fabaceae	Acacia sieberana	Umunyinya	Not assessed	No
9	Poales	Poaceae	Pennisetum purpureum	Urubingo	Not assessed	No
10	Alismatales	Araceae	Colocasia esculenta	Amateke	Least Concern	No
11	Zingibenales	Musaceae	Musa spp.	Insina	Not assessed	No
12	Myrtales	Myritaceae	Eucalyptus sp.	Inturusu	Not assessed	No
13	Brassicales	Caricaceae	Carica papaya	Ipapayi	Not assessed	No
14	Sapindales	Anacardiacea	Mangifera indica	Umwembe	Not assessed	No
15	Poales	Cyperaceae	Cyperus papyrus	Urufunzo	Not assessed	No
16	Arecales	Arecaeae	Phoenix reclinata	Umukindo	Not assessed	No
17	Caryophyllales	Phytolaccaceae	Phytolacca dodecandra	Umuhoko	Not assessed	No
18	Fabales	Fabaceae	Acacia senegalensis	Umukonji	Not assessed	No

環境社会配慮調査報告書（RAP）

Japan International Cooperation Agency

FINAL REPORT

RESETTLEMENT ACTION PLAN FOR PROJECT OF STRENGTHENING NZOVE - NTORA PRINCIPAL WATER PIPELINE IN KIGALI CITY, REPUBLIC OF RWANDA

August, 2018

CONSULTANT CERTIFICATION

Name of the Project: STRENGTHENING NZOVE-NTORA PRINCIPAL TRANSMISSION PIPELINE IN KIGALI CITY, REPUBLIC OF RWANDA.	
Project Owner	Government of Rwanda/Water and Sanitation Corporation Limited
Source of funds	Government of Japan/Japan International Cooperation Agency
Nature of Report	Resettlement Action Plan (RAP)
Name of Consultant	Bureau for Environmental and Social Studies/BESST LTD
Team Leader	Mr. Théogène HABAKUBAHO
Sociologist	BENEMARIYA Emma
Chief Surveyor and assets inventory	NZAMURAMBAHO Etienne
GIS Expert	AYINKAMIYE Marie Ange Gisele
Chef data collection and Analysis	NSEKANABANGA Jovine

I hereby undertake that all requirements included in terms of reference provided by the client, I also undertake that the facts given in this Resettlement Action Plan report are factually correct to the best of our knowledge.

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REXECUTIVE SUMMARY

Project background

The Government of Rwanda with its partners is implementing project that consist at rehabilitation and extension of Nzove Water Treatment Plant. Phase one commissioned March 2016 increased the production from 65,000m3 to 90.000m3/day and Phase 2 which is under implementation will add 55,000m3/day to have the total capacity of 145,000m3/day. At present, Water & Sanitation Corporation(WASAC), has already maintain the principal transmission pipeline between Nzove and Ntora, but the demand for water supply is expected to be increased in the near future, and the Japanese and Rwandan Governments agreed to install another water pipe line between the two locations. In accordance with JICA guidelines on environmental and social considerations as well as national expropriation regulations, such project requires the preparation of Resettlement Action Plan

Objectives of the RAP

The objective of the RAP is to ensure immediate compensation or other supports to Project Affected Persons (PAPs) for their affected properties at the project sites prior construction. The present report principally describes the proposed Project components/activities and associated resettlement impacts. The RAP also provides the legal and regulatory framework for assets valuation, eligibility, and compensation. Estimated affected Person and assets and project affected Person, entitlement, compensation and resettlement measures, public consultation, Grievance Redress Mechanism (GRM), estimated budget, implementation, monitoring and reporting arrangement.

Approach and methodology of the study

To achieve the study objectives, the consultant followed procedures stipulated in JICA guidelines for environmental and social consideration and national expropriation and evaluations laws. The study adopted the following approach: (i) preliminary assessment and review of preliminary design of the projects, (ii) review of secondary data on baseline information (iii) review of policies and regulations, (iv) review of previous meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the project sites including socio-economic baseline data and assets inventory. Spatial data ,site locations, land cover, proposed infrastructure were described fully with clear maps using Global Position System (GPS) and Geographic Information System (GIS) tools for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation.

Project location and description

The proposed project is located in Kigali City in both Nyarugenge and Gasabo district. The principal pipeline will mainly follow the existing pipeline from Nzove Water Treatment Plant, located in Nzove cell, Kanyinya sector of Nyarugenge District, to Ntora water reservoir located in Ruhango Cell, Gisozi sector of Gasabo District.

Content of RAP

The present report principally describes the proposed Project components/activities and associated resettlement impacts. The report also provides the socio-economic baseline data, identified PAPs and inventory of properties/assets highlights to be affected, biography of the PAPs and the magnitude of

the properties to be lost. The RAP also provides the legal and regulatory framework for assets valuation, eligibility, and compensation.

Consultation

The persons to be compensated were meaningfully consulted and participated in planning and implementing the compensation process. Before and during the preparation of this RAP, consultative meetings were held on site to inform the PAPs that their properties or their income might at some point be destroyed or cleared to make way for the rehabilitation of irrigation facilities. In the meetings, PAPs got to know how the compensations will be done, their rights and their major role in the Project activities. Other meetings and interview were also conducted with implementing and regulatory institutions as well as different experts working on similar projects.

WASAC together with Nyarugenge and Gasabo districts will be responsible for implementation, monitoring and reporting the implementation of the RAP. Any aggrieved party may ask for justification of the decisions from the resettlement and compensation committee to be established, but should the answer still be unsatisfactory, they may appeal to the local authorities starting with the cell, sector and district authorities. If the grievances are not resolved in this way, the complainant should bring his case to local mediators known as «Abunzi» or court of law depending on the nature of complaint. WASAC Ltd and both districts will ensure that all PAPs appreciate the complaints procedure and will make sure each party involved fulfils its duties.

RAP budget

The proposed Nzove Ntora Principal water pipeline was designed in a way that avoid or minimize physical and economic resettlement impacts. However, the identification of project affected households revealed that 80 HHs and 8 corporation will be affected including two households who will lose their houses. Other households will be affected by losing either land, crops, trees or structures. According to the current market value and similar projects in Kigali City, the cost for RAP implementation and monitoring is estimated at **one hundred and fifty four million Rwandan francs (154,000,000) equivalent to 180,000USD**. This amount is provided for planning purposes and the real cost will be determined by an independent valuer. The budget for RAP implementation and monitoring will be born from government of Rwanda funds.

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ACRONYMS

BESST	: Bureau for Environmental and Social Studies
DDP	: District Development Plan
DLB	: District Land Bureau
EIA	: Environmental Impact Assessment
EICV	: Enquête Intégrale sur les conditions de vie
ESMF	: Environmental and Social Management Framework
FRW	: Franc Rwandais/Rwandan Franc
GDP	: Gross Domestic Product
GIS	: Geographic Information System
GoJ	: Government of Japan
GoR	: Government of Rwanda
HH	: Household
JICA	: Japan International Cooperation Agency
M&E	: Monitoring and Evaluation
MoE	: Ministry of Environment
NGO	: Non-Governmental Organization
OP	: Operational Policy
PAPs	: Project Affected Parties/People
RAP	: Resettlement Action Plan
REMA	: Rwanda Environment Management Authority
RLMUA	: Rwanda Land management and Use Authority
RPF	: Resettlement Policy Framework
ToRs	: Terms of Reference
UPI	: Unique Personnel Identification
USD	: United States Dollars
WB	: World Bank
WASAC	: Water and Sanitation Corporation

DEFINITIONS OF TERMS

Unless the context dictates otherwise, the following terms shall have the following meanings:

- **Census** is a data collection technique of completing enumeration of all Project Affected Households and their assets through household questionnaire.
- **Compensation**: means payment in cash or in kind to replace losses of land, housing, income, and other assets caused by a project.
- **Cut-off date**: This refers to the date prior to which the project affected family was in possession of the immovable or movable property within the affected zone.
- **Entitlement**: is defined as the right of project affected persons (PAPs) to receive various types of compensation, relocation assistance, and support for income restoration in accordance with the policy provisions.
- **House hold** includes a. person, his' or her spouse, minor sons, unmarried daughters, minor brothers, unmarried sisters, father, mother and other relatives residing with him or her and dependent on him or her for their livelihood; and includes "nuclear family" consisting of a person, his or her spouse and minor children.
- "**Involuntary Displacement"** means the involuntary taking of land resulting in direct or indirect economic and social impacts caused by:
    - loss of benefits from use of such land;
    - relocation or loss of shelter;
    - loss of assets or access to assets; or
    - loss of income sources or means of livelihood, whether or not the project affected person has moved to another location.
- **Land acquisition"** means the taking of or alienation of land, buildings or other assets thereon the land. ,
- **Loss of income:** In this A-RAP, loss of income is defined as the future benefit that was going to be gained if the project was not implemented.
- **Non-titleholder**: Affected persons/families with no legal title to the land, structures and other assets adversely affected by the project. Non-titleholders include encroachers, squatters, etc.
- "**Project affected persons" (PAPs)** means persons who, for reasons of the involuntary taking or voluntary contribution of their land and other assets under the project, result in direct economic and or social adverse impacts, regardless of whether or not Project affected persons physically relocate. These people may have their:
    - Standard of living adversely affected, whether or not the Project Affected Person must move to another location;
    - Right, title, interest in any house, land (including premises, agricultural and grazing land) or any other fixed or movable asset acquired or possessed, temporarily or permanently, adversely affected;
    - Access to productive assets adversely affected, temporarily or permanently;
    - Business, occupation, work or place of residence or habitat adversely affected.
- "**Resettlement and Compensation Plan**", also known as a "Resettlement Action Plan (RAP)" or

"Resettlement Plan" - is a resettlement instrument (document) to be prepared when subproject locations are identified. In such cases, land acquisition leads to physical displacement of persons, and/or loss of shelter, and /or loss of livelihoods and/or loss, denial or restriction of access to economic resources. When the projects affects lees than 200 households or the has low impacts, an Abbreviated Resettlement Action(A-RAP) may be appropriate;

- "**Resettlement Assistance"** means the measures to ensure that project affected persons who may require to be physically relocated are provided with assistance such as moving allowances, residential housing or rentals whichever is feasible and as required, for ease of resettlement during relocation,
- **Replacement cost/value**: Replacement cost is the cost of purchasing comparable assets elsewhere by the affected person in lieu of the acquired land, buildings, structures, and other immovable assets, etc.
- **Socio-economic survey**: is carried out in order to prepare profile of PAPs and to prepare for Resettlement Action Plan. The survey result is used (i) to assess incomes, identify productive activities, and plan for income restoration, (ii) to develop relocation options where applicable, and (iii) to develop social preparation phase for vulnerable groups.
- **Titleholder**: A PAP who has legal title to land, structures and other assets in the affected zone and the land has a unique personnel Identification;
- "**Vulnerable Groups**" refers to: a. Widows, the disabled, marginalized groups, low income households and informal sector operators; b. Incapacitated households – those no one fit to work and; c. Child-headed households and street children d. Including among other things, persons characterized by low nutrition levels, low or no education, lack of employment or revenues, old age, ethnic minority and/or gender bias.

Measurement unit and rates used

- 1 ha= 100 are
- 1 Are=100 sqm
- 1 USD=855 Frw (BNR exchange rate on May 15th , 2018

CHAPTER I: INTRODUCTION

1.1. Project background

The overall objective of water supply and sanitation policy is to ensure safe, reliable and affordable water supply services for all 100% by 2020. This will be achieved while strengthening the financial viability of the utility and ensure sustainable functionality of water supply infrastructure by developing effective management structures and well- regulated public private partnership (PPP) arrangements. To achieve this objective, the Government of Rwanda with its partners is embarked in different water supply projects including construction of new Water Treatment Plants and associated forwarding infrastructure, the rehabilitation and extension of existing Water Treatment Plants and strengthening the existing water supply network.

One of the major ongoing project is the rehabilitation and extension of Nzove Water Treatment Plant. Phase one commissioned March 2016 increased the production from 65,000m3 to 90.000m3/day in Kigali against the demand which is 120,000m3/day. Phase 2 which is under implementation add 55,000m3/day to have the total capacity of 145,000m3/day. Phase 2 involves upgrading production capacity of the existing 25,000m3day to 40,000m3/day and construction of a new treatment plant with initial capacity of 40,000m3/day with upgradable capacity of 65,000m3/day. At present, Water & Sanitation Corporation, WASAC, has already maintain the principal transmission pipeline between Nzove and Ntora, but the demand for water supply is expected to be increased in the near future, and the Japanese and Rwandan Governments agreed to install another water pipe line between the two locations.

1.1. Presentation project developer

Water and Sanitation Corporation (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.

1.2. Presentation of the consultant

Bureau for Environmental and Social Studies(BESST) is a Rwanda company registered with Rwanda Development Board (RDB).The company is licensed by Rwanda Association professional Environmental Practioners(RAPEP) with license number RAPEP/EA/O72(list Certified experts available at www.repep.org). The company has its headquarters in Kigali City, Gasabo district, KG 182st, Martin Plaza, second Floor. The company is specialized in EIA, RAP, climate change risk assessment, socio-economic assessment, baseline surveys, waste management, water and sanitation, advisory services in sectors ranging from Agriculture, energy development, Infrastructure and housing development, transport and water supply. For this specific assignment of preparation of EIA, the company used the following consultants:

- **Théogène HABAKUBAHO, Team leader –** He is an authorized EIA Lead expert**(RAPEP/EA/024)** . He holds a master of science in environmental science management and development and BSc in physical geography. He has over 12 years professional experience in the field of environmental assessment and management. He has worked on various projects as team leader of environmental studies. Key projects worked on include irrigation projects, green house agriculture, Water supply mining projects, road and bridge construction projects, building and house constructions, schools and hospitals, among others.

- **Mrs. Emma BENEMARIYA, Sociologist-** holds a Master of Development Studies and a bachelor's degree in Social Sciences. She is tasked with evaluation of social impacts associated with project and has led the socio-economist survey.

- **NSEKANABANGA Jovine, Statistician** : He is an experience data collection and analysis and he has a bachelor's degree in applied statistics with over five years in data collection and analysis. He supervised data collection, data entry and conducted data analysis.

- **NZAMURAMBAHO Etienne, Chief surveyor:** He is an experience land surveyor with bachelors degree in land survey and diploma in topography. He coordinated assets inventory and identification of project affected people.

- **AYINKAMIYE Marie Ange Gisele, GIS Expert:** She is an authorizer EIA Junior Expert (**RAPEP/EA/063).** She holds a bachelors degree in Environmental Management with solid knowledge in GIS and remote sensing. She assisted the team in data collection and mapping. She also participated in assets inventory. The above team was supported by field enumerators and data entry officers

1.2. Scope of the RAP

The aim of the RAP report is to develop an action plan that ensures that the PAPs livelihoods and standards of living are improved or at least restored, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. The scope of work undertaken during the RAP preparation included public consultation, PAPs identification, and assets inventory, establishment of legal and regulatory framework for assets valuation and compensation, monitoring and grievance redress mechanism. The provisional assets inventory and estimated cost was included in the RAP but shall be updated upon the completion of final design studies and compensation made prior construction.

1.3. Methodology

The preparation of this RAP results of the combination of desk study, field surveys and census as well as public consultation with PAPs and stakeholders. The desk study involved review of previous study documents and analysis of the proposed project maps; and field surveys to establish the location of the proposed dam, irrigation canals and related infrastructure. The field survey consisted on conducting household census of identified PAPs; conducting baseline socio-economic survey on the project area as well as census and measurement of lands and crops which are likely to be affected. Discussions with PAPs and key stakeholders including district administration was also another tools used along the preparation of this RAP.

1.3.1. Literature review

Review on the existing baseline information and literature material was undertaken to gain a further and deeper understanding of the project. Among the documents reviewed included the project inception report, JICA guidelines on environmental and social consideration, World bank OP4.12 on Involuntary Resettlement Expropriation and valuation law, Land law and land Policy, Resettlement Action Plan of Similar project or other project in Kigali City such as Abbreviated Resettlements Action Plan for Kigali Bulk Water Supply Project, Resettlement Action Plan for Kigali Gatuna Road and Resettlements Rwanda Urban Development Project funded by World Bank.

1.3.2. Field work

The consultant deployed surveyors/enumerator's team lead by a GIS expert and used a detailed questionnaire to collect socio-economic baseline data. Furthermore, the GIS expert and his team used a designed form to record all properties including land, crops and trees in submerged, borrow pits, disposal, access roads and camps site areas. The identification of all projects affected person was also done through field survey by GIS expert and surveyors. The provisional assets valuation was made based on similar project and prevailing market price in the area but it shall be updated upon the completion of final design studies and payment should be made prior construction work.

1.3.3. Public consultation

In compliance with national regulations and JICA guidelines on environmental and social consideration stakeholder engagement and public consultation was the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement involved, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation with stakeholders and participation, grievance redress mechanism(GRM), and on-going reporting to beneficiaries or PAPs.

From the scoping exercise, stakeholders were identified in two categories. First category made of implementing and regulatory agencies including government institutions, local administration and key experts in the area of irrigation and involuntary resettlement. Second category is made by potential project beneficiaries and/or project affected parsons. During the Public consultation, the RAP expert applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders were informed on the proposed project and anticipated resettlement implications, existing legal framework and provisions in relation to involuntary resettlement. Though the consultant guided discussions, most of the time was given to participants to provides, views, and comments and ask questions. For each meeting, key issues discussed were recorded and included in the RAP report together participants lists.

1.3.4. Social impact assessment

The proposed Project has positive social and economic benefit to the user's communities and individuals but it may also have negative impacts including loss of land, crops, trees and means of livelihood. Therefore, the consultant assessed both social benefits and negative effects of the proposed project on local population and users. The social impact assessment considered

permanent changes in land use and loss of property and other assets caused by occupation of land for the irrigation stricture, temporary changes in land uses caused by short term occupation of land for construction, and changes in accessibility to existing land uses resulting from the temporary or permanent presence of the Project.

1.3.5. Assets valuation methodology

As provided by the valuation law, the company certified valuer used the methodology whereby the proposed price for the real property is close or equal to replacement value. The valuar compared prices by referring to the prices recently assigned to a real property that is similar or comparable to the real property subject to valuation. Income loss were estimated based on investment cost, average production on one hectare, unit cost per 1kg for the last season times number of missed season. It is worth to note that the valuation done is just provisional and will be updated upon the completion of final design studies.

1.3.6. Content of the RAP report

The RAP report is structured into different chapters as follow:

- Executive summary
- Chapter I: Introduction and methodology
- Chapter II: Project description and location
- Chapter III: Legal and regulatory frame work
- Chapter IV: Socio-economic survey
- Chapter V: Public consultation
- Chapter VI: Impact assessment and compensation measures
- Chapter VII: RAP implementation and monitoring
- Chapter VIII : RAP budget
- Chapter IX: RAP disclosure

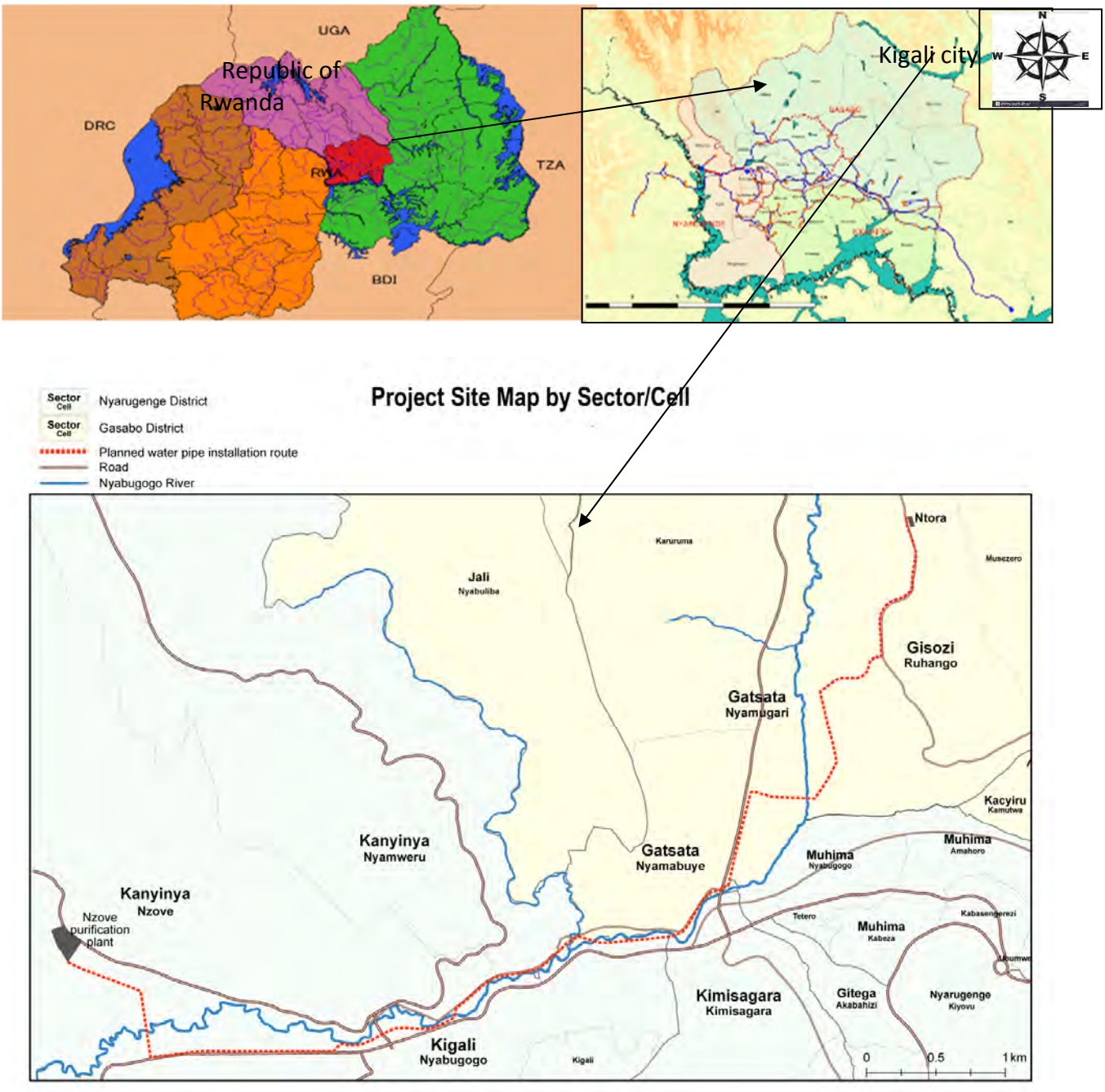
CHAPTER II: PROJECT DESCRIPTION AND LAND REQUIREMENT

Per as terms of reference but also best practices the EIA consultant is requested to describe the proposed project and its activities. The description of project activities shall be based on phases of project life cycle i.e. pre-construction, construction, operation, maintenance, and decommissioning phases. Therefore, this chapter provide the location of the project, projects component/activities in different phases and projects requirements in terms of material or associated facilities.

2.1. Project Location

Administratively, the proposed project is located in Kigali City in both Nyarugenge and Gasabo district. The principal pipeline will mainly follow the existing pipeline from Nzove Water Treatment Plant, located in Nzove cell, Kanyinya sector of Nyarugenge District, to Ntora water reservoir Located in Ruhango Cell, Gisozi sector of Gasabo District.

Figure 1: Administrative location of project area



Source: Project preliminary design rreport, JST, 2018

2.2. Description of the project

The proposed project of strengthening of Nzove-Ntora principal water pipeline will consist at installation of pipeline with 900mm diameter on a distance of 9.7 km from the Nzove water treatment plant located in Kanyinya sector of Nyarugenge district to Ntora Reservoir located in Gisozi sector of Gasabo district. The installation such pipe requires associated infrastructures such access roads, construction of 3 temporary cross river bridges, construction yard for material, construction material and equipment. Three new water pumps and new pump building is also part of the proposed projects. Initially, it was proposed to use the new pipeline with the exiting one but it was decided to use the new pipeline and increase its capacity to 900mm diameter.

2.2.1. Construction phase activities

The construction works will consist at installation of water pipe and river cross bridge as well as access road in some sections where the pipe passes far front existing road. As a result, of preliminary design, it is possible to install new pipeline in parallel with existing one, but it is difficult to physically arrange the following two areas side by side, and it is necessary to install a water supply pipeline with a new route. The proposed pipeline will cover a distance of 9.7 km and the pipe will have ◘900. Therefore, the area that would be cleared and excavated is about 9.8 m width if we consider access road. Figure 2 presents the proposed cross-section view of water pipe installation and Figure 3 present cross section view of excavation works.

- **Pipe installation activities:**

A still pipe of 900mm of diameter will be installed on a distance of 9.4 km from Nzove WTP to Ntora water reservoir. The installation of principal water pipeline will involve different activities including:

- Manufacturing and importation of pipe;
- Site clearance and excavation;
- Construction of temporary access road;
- Construction of temporary cross river bridge(3)
- Pipe installation with 6 tunnels;
- Concrete placement to protect water pipe ;
- Construction of a corridor for maintenance (steps made of concrete);
- Protecting pipes by covering with concrete

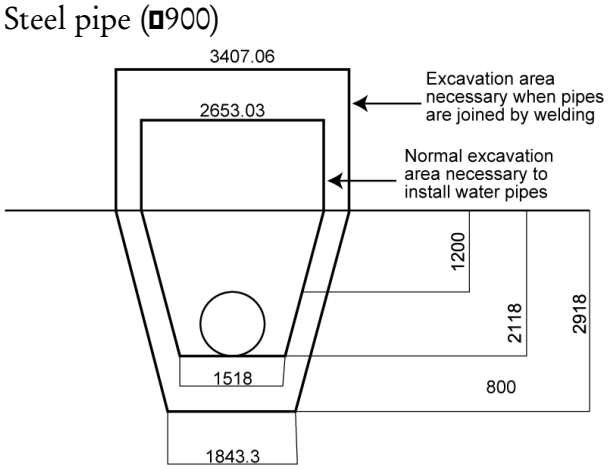
Figure 2: Proposed principal pipeline route

Source: Preliminary design study, 2018

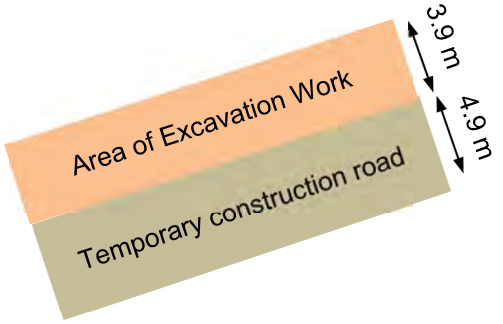
- **Installation work of water pipe at the marshland**

The proposed construction method is open cut method that will be taken by backhoe excavating by the backhoe. However, the contraction should consider careful the cutting angle not to collapse the soil because the soil is very soft.

Figure 3: Cross section view of water pipe installation in marshland



Cross section of excavation work at the marshland



Temporary construction road is prepared along the pipe installing route

Temporary construction road

Source Preliminary design study, 2018

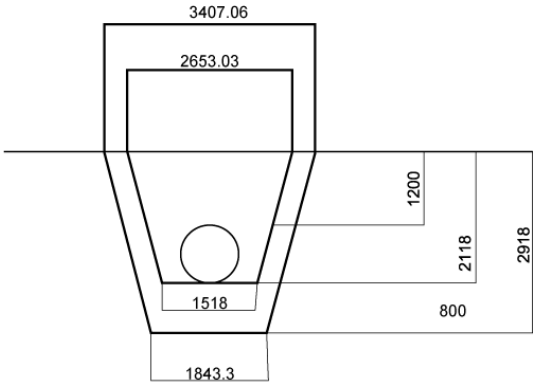
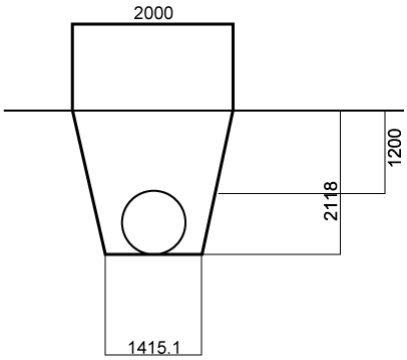
- **Cross river tunnels**

Three alternatives water pipeline routes were explored and the proposed one presented above has six river crossings. The water pipelines is planned to be installed under the river bottom by pipe jacking method at all the six river crossing places.

Figure 4: Location of river crossing places and temporary bridge

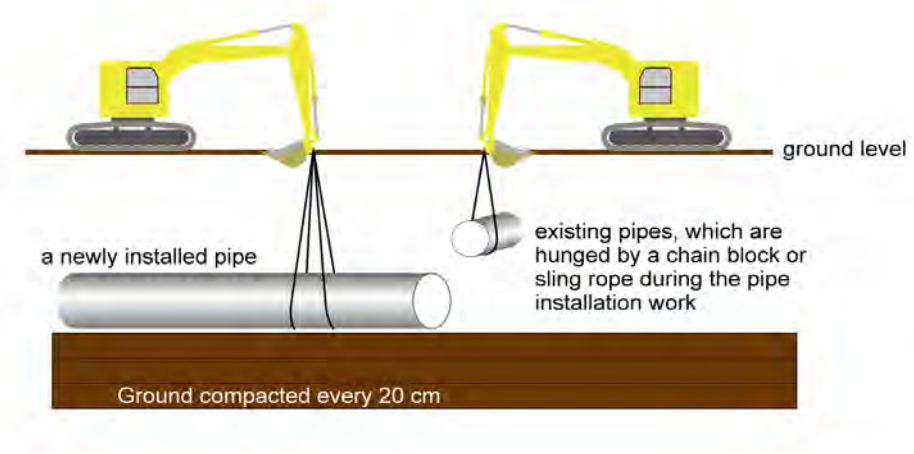
Source: Preliminary design Study, JST, 2018

Figure 5: Cross section of excavation work

Steel pipe (▯900)	Ductile cast iron pipe(▯900)
	
Excavation work in marshland	Excavation work in urban area (installing pipes under the pavement)

Source: Preliminary design, 2018

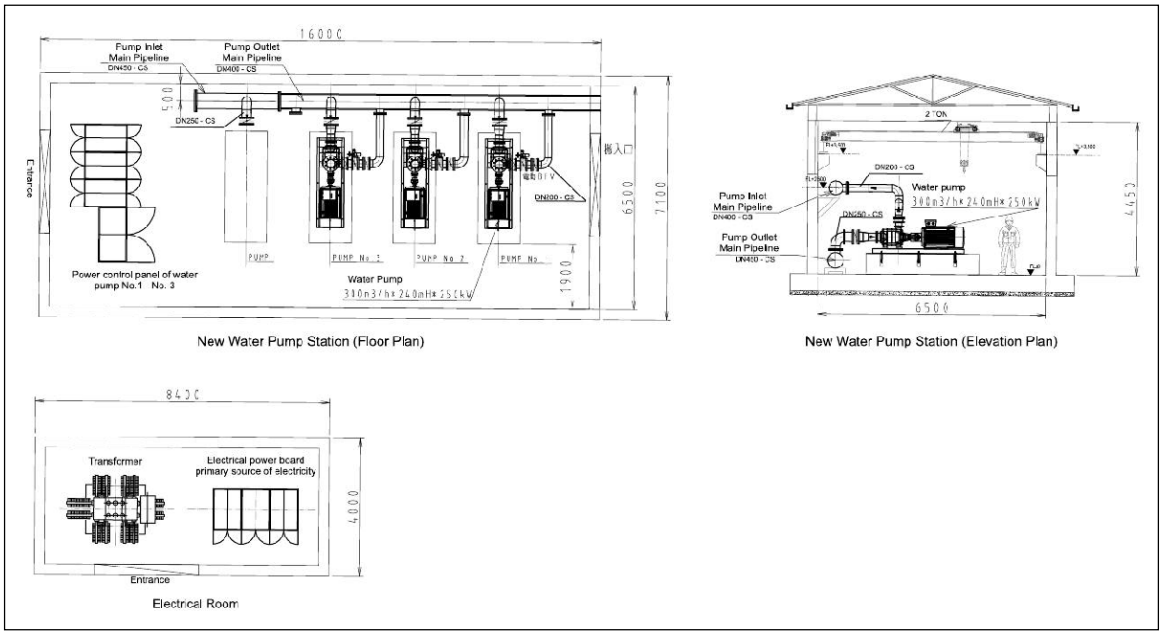
Figure 6: Representation of water pipe after installation



- **Construction of new water pump station**

A new water pipe is proposed and its components are presented in figure 8.

Figure 7: Proposed water pump station



Source: Preliminary design, JST, 2018

2.2.2. Project land requirement

The installation of principal water pipeline does not require much lands but it requires land clearance in construction area that may go up to 9.8 m. In some sections, such as Ntora, the excavation area have been reduced to 2.0 m to avoid private structures such as wall and fences. The permanent land take is expected only where pipe will be installed plus maintenance area, around 3.0 m but this land can be used under conditions. The remaining land will be used only during construction and after that owners will use it again. The lands to be affected include both private and government lands especially in the marshlands and along paved roads. The following table summarises the land that will be affected by the proposed projects temporary or permanently.

Table 1: Total land to be affected by the proposed project

DISTRICT	SECTOR	CELL	Number of HHs	Number of plots affected		Size of affected land (m2)
Gasabo	Gatsata	Nyamabuye	6	Cultivate land	7	1,841
				Business/commercial	2	1,323
		Nyamugari	8	Cultivate land	22	6,174
	Gisozi	Ruhango	46	Cultivate land	26	7,585

				Housing plot	21	373
				Business/commercial	6	144
Nyarugenge	Kanyinya	Nyamweru	7	Cultivate land	6	1,621
				Housing plot	3	116
				Business/commercial	1	378
		Nzove	9	Cultivate land	14	6,397
				Housing plot	0	0
	Kigali	Nyabugogo	19	Cultivate land	28	10,936
				Housing plot	5	3,061
				Business/commercial	6	437
	Kimisagara	Kimisagara	*0	Cultivate land	1	280
Grand Total			**95**		**148**	40,665

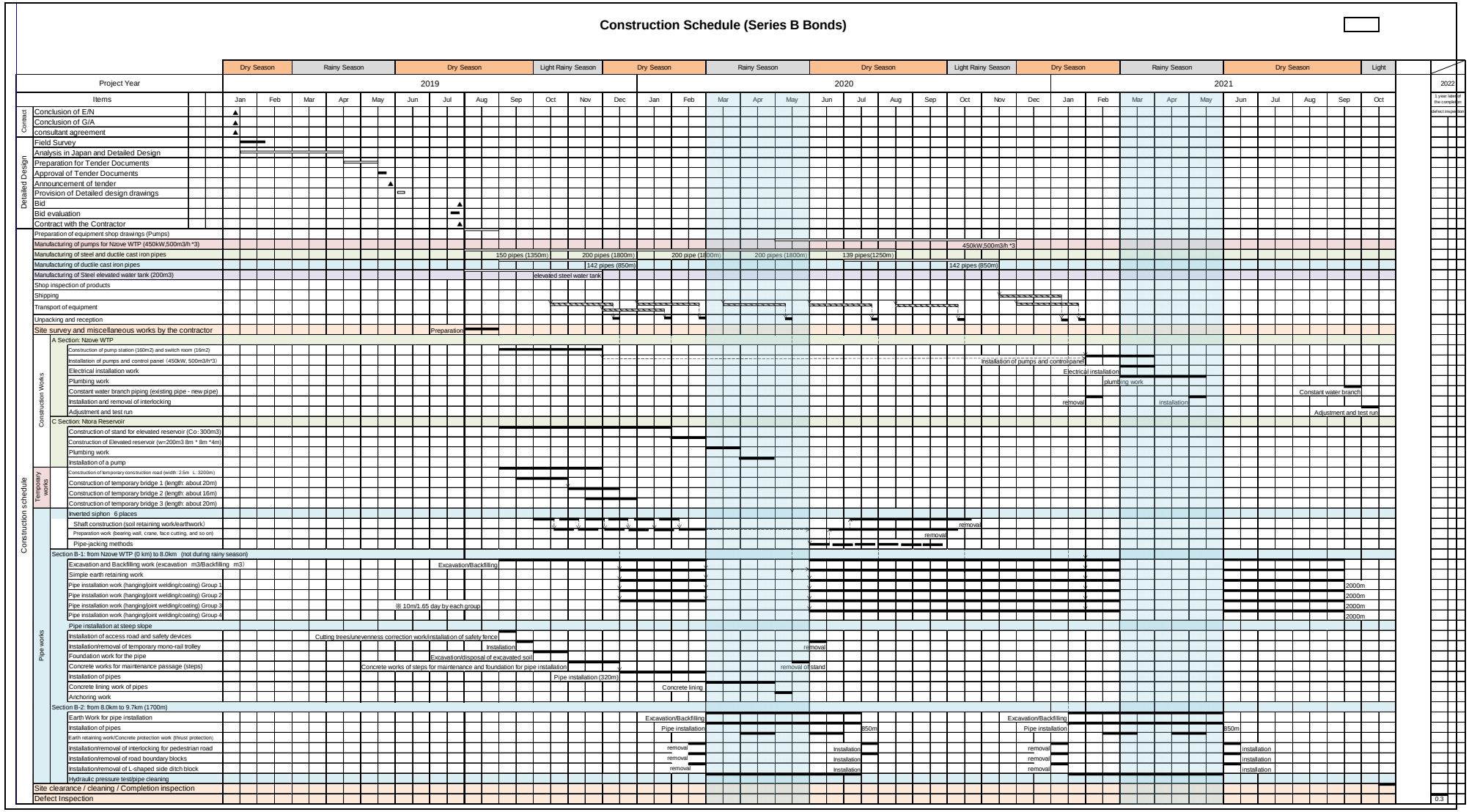
***: PAH who use the plot in Kimisagara is already counted in** Nyamweru

Source: Field survey, BESST Ltd, 2018

2.2.3. Project Schedule

The project schedule include preliminary works and construction works that will be undertaken both in Rwanda and in Japan. Due to the limited length of the construction period (2 years and 3 months), it is proposed to divide the pipe-work area into two sections, one is the wetland and steep slope and the other is the residential area in Ruhango cell. And then the project area in the wetland is divided into 4 sections and to conduct construction work at each section simultaneously.

Table 2: Project construction schedule



Source: Preliminary design, JST, 2018

CHAPTER III: LEGAL AND INSTITUTIONAL FRAMEWORK

3.1. Introduction

This chapter describes relevant policies, strategies, legal instruments, institutional arrangement and framework applicable to the proposed projects of strengthening Nzove- Ntora Principal pipeline in Kigali City. The legal and institutional framework analyses the available laws, regulations, policies and institutions that guide the land acquisition, assets valuation and compensation. The legal framework also provides applicable laws and regulations and administrative procedures including remedies available to displaced persons in the judicial process and the normal time frame for such procedures and available alternative dispute resolution mechanisms that may be relevant to the project. Both national and international regulations related to land ownership; land acquisition and involuntary resettlement were reviewed and gap analysis made.

3.2. National regulations

This part describes national institutional, legal and policy framework for resettlement requirements in Rwanda, applicable to the project as well as the international provisions that bear relevance to the implementation of this project.

3.2.1.Land tenure system and provisions in Rwanda

The organic land law no 08/2005 of 14/7/2005 amended in 2013 categorizes land via two criteria: (1) land use and (2) land ownership. Land use (article 9) is split into two categories: urban lands and rural lands. Urban lands are defined as lands confined within the legal boundaries of towns and municipalities as well as lands in suburbs and collective settlements of towns and municipalities. Any other land is rural land.

Land ownership is divided into the following categories: individual owned lands and State lands (whether urban or rural). Article 11 provides that individual land is comprised of land acquired through custom, written law, acquisition from competent authorities, purchase, gift, exchange and sharing. State lands are further categorized into two sub-categories: public domains and private State owned lands (articles 12 and 13). State land for public domain comprises land reserved for public use, for use by organs of state services or for environmental protection. Private state owned land consists of all other state owned land not considered to be part of public domain.

- **Land tenure legal provisions in Rwanda**

The Organic Land Law also provides two types of formal land tenure: full ownership/ freehold and long term leasehold. So far, all land in the country has been registered and land titles issued to citizens. According to article 10 of new land law of June 2013, private individual land shall comprise land acquired through custom or written law. That land has been granted definitely by competent authorities or acquired by purchase, donation, inheritance, succession, ascending sharing, and exchange or through sharing. This law offers equal protection to rights over land resulting from all channels stipulated in the preceding paragraph. All types of land tenure must be in compliance with the designated land use and environmental protection measures as outlined in the Land Use Master Plan.

In addition, the present organic land law sets a legal framework for property law under articles 5 and 6 which provides for full ownership of land and permits any person that owns land (either through custom or otherwise), to be in conformity with the provisions of this law. It is important

to observe however that full ownership of land is only granted upon acquisition of a land title issued by the general land registrar authority. Once the efforts to provide proper land tenure documentation are completed, ownership of land without proper documents such as land title will not be deemed lawful land ownership and thus in event of circumstances like expropriation, one will not be able to benefit from a fair and just compensation package.

3.2.2. Important resettlement legislations

The expropriation law no 18/2007 of 19/4/2007 revised in 2015 outlines rights and compensation procedures for land expropriated for public interest. The valuation law (2010) stipulates valuation methods to be applied to the expropriated assets. The following laws are important for rehabilitation and resettlement, land acquisition and compensation:

- The Rwandan constitution, promulgated in 2003 and amended in 2015;
- Organic land law n° 43/2013 of 16/06/2013 governing land in Rwanda gazette in the official gazette no special of 16/06/2013 was promulgated to determine the procedure for use and management of land in Rwanda property valuation law no 17/2010; establishing and organizing the real property valuation in Rwanda;
- Organic law n° 32/2015 of 11/06/2015 law related to expropriation in the public interest ;
- Presidential order no 54/01 of 12/10/2006 determining the structures, the responsibility, the functioning and the composition of land commission;
- Ministry order no 001/2006 of 26/09/2006 determining the structures of land registration, the responsibilities and the functioning of the District Land Bureau (DLB) and;
- Ministerial order no 002/16.01 of 2010 on determining the reference land price outside Kigali city.

The above legal orders are briefly describe as follows:

- **The Rwanda constitution**

The constitution is the supreme law of the land. Under article 29 of the Rwanda constitution every citizen has a right to private property, whether personal or owned in association with others. Further it states private property, whether individually or collectively owned, is inviolable. However this right can be interfered with in case of public interest, in circumstances and procedures determined by law and subject to fair and prior compensation. Article 30 stipulates that private ownership of land and other rights related to land are granted by the State. The constitution provides that a law should be in place to specify modalities of acquisition, transfer and use of land (expropriation law). The constitution also provides for a healthy and satisfying environment. In the same breath every person has the duty to protect, safeguard and promote the environment.

- **Organic law N° 43/2013 of 16/06/2013 governing land in Rwanda**

The land law was initially adopted in 2005 and then revised in 2013 and was gazetted in the official gazette no special of 16/06/2013. It determines the use and management of land in Rwanda: This is the law that determines the use and management of land in Rwanda. It also institutes the principles that are to be respected on land legal rights accepted on any land in the country as well as all other appendages whether natural or artificial. According to the law, land in Rwanda is categorized into two: individual land and public land. The latter is subdivided into two categories:

the state land in public domain and the state land in private domain. State land in public domain includes national land reserves for environment conservation; land over which administration building are erected, state roads, land containing lakes, rivers, stream and springs. State land in private domain include swamps that may be productive in terms of agriculture, vacant land with no owner, land purchased by the State, donation, land acquired through expropriation and land occupied by state owned forests.

Land in Rwanda is predominantly individual land and the law gives the owner of land full rights to exploit his or her land in accordance with the existing laws and regulations. The law also provides for expropriation which stipulates that land expropriation can be undertaken if it's for public interest. The law states that swamp land(marshland) belongs to the state and no person can use the reason that he or she has spent a long time with it to justify the definitive takeover of the land.

- **Organic law n° 32/2015 of 11/06/2015 law relating to expropriation in the public interest**

This law determines the procedures relating to expropriation of land in the interest of the public. The law stipulates that the government has the authority to carry out expropriation. However the project, at any level, which intends to carry out acts of expropriation in public interest, shall provide funds for inventory of assets of the person to be expropriated. According to the organic law, no person shall hinder the implementation of the program of expropriation on pretext of self-centered justifications and no land owner shall oppose any underground or surface activity carried out on his or her land with an aim of public interest. In case it causes any loss to him or her, he or she shall receive just compensation for it.

Eligibility for compensation is enshrined under the Rwandan constitution (article 29) and the expropriation law. The two laws regulate and give entitlement to those affected, whether or not they have written customary or formal tenure rights. The person to be expropriated is defined under article 2(7) of the expropriation law to mean any person or legal entity who is to have his or her private property transferred due to public interest, in which case they shall be legally entitled to payment of compensation.

Compensation entitlement: In case an individual suffers any loss, Article 3 of the expropriation law stipulates that he or she should receive just compensation for it, although it is not clear what comprises fair and just compensation, this being left to the judgment of independent valuers. Article 4 of this law also stipulates that any project which results in the need for expropriation for public interest shall provide for all just compensation in its budget. Through mutual arrangement, both parties can determine the mode of payment. Article 22 (2) of the expropriation law provides that through an agreement between the person to expropriate and the one to be expropriated, just compensation may either be monetary, alternative land or a building equivalent as long as either option equates to fair and just monetary compensation. In case the determination of 'just' compensation exceeds in value the alternative land given to the expropriated person, the difference will be paid to the expropriated person.

Furthermore, the law deals with valuation of land earmarked for expropriation. The law identifies properties to be valued for just compensation to be land and activities that were carried out on the land including different crops, forests, buildings or any other activity aimed at efficient use of land

or its productivity. Here the law is silent on access to economic activities on the land. The new law has added 5% of total compensation fees for disturbance allowances.

- **Law n°.17/2010 of 2010 establishing and organizing the real property valuation profession in Rwanda**

This law provides for the registration of land in Rwanda and conditions for registration. The law also allows the government to conduct valuation when mandated by their government institutions. Articles 27, 29, 30 and 31 of the law deal with valuation methods. These articles stipulate that price for the real property shall be close or equal to the market value. The valuation could also compare land values country wide. Where sufficient comparable prices are not available to determine the value of improved land, the replacement cost approach shall be used to determine the value of improvements to land by taking real property as a reference. The law also allows the use of international methods not covered in the law after approval from the institute of valuers council.

- **Ministerial order no. 001/2006 of 2006 determining the structure of land registers**

The ministerial order determines the structure of lands registers, the responsibilities and functioning of the District Land Bureau (DLB). This ministerial order determines the structure of land registers, the responsibilities and the functioning of DLB. The responsibilities of the land bureau include among others to implement land registration and manage land and update, safely keep records of land registers and monitor and approve activities pertaining to valuation of land, other immovable property and demarcate and approve land cadastral. This order does not apply to land specified in articles 12, 14, 15 and 72 of the organic law n° 8/2005 of 14/07/2005 determining the use and management of land in Rwanda.

- **Ministerial order n° 002/16.01 of 2010 on determining the reference land price outside Kigali city.**

Purpose of this order is to provide reference land prices to be used in areas outside Kigali city. This order was aimed at protecting land owners from exploitation and to prevent land speculation when the market is not developed. However with the propagation of land valuation law, the order seems to have been overtaken by events and practicability. This is due to the fact that valuation law provides for independent market rates to apply in land valuation.

3.2.3. Institutional arrangement for RAP preparation and implementation

In Rwanda, there is no single institution governing resettlement activities and social impact are assessed and managed through EIA. The institutional framework for environmental and social management is currently enshrined in the organic law determining the modalities of protection, conservation and promotion of the environment in Rwanda, published in the Official gazette n° 9 of the 1st May 2005, particularly in its chapter III relating to the establishment of the institutions, the 2013 land law and 2015 expropriation law. The responsibility of preparation and implementation is shared by different institution based on the nature of the project and the project proponent.

For the Project of strengthening Nzove-Ntora Principal pipeline in Kigali city, the main actors responsible for development of policy, framing regulations, developing projects, monitoring and approval of issues related to resettlement and compensation are:

- Ministry of Forest and Lands(MINILAF);
- Ministry of Infrastructure(MININFRA);
- Water and Sanitation Corporation Limited(WASAC Ltd);
- Rwanda Land Management and Use Authority (RLMUA);
- Rwanda Environment Management Authority (REMA);
- Local administration including Kigali City, Nyarugenge and Gasabo District;
- Sectors and Cells in the project areas.

- **Ministry of Infrastructure(MININFRA) and Water and Sanitation corporation Ltd**

The mission of 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. the ministry also 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. Through water and sanitation Corporation Ltd, MININFRA is the main implementing agency on government side and will work closely with WASAC Ltd, Ministry of land and Forestry, District land Bureau and ensure that land is acquired in compliance with both national and international regulations.

The Water and Sanitation Corporation (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. WASAC Ltd is the implementing entity for the construction of pipelines but also is responsible for land acquisition for water treatment plant and reservoirs. For this reason, WASAC ltd is responsible for the preparation and implementation of this RAP including the final valuation and compensation of project affected person/households.

- **Ministry of Land and Forestry (MINILAF)**

MINILAF governs the implementation and application of the organic land law and the Land Use Master Plan. While the MINILAF deals with overall land policy and the alignment with these Laws at the national level, responsibilities for their implementation locally has been devolved, following decentralization, to land commissions and committees at district, sector and cell levels. MINILAF is also the key ministry governing resettlement arrangements in Rwanda through the Land Bureaus. They do this by working directly with the ministry/institution developing the land on which resettlement is required. MINILAF A will therefore play a critical role in ensuring that appropriate and consistent compensation is provided to all affected persons resulting from the implementation of the project.

- **Rwanda Land Management and Use Authority (RLMUA)**

RLMUA through its department of land administration and mapping is the organ responsible for overall management and coordination of all activities related to land administration, land use planning and management in Rwanda. The role of RLMUA in RAP process is to advise on matters related to land ownership and expropriation. District land bureau in close collaboration with project staff will check and approve surveys, various maps and approve land surveys carried out during valuation exercise.

- **Nyarugenge and Gasabo districts and local administration**

The article 66 of the environmental organic law specifies to establish, at the provincial, district, town, sector and the cell levels; committees responsible for conservation and protection of the environment. The organization, functioning and their responsibilities are determined by prime minister's order. The executive committee of the district is responsible to initiate the expropriation and district council implements the expropriation after considering the decision of the land commission (expropriation law, 2015).

Both districts manage lands through the district land bureau. Thus, the district land bureau will be responsible for ensuring activities undertaken comply with the national and district level land use master plans and will assess the validity of land tenure rights of affected persons. In addition the officer, will be responsible for ensuring effective grievance redress mechanism is in order to reduce disputed or complaints.

- **The Institute of Real Property Valuers(IRPV)**

The responsibilities of IRPV are to:

- to analyze and find solutions to all problems related to the real property valuation profession;
- to analyze and find solutions to all problems related to the conduct of real property valuers;
- to exchange information relating to the real property valuation profession;
- to promote the real property valuation profession in Rwanda;
- to prepare regulations and guidelines governing the real property valuation profession,
- to prepare real property valuation standards; and
- to represent the interests of, and advocate for real property valuers in Rwanda and abroad.

In relation to the proposed project, upon the completion of detailed design studies, WASAC Ltd should hire an independent valuar certified by IRPV to conduct final valuation.

3.2.4. RAP preparation and approval process in Rwanda

In Rwanda involuntary resettlement is governed by expropriation law and valuation law. Both laws do not have provisions on RAP preparation and approval. Instead, the expropriation defines the process of expropriation and valuation while the resettlement impacts are assessed together with the EIA report. The chapter III of the law n° 32/2015 of 11/06/2015 relating to expropriation in the public interest expropriation law defines steps to be undertaken for expropriation as follows:

- **Organs determining projects of expropriation in the public interest**

- Organs which determine projects of expropriation in the public interest are the following:
- the executive committee at the district level, in case such activities concern one district;

- the executive committee at the level of the City of Kigali, in case such activities concern more than one district in the boundaries of the City ;
- the relevant ministry, in case planned activities concern more than one district or if it is an activity at the national level, subject to provisions of item 2° of this Article.

- **Organs supervising projects of expropriation in the public interest**

Organs in charge of supervising projects of expropriation in the public interest are hereby established as follows:

- the committee in charge of supervision of projects of expropriation in the public interest at the district level where the project concerns one district;
- the committee in charge of supervision of projects of expropriation in the public interest at the City of Kigali level where the project concerns more than one district within the boundaries of the City ;
- the committee in charge of supervision of projects of expropriation due to public interest at the national level where the project concerns more than one district or it is a project at the national level, subject to the provisions of item 2° of this article.

- **Organs approving expropriation in the public interest**

The organs approving expropriation in the public interest are the following:

- at the district level, it is the district council after considering the recommendation of the committee in charge of supervision of projects of expropriation in the public;
- at the level of the City of Kigali, where the project concerns more than one district within the boundaries of the City of Kigali, it is the council of the City of Kigali after considering the recommendation of the committee in charge of supervision of projects of expropriation in the public interest at the level of the City of Kigali;
- at the level of more than one district, the ministry in charge of land, upon proposal by the committee in charge of supervision of projects of expropriation in the public interest at national level subject to provisions of item 2 of this Article. A ministerial order shall be used;
- at the national level and in case of activities related to security and national sovereignty, the Prime Minister's Office upon proposal by the committee in charge of supervision of projects of expropriation in the public interest at the national level by way of a Prime Minister's order.

- **Procedure for expropriation in the public interest**

Procedures for expropriation are as follows:

- Request for expropriation in the public interest by project proponent/ developer;
- Consideration of the relevance of the project proposal for expropriation in the public interest by relevant committee.
- Decision on the relevance of a project of expropriation in the public interest;
- Approval of expropriation in the public interest;
- Publication of the decision on a project for expropriation in the public interest;
- Valuation of assets and agreement on compensation measures;
- Compensation.

- **RAP process for donor funded projects**

For donor funded projects, where the RAP preparation and approval is a requirement, the donor policies applies and the RAP is prepared in compliance with both international and national laws. The normal practice is as follows:

- Preparation and approval of terms of reference by both donor and implementing agency;
- Recruitment of independent consultant to prepare the RAP;
- RAP preparation by independent consultant;
- Approval of the RAP report by both donor and implementing agency;
- Implementation and monitoring of RAP by implementing agency.

3.3. International regulations

3.3.1. JICA Guidelines for Environmental and Social Considerations

The project of strengthening Nzove-Ntora principal pipeline will be funded by Japan Government through Japan International Cooperation Agency (JICA) and it is very important to consider the JICA guidelines for environmental and social consideration in preparation and implementation of the RAP. The key principle of JICA's policy on involuntary resettlement is summarized below:

- Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- When population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
- People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- Compensation must be based on the full replacement cost as much as possible.
- Compensation and other kinds of assistance must be provided prior to displacement.
- For projects that entail large-scale involuntary resettlement, RAPs must be prepared and made available to the public. It is desirable that the RAP include elements laid out in the WB, OP 4.12 Annex A.

During the preparation of RAP, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner and language that are understandable to the affected people. Appropriate participation of affected people must be promoted in planning, implementation and monitoring of RAPs. Furthermore, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principle is complemented by the WB OP 4.12 (Annex Q), since it is stated in JICA Guidelines that "JICA confirms that projects do not deviate significantly from the WB's Safeguard Policies".

3.3.2. World Bank O.P. 4.12 on involuntary resettlement policy

The WB involuntary resettlement related policies are also critical in preparation and implementation of this RAP. The main objectives of the WB O.P. 4.12 include: avoiding or minimizing involuntary resettlement where feasible, exploring all viable alternative project design;

where it is not feasible to avoid resettlement. Resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to give the persons displaced by the project the opportunity to share in project benefits.

Displaced persons should be meaningfully consulted and have opportunities to participate in planning and implementing resettlement programs. Those displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to beginning of project implementation, whichever is higher. Specifically, the production systems of a community are safeguarded to the extent that guarantees their livelihoods and that their skills base remain relevant regardless of the resettlement site. The policy objectives are also designed to minimize kinship group dislocation that might subject the affected persons to unfair competition when mutual help is diminished or lost.

The project consultant met the objective of the WB OP 4.12, by conducting public participation in the project area; evaluating project alternatives to enable minimize involuntary resettlement and developed an entitlement matrix to guide in calculation of resettlement and replacement costs.

Table 3: Gap between Rwandan laws and JICA guidelines for environmental and social considerations

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
▪ After the disclosure of the scoping drafts, project proponents etc. conduct consultations with local stakeholders*. JICA incorporates the results of such consultations into its TOR. The consultations cover the needs of projects and the analysis of alternatives. (JICA GL)	▪ Nothing mentioned	▪ There is description about consultation with stakeholders including project alternatives; however, the agenda does not cover scoping.	JICA guidelines shall apply
▪ Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	▪ Resettlement is acceptable for public interest. Affected persons are fully informed of expropriation issues. The law prohibit any opposition to the expropriation.	Loss of means of livelihoods is not captured in the expropriation law	JICA guidelines shall apply
▪ When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	▪ Affected person receive fair and just compensation. However a ministerial order gives the value of land and crops.	In Rwanda loss of income and compensation of illegal occupants in not provided	JICA guidelines shall apply
▪ Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	▪ Rwanda expropriation law stipulates a timeframe upon when the property to be expropriated must be handed over which is 90 days after compensation has been paid.	JICA GL does not specify the period of payment and assistance while the Rwandan law specify payment must be done 90 days prior displacement.	Payment should be done prior construction work
▪ The socio-economic studies should be implemented in the early stages of project preparation and with the involvement of potentially displaced people (WB OP4.12, Para 6)	▪ Census survey and asset survey shall be implemented; however, they are done after official approval of any projects. ▪ The procedures to be respected in expropriation shall not exceed a period of four (4) months from the day organs mentioned in article 10 of this law approve it. (Law N°32/2015 of 11/06/2015 Expropriation in the public interest, Art.16)	JICA request the census survey for project approval while it's done after project approval in case of Rwandan,	Provisional survey shall be done at this stage, and to be updated at final valuation stage.
▪ For projects that entail large-scale involuntary resettlement, RAP must be prepared and made available to the public. (JICA GL)	▪ An application for expropriation should be prepared and submitted to the competent authority for approval the law gives the content of an application. Art 11	▪ Donor like WB supports preparation of RAP for its project.	▪ JICA has funded the preparation of RAP
▪ Affected people are to be identified and recorded as early as possible in order to	▪ A person to be expropriated shall be informed of the beginning of the process of the land survey	▪ In other projects in Rwanda supported by	▪ The provisional cut-off date was

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	and the inventory of the properties thereon. The owner of the land is not allowed to carry out any activities after the land survey and the inventory of the properties thereon and coming to terms with the beneficiaries. In case he or she carries out any activities, they shall not be valued in the process of expropriation. Art 17, expropriation law.	WB, they set cut-off date on the census survey implementation after official approval of project implementation, not during F/S or basic design stage.	established as the date of baseline survey. This may be reviewed upon the completion of detailed design study.
▪ Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets--provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan are eligible for benefit (WB OP4.12, Para 15)	▪ Article 18 of the law requires the person who owns land intended for expropriation to provide evidence of ownership or rights on that land and presents a certificate to case. ▪ The person who owns land intended for public interest shall provide evidence to confirm that he or she possesses rights on that land and among the evidence to confirm ownership of the land, there shall be included: ▪ written evidence indicating that he or she purchased the land, received it as a donation or as a legacy or a successor; ▪ a document or a statement of local administrative entities indicating rights of the expropriated person on the land; ▪ a document or testimony of the neighbours; confirming the ownership of the land; ▪ a Court certificate(art 18 expropriation law)..	▪ There are some cases whereby Government provided in kinds supports, but, they were not full compensation. ▪ The WB OP 4.12 also provide eligibility of benefits including the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law) the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal rights to the land they are occupying.	▪ JICA guidelines were applied and income for illegal occupants will be considered ▪ Compensation for structures at the land without land titles will be considered
▪ Compensation based on the full replacement cost must be provided as much as possible (JICA Guideline).	▪ The land prices stipulated by "N°002/16.01 of 26/04/2010 Ministerial Order determining the reference land price outside the Kigali City" when the government expropriates land. This land unit prices are set considering market prices. ▪ The compensation for disruption caused by	Market value vs replacements cost	▪ Market value plus 5% of disturbance allowances were used. ▪ The proposed price for the real property

JICA Guidelines	Rwandan regulation	Gaps	Measures to be taken
	expropriation to be paid to the expropriated person shall be equivalent to five percent (5%) of the total value of his/her property expropriated. ▪ (Law N°32/2015 of 11/06/2015 Expropriation in the public interest, Art.28)		will be made close or equal to full replacement cost, including tax and registration fee
JG requires displaced persons to be consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives	▪ Through agreement between the person to expropriate and the one to be expropriated, the just compensation may be monetary or an alternative land and a building equivalent to the determination of just monetary compensation (art.23 expropriation law).		JG were used for consultations
▪ Provide support for the transition period (between displacement and livelihood restoration).	▪ No mention		Four seasons were considered for income loss.
▪ Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities, etc.	▪ No mention	▪ The Rwandan expropriation law is silent on vulnerable people.	Vulnerable people should be given special attention such priority in recruitment of labour.
▪ In preparing a RAP, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA Guidelines) ▪ Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of RAPs and measures to prevent the loss of their means of livelihood (JICA Guidelines)	▪ Public consultation is needed to be organized and the result must be included in EIA report. ▪ The Rwandan organic law on expropriation simply stipulates that affected peoples be fully informed of expropriation issues. The law prohibits any opposition to the expropriation	▪	Public consultation was held with all project affected Person and the final assets valuation results will be displayed to People and approved by both valuer, affected person and Local Authorities

CHAPTER IV: SOCIO-ECONOMIC BASELINE DATA

4.1. Introduction

This Chapter describes the current situation of the population in the project area and provide the baseline socio-economic status of project affected people that will be used to measure the project impact on them. The information presented in this chapter has been collected through socio-economic survey conducted on people owning or using land in the project targeted area. In Total, 80 households and 6 corporations out of 87 HHs and 8 corporations identified as project affected households.

4.2. Data collection and analysis methodology

Data collection and analysis followed predefined steps including preparation of questionnaires, training of field enumerator, pre-test, and filed survey. This study is descriptive as it is describing in detail, the socio-economic characteristics of households and corporate owning or using plots in the targeted area

- **Area covered by the study**

The survey covered households who own or used the land located in project targeted area and it conducted two districts, Nyarugenge and Gasabo, 4 sector and six cells. The table below summarizes the area covered by the survey.

- **Determination of survey population**

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population usually have a common, binding characteristic or trait. In this survey, targeted population were households or corporation who own or use plots in targeted area.

- **Reliability and validity**

Reliability is a measure of the degree to which instrument yields consistent results of data after repeated traits. While, validity is the degree to which results obtained from the analysis of the data represent the phenomenon under study. To enhance reliability, methods such as pre-test; internal consistency and alternative form were used. In test retest method, the researcher gives the same test to a group of subjects at two different times. Internal consistency measures whether several items that propose to measure the same general construct produce similar scores. Validity was censured by conducting the pre-test and finalizing the questionnaire based on pre-test results. The pre-test was conducted on 8 households and one corporation and results confirmed the validity of questionnaire after minor correction. To ensure the quality of data collection and data entry, 8 enumerator participated in one day training and in pre-test.

- **Data processing and analysis**

After data collection and data entry, the next step is data processing and data analysis. Response obtained from field survey were interpreted and put into different specific and relevant categories. Then, data were analysed using descriptive statistics in tables and charts. Data processing and analysis was done in excel statistical analysis tool and different tables and diagrams was used to display survey findings.

4.3. Findings of socio-economic baseline data

In total 95 units were identified including 87households and 8 corporate but the field covered 80 households and 6 corporate. 7 households were already resettled under a road construction project and removed from the targets of the socio-economic survey and two corporation did not want to disclose information. Here is the outline of Projects Affected Households(PAHs):

Table 4: Outline of PAHs

PAHs

District	Sector	Cell	Identified before Socio-economic survey		Identified later in the survey (no Socio economic survey)		total
			Own a part or whole land plots	Cultivate government owned land	Own a part or whole land plots	Cultivate government owned land	
Nyarugenge	Kanyinya	Nzove	6		1		7
		Nyamweru	5		1		6
	Kigali	Nyabugogo	10	1	3	3	17
Gasabo	Gatsata	Nyamabuye	2		4		6
		Nyamugali	0	5	8		13
	Gisozi	Ruhango	29		5	1	35
total			52	6	22	4	84

PAP

District	Sector	Cell	Identified before Socio-economic survey		total
			Own a part or whole land plots	Cultivate government owned land	
Nyarugenge	Kanyinya	Nzove	20		20
		Nyamweru	23		23
	Kigali	Nyabugogo	37	9	46
Gasabo	Gatsata	Nyamabuye	14		14
		Nyamugali		23	23
	Gisozi	Ruhango	164		164
total			258	32	290

Corporations

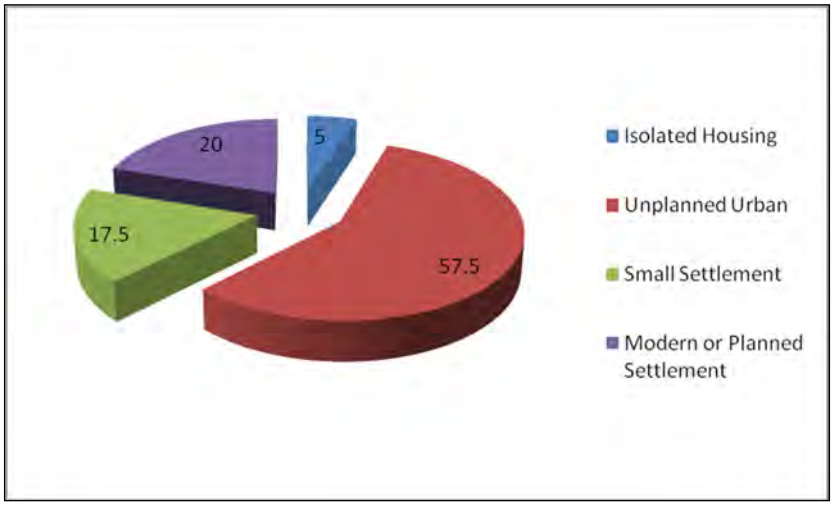
District	Sector	Cell	Identified before Socio-economic survey		Identified later in the survey	total
			Target of socio-economic survey	Rejected the survey		
Nyarugenge	Kanyinya	Nzove	1	1		2
		Nyamweru		1		1
	Kigali	Nyabugogo	1		1	2
Gasabo	Gatsata	Nyamabuye				
		Nyamugali				
	Gisozi	Ruhango	4		2	6
total			6	2	3	11

4.3.1. Characteristics of households

- **Type of housing**

Background describe type of household habitation and its members as well as nature of their land (main purpose of land or plot). This assessment at each level present a mixture of both household's characteristics and corporate characteristics where is possible.

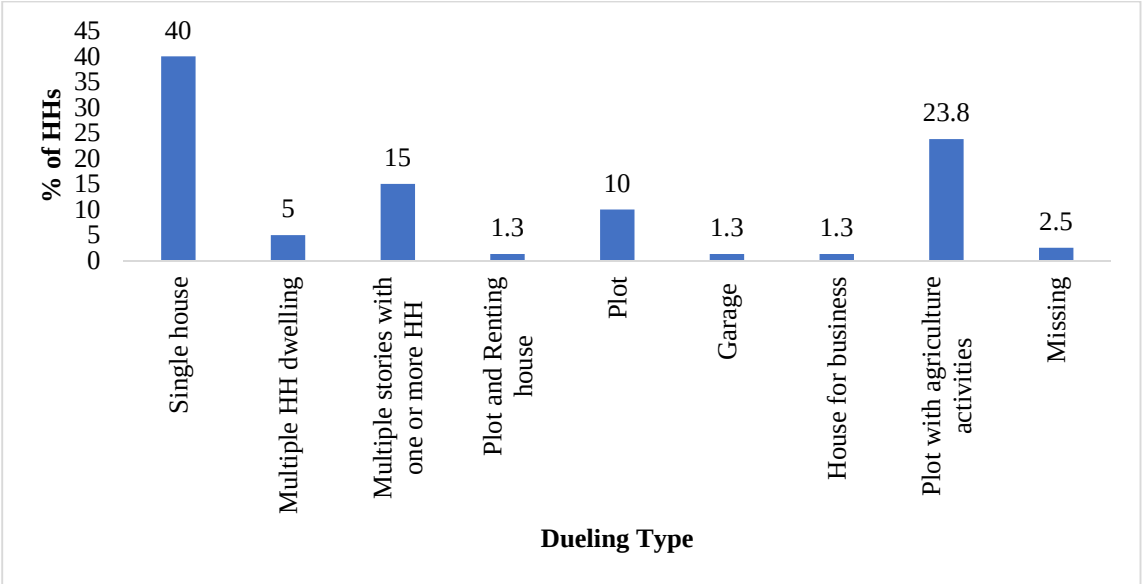
Figure 8: Type of housing



Source : Socio-economic survey, BESST Ltd 2018

From the above, diagram unplanned urban settlement dominate the type of habitat with 57.5% and this is due to the fact that most of the households are in Gisozi sector which is in urban area but its development was done before Urban master plan. On the second place we have planned settlement with 20%, small settlement with 17.5 and isolated housing with 5%. This type of habitat reflect the current situation of Kigali City where unplanned urban planning dominate other type of habitat. Modern or planned settlement seems to be high and this may due to the fact that all modern house located in area demarcated as residential are considered modern or planned even though there were constructed before the master plan. Isolated settlement are only found in Rural areas that was annexes to Kigali City such as Kanyinya.

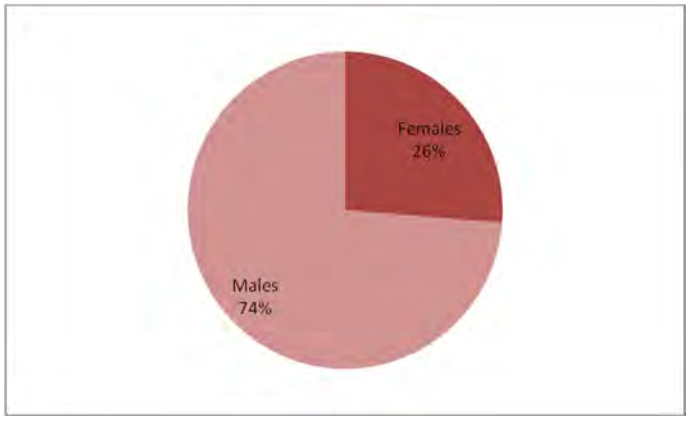
Figure 9: Type of duelling in project area



Source: Field survey, BESST Ltd 2018

From above chart 40% of households assessed, held single house type, 5% multiple household duelling, 15% multiple stories with one or more household, 1% plot and renting house, 10% are plots only, 1% is a garage, 1% house of business, 24% are plots containing agriculture activities and around 3% (2.5%) are consisted by these who failure to identify the form of their duelling. Thus, the most of them are living in single house type of duelling and other plots are still being used for agriculture development.

Figure 10: Heads of households by sex



Source: Field Survey, BESST Ltd, 2018

From the above diagram, 26% of heads of household are females and 74% males. And they are all aged between 24 to 87 years old. 33% of them are aged between 24 and 65 years old (in between working age in Rwanda) which is equivalent to 85% of the whole assessed households.

4.3.2. Characteristics of households members

This section provides baseline on household members including sex, age, education, source of income (primary and secondary), working conditions as well as the average amount or income earning per year by specific activities. In 52 assessed households, 290 family members were identified assessed which makes average of 5 members/households.

Table 5: Members of households by age and by sex

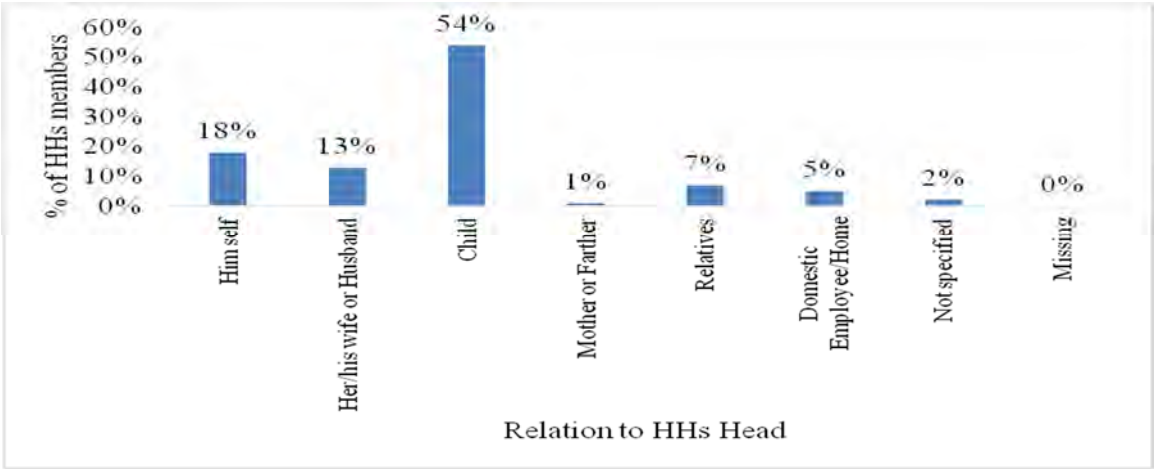
Age intervals	Female		Male		Total	
	Number HHs of members	Percentage	Number of members	Percentage	Number members	Percentage
Less than 10 years	23	17%	24	16%	47	16%
Between 10 and 20 years	30	22%	32	21%	62	21%
Between 20 and 30 years	28	20%	36	24%	64	22%
Between 30 and 40 years	19	14%	18	12%	37	13%
Between 40 and 50 years	15	11%	14	9%	29	10%
Between 50 and 60 years	11	8%	15	10%	26	9%
Between 60 and 70 years	8	6%	4	3%	12	4%
Between 70 and 80 years	2	1%	4	3%	6	2%
Between 80 and 90 years	0	0%	1	1%	1	0%
Don't their age			1	1%	1	0%
Not specified	2	1%	4	3%	6	2%
Total	**138**	**48%**	**152**	**52%**	**290**	**100%**
Median Age	**24**		**24**		**24**	

Source: Field survey, BESST Ltd 2018

The above table shows that 48% of them are males and 52% are females. In regards to the age, the big portion for both males and females are below 50 years. The table also shows that 15% of households members are below 10 years for both sex, 26% of the total males and 19% of total females are aged between 10 and 20 years old. 21% of total males and 23% of females are aged between 30 and 40 years old. 11% of total males and 14% of total females are aged between 40 and 50 years and 8% of males to 8% of total females are aged between 50 and 60 years old. The remaining shares for both males and females are aged 60 years plus.

- **Relation of households members with heads of households**

Figure 11: Relationship in the household



Source: Field survey, BESST Ltd 2018

Reference made to the above chart, 18% are heads of household, 13% are husband or wife of the head of households, 54% represent children of the head of household, 1% represented by the mother or father of the head of household, 7% are relatives while 5% are domestic employee.

- **Vulnerability**

In total 15 vulnerable people were identified including 5 with physical disability, 3 with chronic diseases, twelve orphans, 1people with mental disability and 4 old people.

Table 6: Vulnerability in the project area

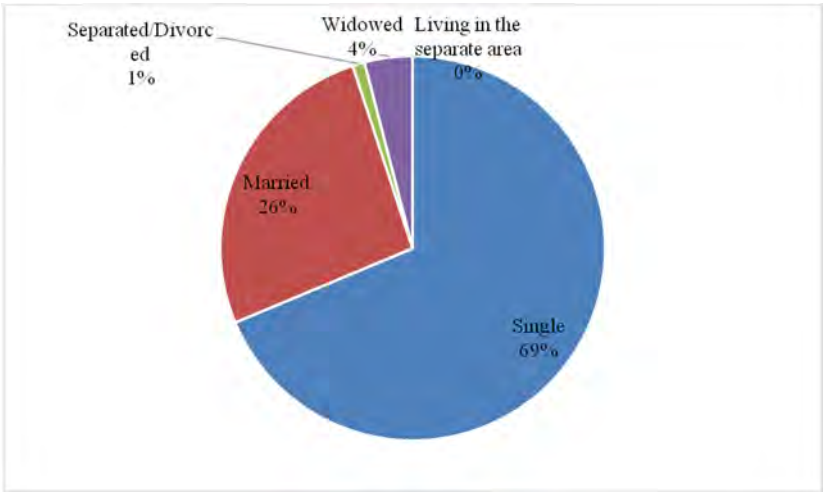
Vulnerability	Number of family members	Percentage
Physical Disability	5	1.7%
Chronic diseases	3	1.0%
Mental Disability	1	0.3%
Orphan	2	0.7%
Old people	4	1.4%
Total people suffering any type of Disability	**15**	**5.2 %**

Source: Field survey, BESST Ltd 2018

- **Marital status**

The survey revealed that 69% of households members are still single, 26% are married, 1% separated and 4% are widows. The share of single is high since more than 50% of total household member are children of the household head.

Figure 12: Marital status of household members in the project area

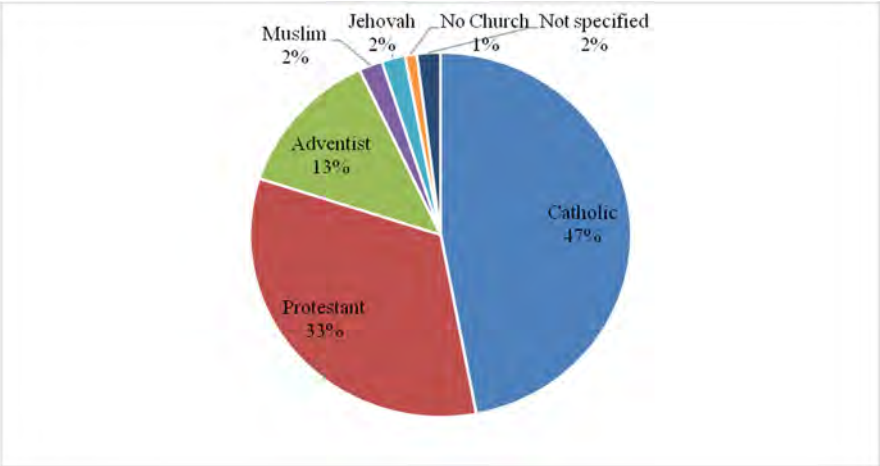


Source: Field survey, BESST Ltd 2018

- **Members of households by religion**

In reference to the following diagram, Roman Catholic is a dominant religion with 47%, the second is protestant at 33%, 13% Adventist, 2% Muslim, 2% Jehovah and 1% do not belong to any church. This reflect the situation in the country where catholic church members are majority.

Figure 13: Religion characteristics of household members in the project area



Source: Field survey, BESST Ltd 2018

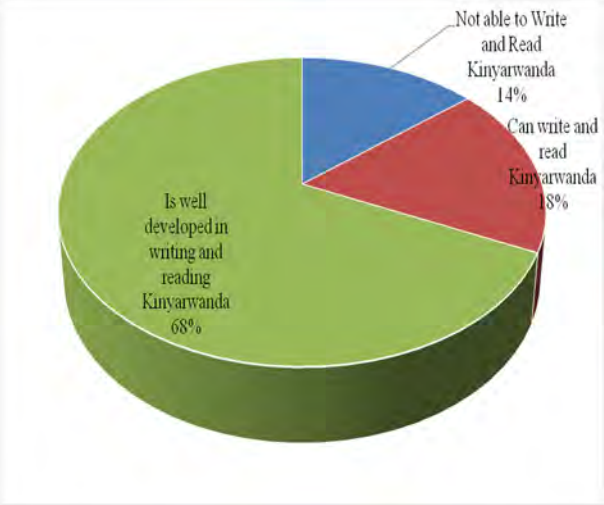
- **Education**

The survey revealed that 10.3% of 290 household members living in the project area do not have any formal education, 4% have only attended pre-primary education, 29.7% did primary education, 30% did high schools , 4% VTC, 22% university and 1% did high schools. Thus, only 56% of 290 who have at least secondary education background.

- **Literacy among household members**

A person is qualified as literate if he/she is able to read, write and understand at least one language. According to the fourth The fourth Population and Housing Census in Rwanda conducted in August 2012 (2012 RPHC) shows that 68% of Rwandan population aged 15 years and above were literate. The field survey shows that 14% of the household members are not able to write and read Kinyarwanda correctly, 18% can write and read Kinyarwanda while 68% can writing and reading Kinyarwanda. This concur with the national status.

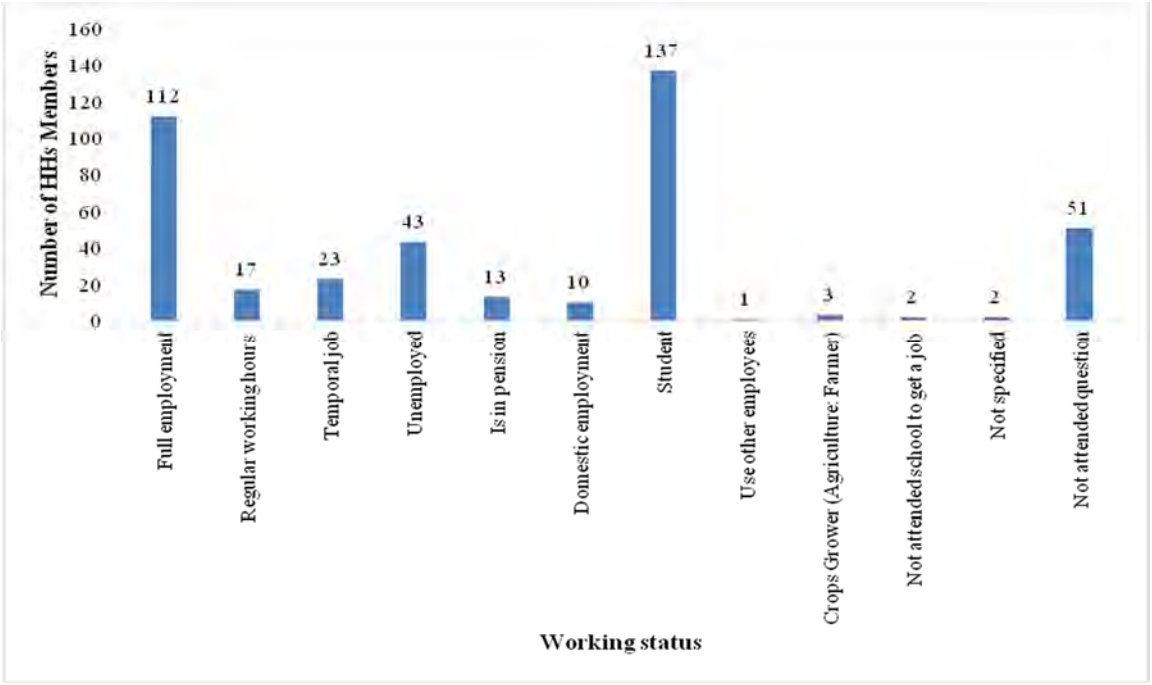
Figure 14: Households members Literacy



Source: Field survey, BESST Ltd 2018

- **Status of employment in project area**

Figure 15: Working status for the household members in the project area



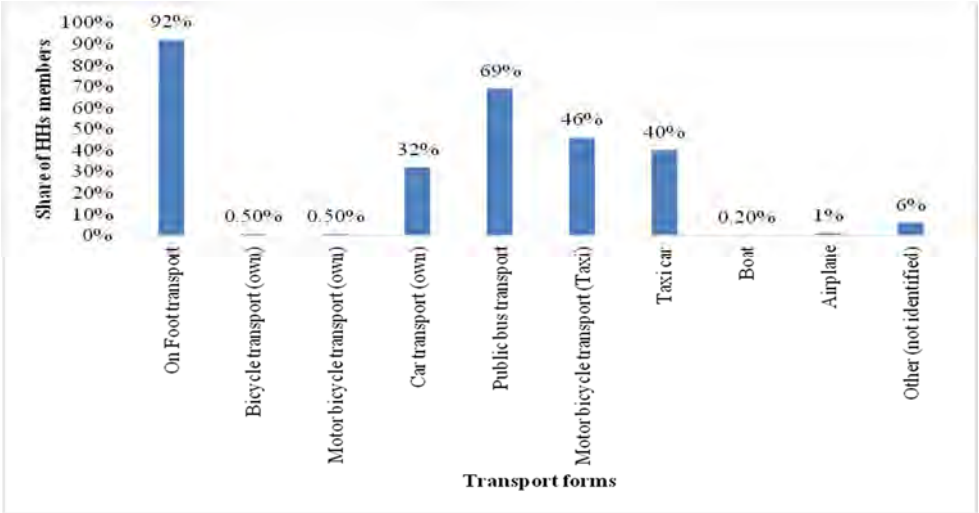
Source: Field survey, BESST Ltd 2018

From the above chart, 27% of the total household members are full employed, 4% have regular working hours, 6% has part time(temporary) jobs, 10% are unemployed, 3% are in pension 2% domestic or home employees, 33% are students.

- **Means of transport**

People use various transport means in different period or mixed of all possible transport means. In many cases households members use different means of transport. The field survey shows that 92% has walking/foot transport as main transport means, 0.5% of the total household members use bicycle, 0.5% are own motor bicycle use it as transport means, 32% use car transport (own), 69% use public transport (bus), 46% use motor bicycle transport (taxi), 40% use tax car, 0.2% use boat, 1% use airplane and 6% other transport means not identified. It shows that many people used to use on foot and public transportation means.

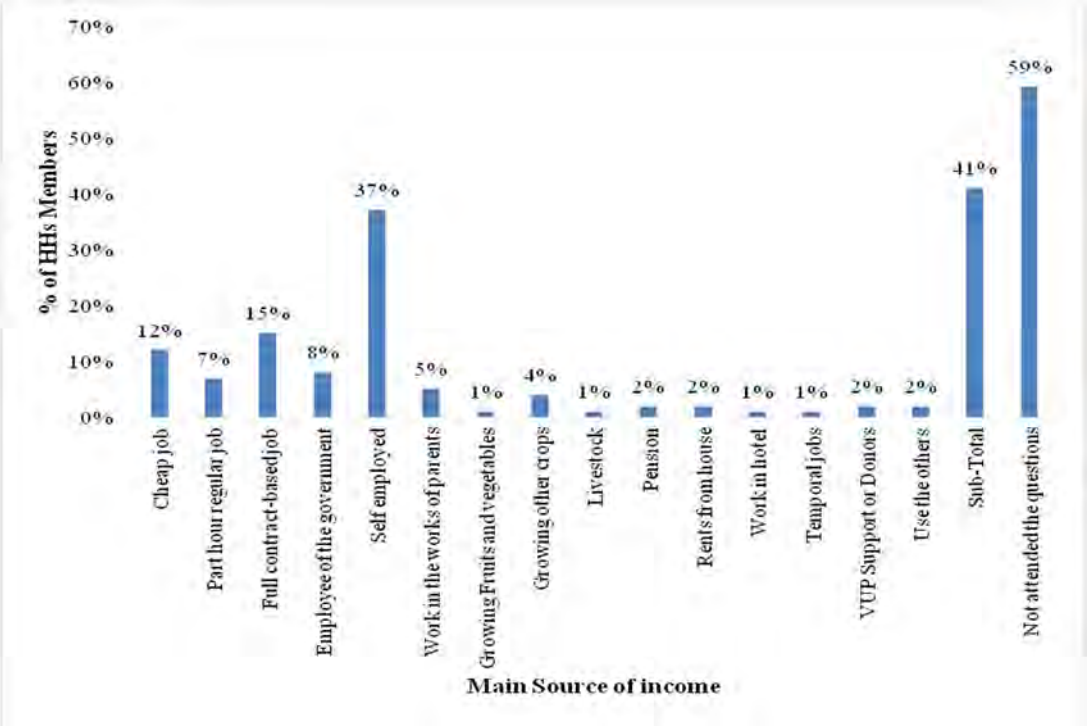
Figure 16: Means of transport used by household members in the project area



Source: Field survey, BESST Ltd 2018

- **Source of income for households members**

Figure 17: Share of main Source of income for household members in the project area



Source: Field survey, BESST Ltd 2018

In reference to the above chart, the main source of income per each household member in the project area (52 households assessed). The assessment was attempted from 114 household members (39% of total household members) since some people keep confidentially the information related to their income. From all 114 household's members who clarified their main income source, 12% their main source of income is cheap job, 7%-part hour regular job, 15% full contract job, 8% work for the government, 37% are self-employed, 5% work for their parents, 4% are growing crops, others for livestock, pension, temporal jobs, VUP supports or other donors, work in hotel, etc. The main source of income for the people in the project area is self-employment.

- **Main income generation activities in the project area**

Key activities that generate income for members of households include agriculture, 18% , livestock 7%, construction 1%, Formal and informal commercial 29%, and remaining in different levels of activity like: industry, finance and accounting as well as management, education, arts, plays, NGOs, work the wife or husband, lawyer, consultant, pension, rents from house and ICT. Thus, in the area commerce and trade are the important activity levels to signify people's main source of income.

Table 7: Main income generation activities in the project area

Level of the activities	Number of family members	Percentage
Agriculture	20	18%
Livestock	8	7%
Construction	1	1%
Manufacturing	1	1%
Commercial	33	29%
Trading	1	1%
Financial	5	4%
Transportation	3	3%
Government	11	10%
Education	1	1%
Professional	9	8%
Others	21	18%
Total	114	100%

Source: Field survey, BESST Ltd 2018

- **Yearly income by main income source**

It is not an easy task to calculate early income for households members because some of them cannot estimate their income on do not want to disclose this information. However, surveyors managed to get this information from 79 out of 290 household members. According to this survey, 29.1% of members households has an yearly income below0.5 million per year and the average is 253,348 Rwfs. 15.2% earn income between 0.5-1 million Rwfs per year, 41.8% earn income between 1-10 million Rwfs per year. 10.1% earn an income ranged between 10-50 million, 2.5 % earn income ranged between 50-100 million and 1.3 % earn 100 million and above.

Table 8: Household member yearly income

Size of yearly income (Rwfs)	Number of family members	Percentage	Average
Less than 0.5 Million Rwfs	23	29.1%	253,348
Between 0.5 Million Rwfs to 1 Million Rwfs	12	15.2%	670,417
Between 1 Million Rwfs and 10 Million Rwfs	33	41.8%	3,478,398
Between 10 Million Rwfs and 50 Million Rwfs	8	10.1%	22,631,638
Between 50 Million Rwfs and 100 Million Rwfs	2	2.5%	57,615,000
100 Million Rwfs and More	1	1.3%	428,140,000
	79		**10,798,509**
Median			**1,500,000**

Source: Field survey, BESST Ltd 2018

- **Income by second activities of household members**

Only 11% of household members in the project reported a second main source of income activity, from them 9% are gaining as second income from small jobs, 4% part time jobs, 9% full time contract based jobs, 2% are employees of government, 28% are working in their own businesses (self-employed), 2% work for their parents (work in family businesses), 11% are agriculture farmers, 22% gain rents of the house, 2% gain pension, 2% enjoy supports from friends and donors, 2% are gain rents fees from their land or plots, 2% enjoy benefits from cooperatives, 2% gain from domestic worker wages and 2% are employing other employees.

Table 9: Annual income from second income generating activities

Size of income from secondary main source of income (Rwfs)	Number of family members	Percentage
0-100,000	4	10,2
100,001-500,000	4	10.2
500,001-1,000,000	4	10.2
1,000,001-2,000,000	11	28.
2,000,001-4,000,000	6	15.1
4,000,000-10,000,000	6	15.3
10,000,000-20,000,000	2	5
Above 20,000,000	2	5
Total	**39**	**100**
Average (Rwfs)	**8,587,959**	

Source: Field survey, BESST Ltd 2018

4.3.3. Land ownership in the project area.

In Rwanda all plots have been registered and given a Unique Personnel Identification(UPI) that shows the land owner. In some instance the land owner may lease his land to someone else for a given period. There also people who are using the government land especially in marshlands. The field survey team identified the land ownership and these data are very important especially during compensation exercise.

- **Time spent in current residential house**

The survey revealed that only 5 household has spent less than one year in the project area. 37.5% spent more than 20 years in the current residential houses. This is due to the fact that most of the household in the project area own their houses. All people who recently moved to the project area are from Gasabo district and one is from Kicukiro district. No one from outside Kigali City.

Table 10: Time spent in current house

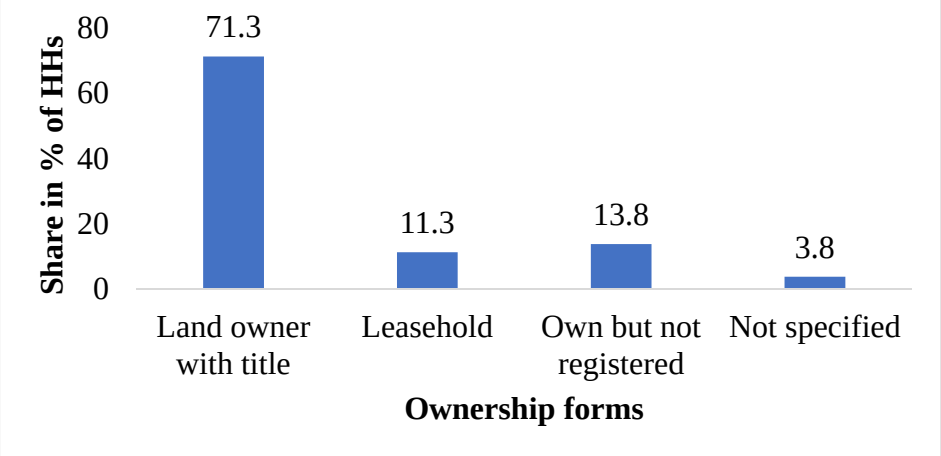
Number of years spent in the house	<1year	1-5	6-10	11-16	16-20	>20
Number of households	5	14	14	9	8	30
%	6.2	17.5	17.5	11.3	10	37.5

Source: Field survey, BESST Ltd 2018

- **Residential land ownership**

Results of filed survey shows that 71.3% of interviewed households are owner of the residential houses, 11.3% live in rental houses and 13.8 occupy their own house but the land is not registered. 3.8% of interviewed households failed to provide information on land ownership.

Figure 18: Residential land ownership.

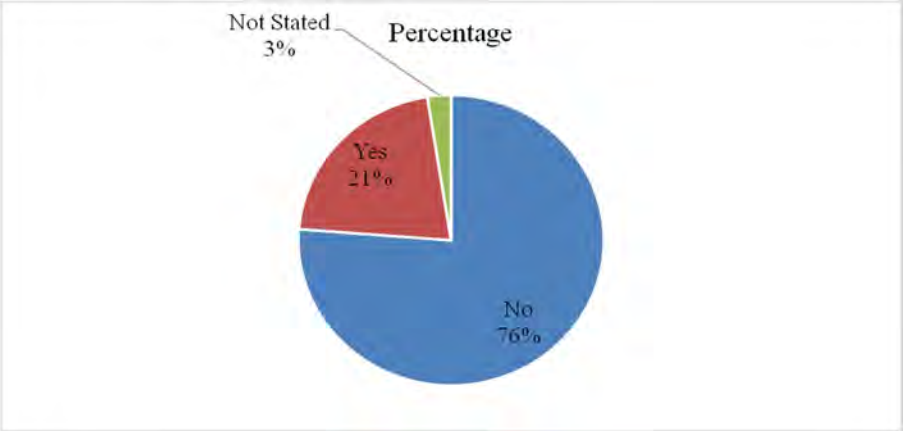


Source: Field survey, BESST Ltd, 2018

- **Other land than residential area**

Only 21%household reported that they have other plots in the project area while 76 have only residential land.

Figure 19: Households with additional lands.



Source: Field Survey, BESST Ltd 2018

4.3.4. Source of income and households expenditures

In addition to the source of income by household members, it was paramount to analyse the source of income in the household and how household spend resources.

- **Household Source of income**

Households were requested to provide information on their main source of income and the second source of income. Source of income includes salaries and wages, retirement income, near cash government transfers like food stamps, and investment gains. Results from the study are presented in the following table. In total, 40 households are growing vegetables/crops inside the project area, but the number of households whose main income is from farming is 9.

Table 11: Main and second source of income in the project area.

Household Source of income	Main source of income		Second source of income	
	No. of HHs	%	No. of HHs	%
Agriculture	9	15.5%	13	22.4%
Livestock	5	8.6%	7	12.1%
Construction	1	1.7%	1	1.7%
Manufacturing	1	1.7%	0	0.0%
Commercial	16	27.6%	3	5.2%
Trading	1	1.7%	0	0.0%
Financial	2	3.4%	1	1.7%
Transportation	0	0.0%	1	1.7%
Government	5	8.6%	3	5.2%
Education	1	1.7%	0	0.0%
Professional	8	13.8%	6	10.3%
others	4	6.9%	7	12.1%
No reply	5	8.6%	16	27.6%
Total	58		58	

Source: Field survey, BESST Ltd 2018

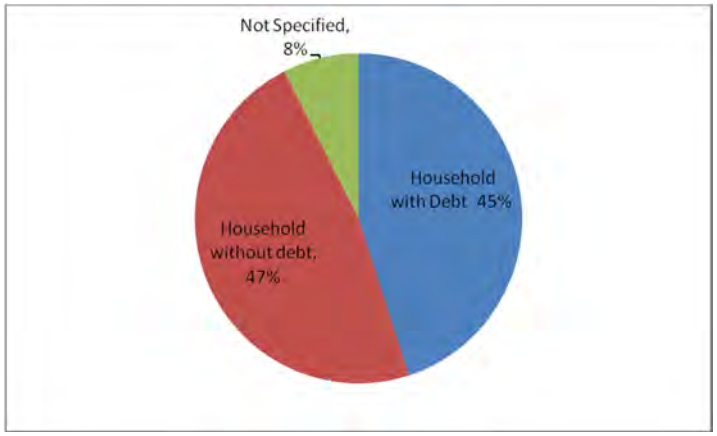
- **Loans**

Household debt is defined as the combined debt of all people in a household. It includes consumer debt and mortgage loans. Household debt can be defined in several ways, based on what types of

debt are included. Common debt types include home mortgages, home equity loans, auto loans, student loans, and credit cards.

In Rwanda people use debt for improving household consumption, develop or improve their small or larger income generating activities, paying school fees, etc. The survey assessed the main purpose the loan, source, size, pay, payment period (agreed) of debt held by household in the project area.

Figure 20: Loan status in the project area.



Source: Field survey, BESST Ltd 2018

From the above chart, 45% of households have borrowed money, 47% did not report any loan while 8% did not want to provide information on the question.

- **Purpose of the loan**

Households reported different reasons of borrowing money and 37% borrowed for buying house or constructing houses, 18.5% for starting or increasing business (commercial activities), 7.4% to add value to existing house and expanding it, 3.7% also for commercial activities expansion 3.7% equally for both buy and renew the house. The following table summarizes different reasons of taking the loan.

Table 12: Purpose of taking loan

Purpose of debt	Number of Households	Percentage
Buy a house	10	37.0%
Add a value to existing house and expansion	2	7.4%
Buy domestic household materials	1	3.7%
Buy Motorcycle	1	3.7%
Buy parcel of land	1	3.7%
Expanding garage	1	3.7%
Expanding house for animal rearing purposes	1	3.7%
Commercial activities expansion	1	3.7%
Develop Bar business	1	3.7%
Business (Commercial)	5	18.5%
Animal Rearing	1	3.7%
Rearing caws	2	7.4%
Sub-Total	27	

Source: Field survey, BESST Ltd, 2018

- **Source of loan**

The survey revealed that have loan from commercial banks with 97,2 while only one person took the loan from his employer. 63.9 % of interviewed household acknowledge to have the loan but

did not disclose the name of the Bank.. the following table summarizes the source of loan among 27 HHs who have loans.

Table 13: Source of debt for household living in the project area

Source of Debt	Number of Households	Percentage
BANK	16	59.3%
Bk	2	7.4%
BPR	4	14.8%
COGEBANQUE	1	3.7%
CSS BANK	2	7.4%
Letshego	1	3.7%
Advance salary payment	1	3.7%
Sub-Total	27	100

Source: Field survey, BESST Ltd 2018

- **Size of the loan**

Only 24 household accepted to disclose the size of the loan and following table provides an indication on the size of the loan. 37.5% of households borrowed more than 20 million and this is due to the fact that most of the loans are for house construction and to construct a house in project area goes beyond 20million.

Table 14: Size of debt for households in the area covered by the project

Size of the Loan	Number of HHs	%
< 1000,000	1	4.2%
1m-5m	7	29.2%
5m-10m	6	25.0%
10-15	1	4.2%
> 20	9	37.5%
	24	100

Source: Field survey, BESST Ltd 2018

- **Loan repayment period**

Debt period range from one year to 15 years and this reflect the terms of the loan given by most of the bank in Rwanda. Only one household has short term loan that equal to six months and this is the loan from employer. The table below provide information on debt period

Table 15: Debt period of payment for household living the area covered by the project

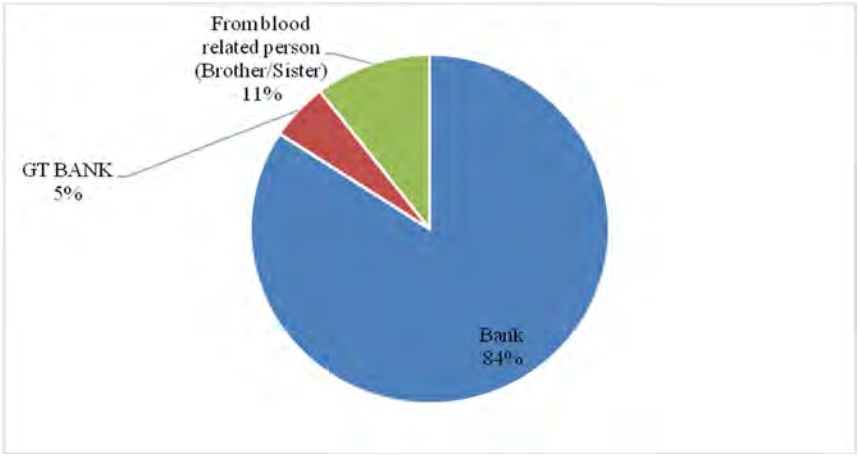
Debt payment period	Number of Households	Percentage
6 Months < 1year	2	8.3%
1 -3	11	45.8%
4-10	10	41.7%
Above 10	1	4.2%
General Total	**27**	**100**

Source: Field survey, BESST Ltd, 2018

- **Additional debt**

Among the interviewed households, 19 confirmed to have additional debt the source is almost the same as the first loan but the second loan is taken in different banks.

Figure 21: Source of additional debt

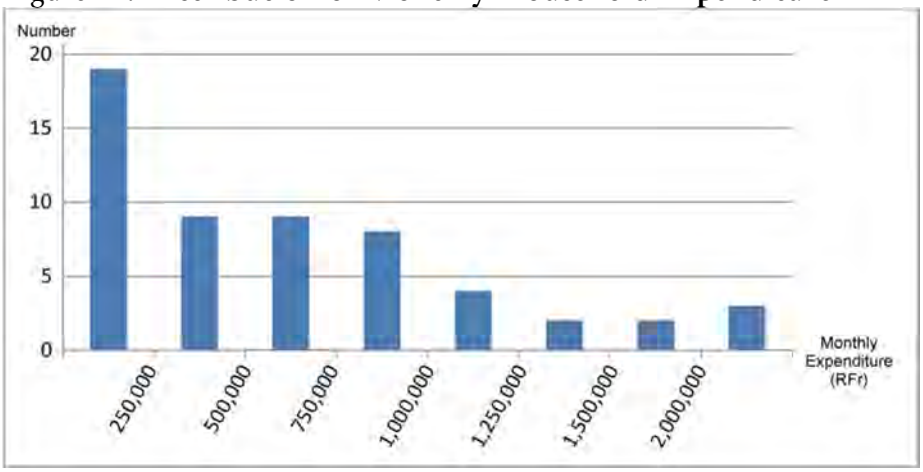


Source: Field survey, BESST Ltd 2018

- **Household monthly expenditures**

The distribution of the monthly household expenditure of 52 households is shown below. The median household expenditure is RF 505,175 and much of the money is spent on food with 29%, Fuel comes at the second place with 14 % while water is the last with 1 %. The table 15 summarizes household monthly expenditures.

Figure 22: **Distribution of Monthly Household Expenditure**



Source: Field survey, BESST Ltd 2018

Table 16: Household monthly expenditures

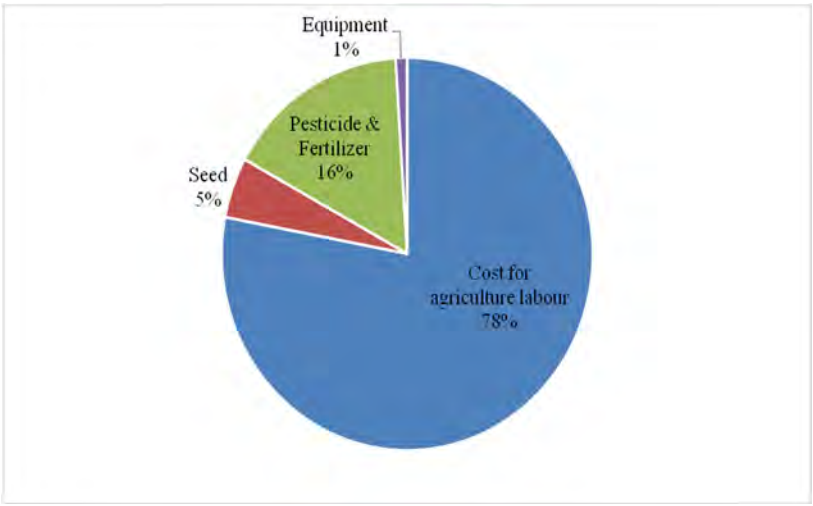
Services spending for/ Monthly Expenditure on	Total households expenditure	Average expenditure per household	Share in %
Food	20,465,500	255,819	**29%**
Fuel	10,055,000	279,306	**14%**
Water	852,435	11,677	**1%**
Electricity	1,408,250	18,777	**2%**
Daily Transportation	3,561,067	54,786	**5.2%**
Transportation to school	3,432,952	68,659	**5.7%**
Health	3,662,355	51,582	**5.1%**
Other education related	18,415,699	270,819	**27%**
Others	**7,634,534**	**127,242**	**11%**
General total	**69,487,792**	**120,221**	100%

Source: Field survey, BESST Ltd 2018

- **Yearly expenses for Rice farming**

For households where rice farming is the main source of income, the total expenditure is about 1,925,000Rwfs annually where 78% are spent on agriculture labour, 5% for seed, 16% for pesticide and fertilizers and 1% for equipments.

Figure 23: Yearly expenses of household for Rice farming.

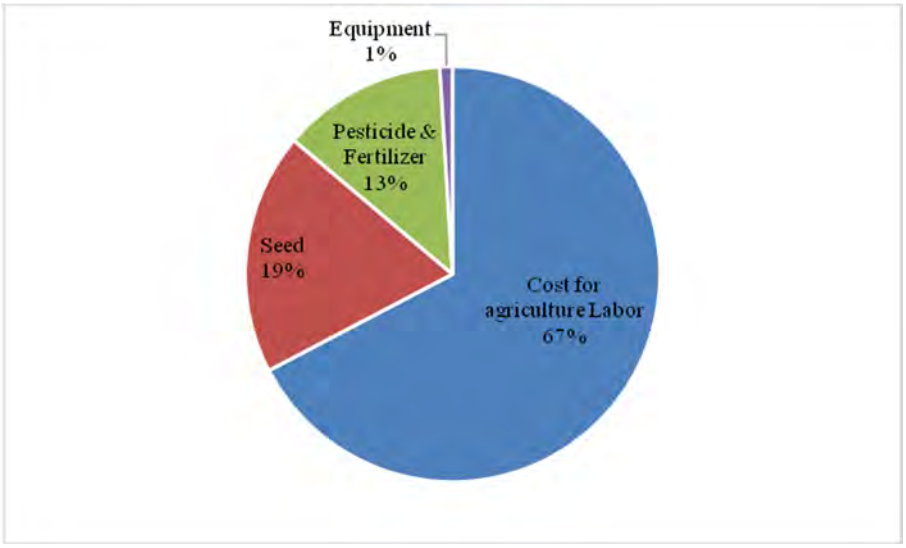


Source: Field survey, BESST Ltd, 2018

- **Yearly expenditure for vegetable farming.**

For households with vegetable farming is the main source of income, households spent in average 592,500 FRW per year. The same as on the rice farming, most of money are sent on agriculture labor (68%). Other money are spent on seed costs (19%), pesticide and Fertilizer (13%), and equipment's for vegetables and fruits growing (1%).

Figure 24: Yearly expenses for vegetable and fruits farming.

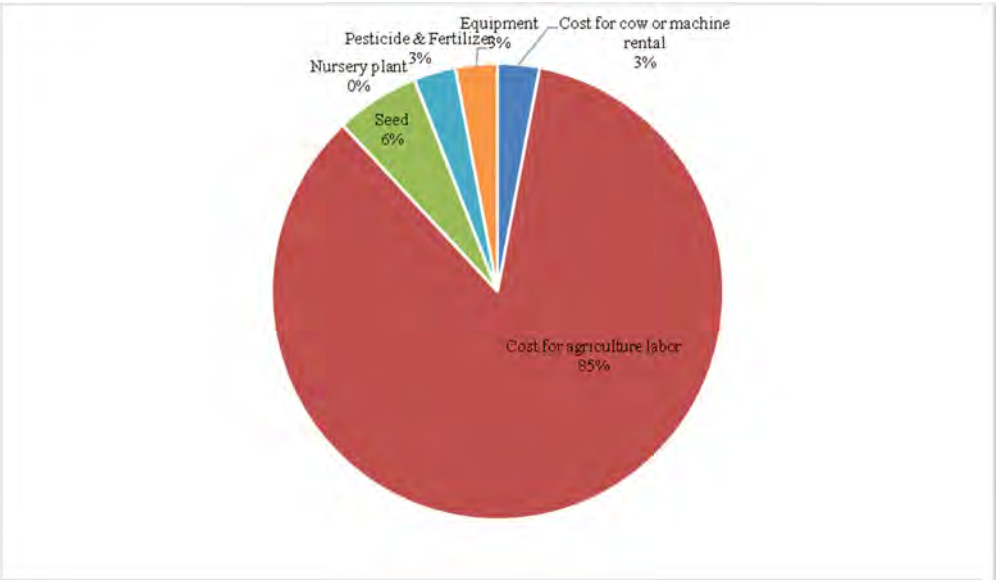


Source: Field survey, BESST Ltd 2018

- **Expenses for farming other crops**

Though Kigali is an urban area, some households reported farming of subsistence and commercial crops s the main income source. In average a households can spent about 1,138,389RWF for farming other crops in three season. Most of expenses are on labour with 85% of total costs. second are costs for cow or machine rental (3%), seed (6%), pesticide and fertilizer (3%) and equipments with (3%).

Figure 25: Yearly expenses for household for farming other crops.



Source: Field survey, BESST Ltd 2018

- **Expenses for livestock keeping**

For livestock keeping in the project area, expenses are a little bit high because farmers who are relying on livestock are big farmers who secured farms in the project area. In average total expenses is 3,870,375 rwf where animal feeding takes 76%. The rest of money spent on animal vaccination (6%) and other expenses like guards takes 18%. It worth to note that these expenses for agriculture and livestock are estimation because most of farmers do not do record their expenses on regular basis.

Table 17: Yearly expenses for household livestock keeping

Item which cause expenses/ need costs	Number of Household	Total Expenses/ per year (in Rwfs)	Average costs per year (in Rwfs)	Share in %
Animal feed	16	61,926,000	3,870,375	76%
Vaccination	16	5,150,000	1,287,500	6%
Others	16	14,652,265	610,511	18%
Total	**16**	**81,728,265**	**5,108,017**	**100%**

Source: Field survey, BESST Ltd 2018

- **Yearly expenses for trading and other small business**

Expenses for running shop and other small were reported by 22 households. In this category, households spent 44,957,500 and most of the money are spent on purchasing commodities with 95%. Other expenses are spent on labor and staff in business (3%), rental fees for working place (0.28%), electricity 0.20%.

Table 18: Yearly expenses for running shop and other small business

Item which cause expenses/ need costs	Number of Household	Total Expenses/ Costs per year (in Rwfs)	Average costs per year (in Rwfs)	Share in %
Purchasing commodity	22	989,065,000	44,957,500	95.65%
Cost for labor & staff	18	34,193,000	1,899,611	3.31%
Water	15	2,946,200	196,413	0.28%
Electricity	9	2,049,500	227,722	0.20%
Others	19	5,787,900	304,626	0.56%
Total	**22**	**1,034,041,600**	**47,001,891**	**100.00%**

Source: Field survey, BESST Ltd, 2018

4.3.5. Household domestic appliances or materials

Households were asked to list appliance or material their own. Materials and appliances are in many categories and they are used either for food preparation purposes, washing clothes or any other domestic activity and they constitute one of the measurement indicator for socio-economic

development. The next table provides detailed information on appliance owned by households in project area.

Table 19: Household properties/appliances or materials in the project area

Household Items	Number of household owning item	Total assessed household	Total number of Items
Fridge	28	48.3%	37
Cooking stove/equipment	34	58.6%	42
Micro oven	17	29.3%	17
Washing machine	6	10.3%	6
TV	45	77.6%	61
Radio	39	67.2%	54
Computer (desktop)	6	10.3%	8
Computer (notebook)	31	53.4%	66
Bicycle	11	19.0%	15
Motorbike	3	5.2%	4
Car	22	37.9%	38
Mobile Phone	46	79.3%	135
Smart Phone	46	79.3%	117
Landline Phone	2	3.4%	4
Electric fan	6	10.3%	16
Inverter	20	34.5%	28
Battery for inverter	4	6.9%	4
Solar panel	6	10.3%	6
Generator	5	8.6%	5
Tractor	1	1.7%	1
Agricultural machine	0	0.0%	0
water pump	7	12.1%	7
Others (iron)	16	27.6%	24
Total			

Source: Field survey, BESST Ltd 2018

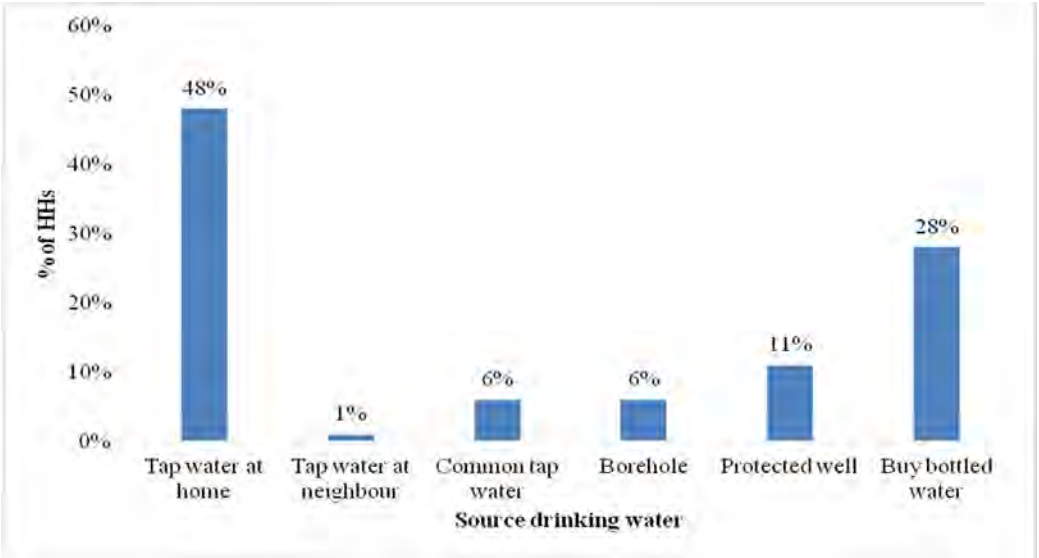
4.3.6. Household accessibility to water and electricity

Water and electricity are major component of household daily activities. This section provides information on how households access those services in project area.

- **Source of drinking water**

The survey results show that all households in the project target area have access to safe drinking water. The survey show that 48% have tap water at home, 28% buy bottled water, 11% use protected well, 6% common tap water, 6% also borehole and only 1% to tap water at neighbour.

Figure 26: Share of main source of drinking water for household in the project area

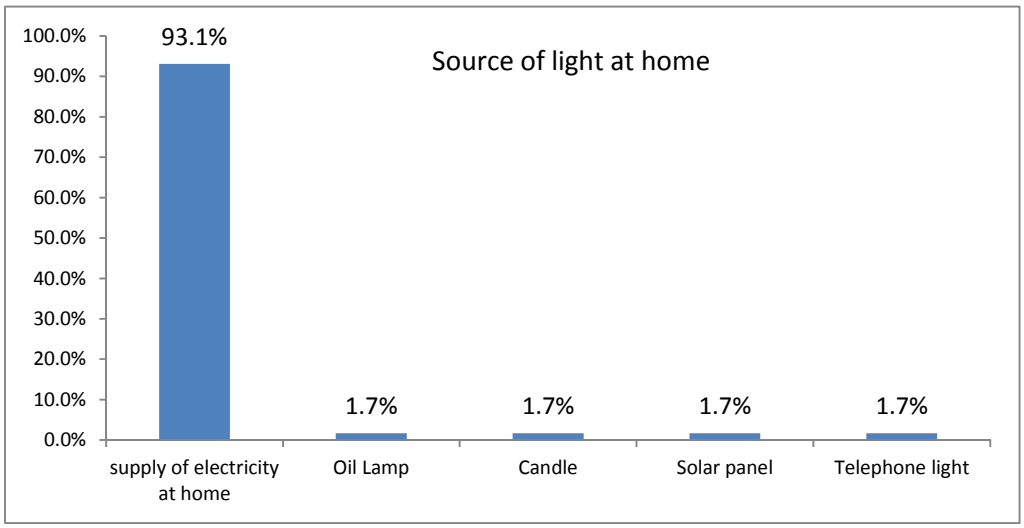


Source: Field survey, BESST Ltd 2018

- **Source of energy for lighting**

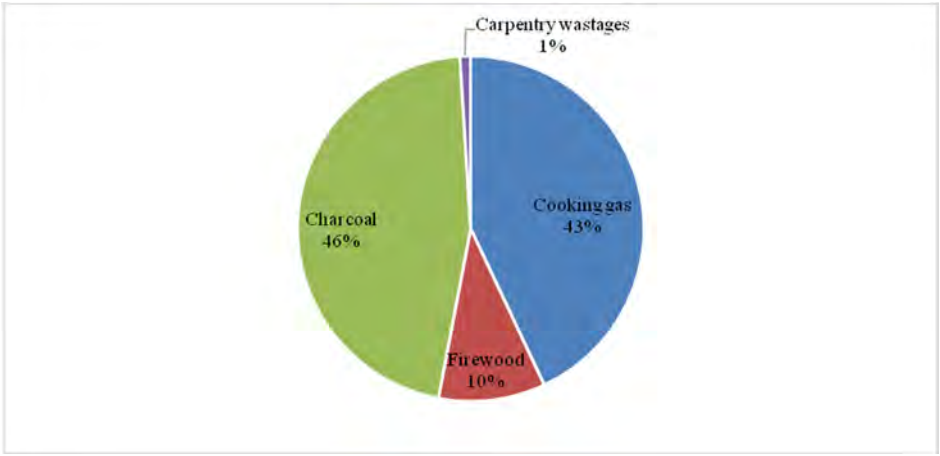
On 58 households interviewed, 93% are connected to the national grid and use electricity for lighting, 1.7% candle, 1.7% oil lamp, 1.7% solar panel and 1.7% telephone light.

Figure 27: Main source of household energy for lighting in the project area



Source: Field survey, BESST Ltd 2018

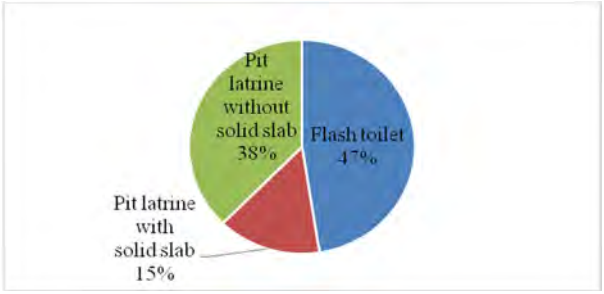
Figure 28: Main source of energy for cooking for household in the project area



Source: Field survey, BESST Ltd, 2018

- **Sanitation facilities in project area**

Figure 29: Main type of toilet used by households



Source: Field survey, BESST Ltd 2018

4.3.7. Access to health services and frequent diseases

Access to health facilities is an important indicator is socio-economic survey and is assessed by considering the time citizens use to get health services. This survey also assessed the frequent

diseases in the project area. From 58 household assessed in the project area, the longest time to get health service is 60 minutes with 4% of households, 20% use 10 minutes from home to nearest health centre, 25% use 40 minutes, 18% takes 30 minutes. The average time of household (any) to nearest health centre is 25 minutes for all households owning plots in the area of the project.

Table 20: Time it takes from home to the nearest health facility

Size	Number of Household	Percentage
<5minutes	3	5.2%
5-10	15	25.9%
10-20	10	17.2%
21-30	12	20.7%
31-40	15	25.9%
>40	3	5.2%
	58	100%

Source: Field survey, BESST Ltd 2018

Table 21: Frequent diseases that required medical treatment from last year (2017)

Disease affected household member in last year	Number of Respondents	Percentage
Malaria	27	34%
Diarrhea	4	5%
Stomach problems	10	13%
Respiratory problems	18	23%
Eye infection	15	19%
STIs/HIV/AIDs	2	3%
Blood Infection	1	1%
Diabetes	1	1%
Disability	2	3%
Skin diseases	2	3%
Child disease	1	1%
Sex disease	1	1%
Paralyse	1	1%
Hypertension	3	4%
Accident	1	1%
Typhoid	1	1%
Teeth disease	1	1%
Skin Allergy	1	1%
X-Ray services	1	1%
Humanization	1	1%
Mascles diseases	4	5%
Grippe	1	1%
Infection	3	4%
Hemolagy in the head	1	1%
Snake	1	1%
Back	1	1%
Joints	1	1%
Polio	1	1%
Don't remember	3	4%

Source: Field survey, BESST Ltd 2018

Table 22: Medical treatment

Households attended Hospital for disease treatment in last year	49	86%
Households not went to the hospital for disease treatment in last year	8	14%
Total	57	100%

Source: Field survey, BESST Ltd, 2018

Above tables shows that 86% of interviewed households has at least one member who went to the hospital last year for medical treatment while 66% did not. The most common disease is Malaria (34%), respiratory problems (23%), Eye infection (19%), Stomach problems (13%), Diarrhea (5%), Muscles diseases (5%), Hypertension (4%), Infection (4%), Don't remember (4%), STIs/HIV/AIDs (3%), Disability (3%), Skin diseases (3%) and all other illness or diseases are fluent less than 1%.

- **Access to other socio-economic infrastructure**

In average, households use 19 minutes to access primary education facilities, 24 minutes to access high school, 21 minutes to access administrative office and 24 to access market/shop.

Table 23: Time consumed by households members from their home to selected infrastructures

Time range	Service							
	Access to Primary Education		Access to secondary education		Access to administrative office (cell)		Access to Food market or shop	
	Number of Household	Percentage	Number of Household	%	Number of Household	%	Number of Household	%
<10	8	14.0%	16	28.1%	6	10.5%	13	22.8%
10--20	13	22.8%	7	12.3%	25	43.9%	7	12.3%
20--30	21	36.8%	8	14.0%	6	10.5%	8	14.0%
30--60	13	22.8%	19	33.3%	17	29.8%	23	40.4%
>60	2	3.5%	7	12.3%	3	5.3%	6	10.5%
Average	19.9		24.2		21.6		24.4	

Source: Field survey, BESST Ltd 2018

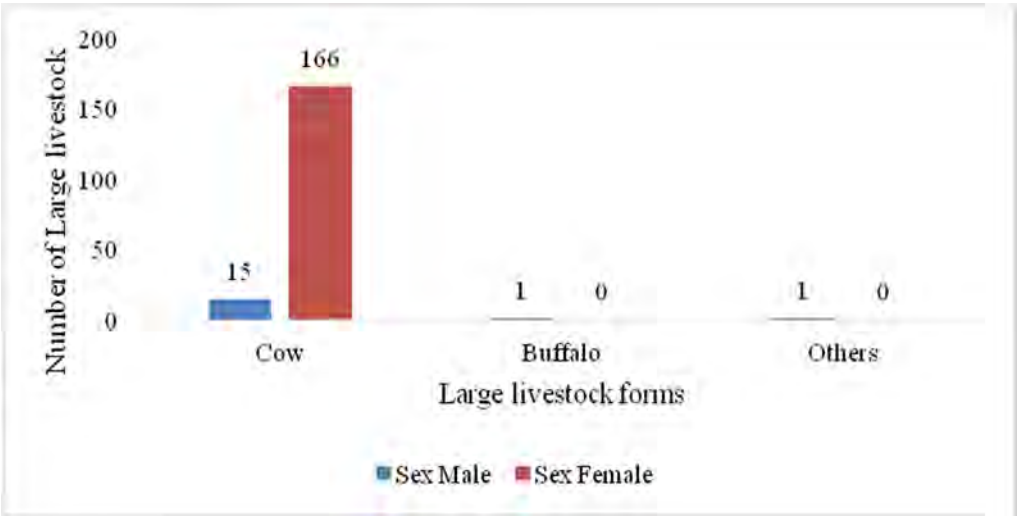
4.3.8. Livestock farming in the project area

Though the project target area is an urban area, people are still keeping livestock. In the project area, households are rearing both small and larger animals.

- **Large size livestock development in the project area**

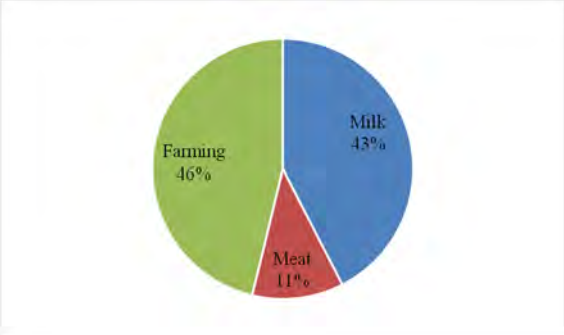
The main large livestock kept in the project area cows. Only one household reported buffalo. The purpose of cattle keep include selling, milk, meat, etc.

Figure 30: Number and sex of larger livestock in the project area



Source: Field survey, BESST Ltd. 2018

Figure 31: Purpose of rearing large animals in %



Source: Field survey, BESST Ltd 2018

- **Livestock keeping after expropriation.**

When asked whether households considers to keep large livestock after expropriation 61% are willing to continue since the proposed project will not affect the entire farms. 31% prefer to change the activity and start new business. the rest of households were not sure and they prefer to decide when they know the project impact on their farms.

- **Small livestock in the project area**

Small livestock rearing is also one of the income generating activities in Rwanda and its one of source income for some household.. In the project area only 13 households out of 80 have at least one small livestock and Chicken are the most visible in the project area with 2,046 chicken reported. Pigs, duck, rabbit and goat are also present in the project area. The following table summarizes small livestock identified in the project area and the use of them.

Table 24: Small livestock characteristics in the household living in the project area

Small Livestock	Total number	Selling		Domestic use		Both: Selling and Domestic use		others	
		Number	Share	Number	Share	Number	Share	Number	Share
Pig	16	16	100%	-	-	-	-	-	-
Chicken	2,046	2,002	97.8%	17	0.8%	27	1.3%	-	-
Duck	11	-	-	-	-	-	-	11	100%
Goat	46	-	-	20	43.5%	21	45.7%	5	10.9%
Rabbit	13	-	-	8	61.5%	5	38.5%	-	-
Total	**2132**	**2018**	**94.7%**	**45**	**2.1%**	**53**	**2.5%**	**16**	**0.8%**

Source: Field survey, BESST Ltd 2018

4.3.9. Socio-economic status of corporation in project area

- **Type of Corporate**

In Rwanda major types of corporate include Government institutions, Non- Governmental Organisation(NGOs), commercial companies, Cooperatives and Community Based Organization(CBOs). in the project area 8 corporations were identified but only six provided information. Among the six corporation identified, 3 are commercial limited companies, 2 non profit organization and 1 local public institution.

Table 25: Type of Corporation

Type of Corporation	Number	Percentage
Limited Liability Company	3	50.0
Non-Profit Corporation	2	33.3
Local public body	1	16.7
Total	6	100

Source: Field survey, BESST Ltd 2018

- **Type corporation business**

The following table presents the type of organization identified in the projects area including churches, schools and commercial enterprises.

Table 26: Category of business for plots owned by the corporate

Business category	Number	Percentage
Education	1	16.7
Lodging, catering, restaurant	2	33.3
Other service	1	16.7
Professional service	1	16.7
Church	1	16.7
Total	6	100

Source: Field survey, BESST Ltd, 2018

- **General information of corporation.**

Though two corporate did not disclose the information on their financial and administrate situation, the surveying team managed to get some information on corporation in the study area and these information are presented in the following table.

Table 27: Description of corporate business in the project area

Type	Starting year	Starting Capital in Rwfs	Number of Employees		No of Board Members	NO of Employees	NO of Factories	Sales in 2017	Last Year Profits (in Rwfs)
School	2015	326,567,235	Full Time	Part Time	6	2	1	85,077,000	
			24	0					
Bar, Resto, Apartment	2012	6,000,000	5	2	2			18,000,000	
	2016	700,000,000	70	0	7			400,000,000	
Church	1995	5,000,000	2	3	53				
Zamura Cooperative	2000	10,000,000	2	5	5	1		Secrete	
Kobil	2013	20,000,000		11	2	1		700,000,000	5,000,000
Average where applicable			21	4	13	1	1	300,769,250	5,000,000

Source: Field survey, BESST Ltd 2018

- **Ownership of the land used by corporate**

The following table provide information on land ownership , access to service like water and electricity and sanitation infrastructures.

Table 28: General information on land ownership, access to social infrastructure

Type of corporate	Kobil Petrol station	Bar, Resto, Apartment		School	Church	Zamura Cooperative
Years/months in Using Plot House	Not Specified (16.66%)	5 Years and 7 Months (16.6%)	1 Year and 6 Months (16.6%)	3Years and 1 Month (16.6%)	23 Years (16.6%)	18 Years (16.6%)
Land Ownership	Tenant/Rent (33.3%)		Plot of ADEPR (16.6%)	50%		
Building Structure	Tenant/Rent (33.3%)		Own (66.6%)			
Source of Drinking Water	Tap water at home (100%)					
Source of energy for lighting	Supply of electricity at home (100%)					
Toilet Type used by the corporate	Flash toilet (66.6%)				Pit latrine with solid slab (16.6%)	Pit latrine without solid slab (16.6%)

Source: Field survey, BESST Ltd 2018

4.3.10. Assets inventory

The project of strengthening of Nzove-Ntora Principal requires the clearance and excavation work where the pipeline will be installed. For this reason, the field survey included inventory of assets that are likely to be affected. Among other assets to be affected, include structures such as fences, wall and concrete floor, perennial crops and trees. The assets inventory considered maximum 9.8 m width where access road is required, 2 to 3.9 m where access road exist width which will be required during construction. After construction all this land will not be required but it should be used under certain conditions.

Table 29: Number of plots identified in the construction area by land use

DISTRICT	SECTOR	CELL	Number of HHs	Number of plots affected		Size of affected land (m2)
Gasabo	Gatsata	Nyamabuye	6	Cultivate land	7	1,841
				Business/commercial	2	1,323
		Nyamugari	8	Cultivate land	22	6,174
	Gisozi	Ruhango	46	Cultivate land	26	7,585
				Housing plot	21	373
				Business/commercial	6	144
Nyarugenge	Kanyinya	Nyamweru	7	Cultivate land	6	1,621
				Housing plot	3	116
				Business/commercial	1	378
		Nzove	9	Cultivate land	14	6,397
				Housing plot	0	0
	Kigali	Nyabugogo	19	Cultivate land	28	10,936
				Housing plot	5	3,061
				Business/commercial	6	437
	Kimisagara	Kimisagara	*0	Cultivate land	1	280
Grand Total			**95**		**148**	40,665

*: User of the land is counted at Nyamweru Cell, because they do business there

Source: Field survey, BESST Ltd, 2018

The targeted land plots are summarized according to the ownerships. The left end column shows the total area of the permanently lost land.

Table 30: Targeted Land Plots by Ownership

District	Sector	Cell	Size of affected land (m2)			Permanently affected land (only private land) m2
			Government land (m2)	Private land (m2)	Total	
Gasabo	Gatsata	Nyamabuye	2,680	484	3,164	157
		Nyamugali	3,933	2,242	6,174	445
	Gisozi	Ruhango	2,563	5,539	8,102	2,392
Nyarugenge	Kanyinya	Nzove	864	5,533	6,397	718
		Nyamweru	98	2,016	2,114	723
	Kigali	Nyabugogo	11,769	2,664	14,433	1,510
	Kimisagara	Kimisagara	280		280	-
total			22,187	18,478	40,665	5,946

CHAPTER V: PUBLIC CONSULTATION AND PARTICIPATION

5.1. Overview

Public consultation and stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that involves the following elements, stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and on-going reporting to affected communities. During this survey consultation meetings were conducted with regulatory authorities, local leaders and local communities. Due to the difficulties of having people many times especially communities who have to work every day , it was advised to have meetings in the afternoon preferably on Tuesday where local people have community meetings. It was also advised to combine meetings for environment and social assessments rather than having separate meeting.

5.2. Purpose

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

5.3. Public consultations and participation

Public participation and community consultation has been taken up as an integral part of social and environmental assessment process of the project. Consultation was used as a tool to inform project affected people, beneficiaries and stakeholders about the proposed activities both before and after the development decisions are made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. Initial Public consultation has been carried out in the project areas with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project.

As part of the project consultations, efforts were made to consult with the decision making official at central level as well as a number of local authorities, to determine their thoughts, opinions and feedback on the impact of Nzove-Ntora project.. Information and comments collected from the public early in the study process were of use. Local communities especially farmers who are the land along the proposed pipeline were also consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the project prior to its start - up.

5.3.1. Stakeholders

Discussions with decision making bodies, key stakeholders, sector institutions and specialist experts were made on the very concepts and nature of the proposed 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 authorities with whom consultations made at the project study areas were:

At national level:

- Ministry of Environment
- Rwanda Water and Sanitation Corporation Limited(WASAC Ltd)
- Rwanda Environment Management Authority (REMA)
- Rwanda Development Board (RDB).
- Kigali City

At local level:

- Gasabo district
- Nyarugenge district
- Kigali , Kanyinya, Gisozi and Gatsata sector
- Potential Project Affected People(PAPs).

List of consulted people are attached in appendices

5.3.2. Public participation – methods and process

During the Public consultation, the study team applied different participatory methods, namely; interviews, one-to-one discussions, focused group discussions (FGD) and official meetings with stakeholders. Stakeholders consulted were informed on the proposed project and by using the key guiding questionnaires, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities. For the socio-economic survey and assets inventory, consultation focused on potential projects households. During these consultations, stakeholders and the communities were explained about the project, its benefits, social and environmental impacts. The participants were encouraged to (i) be open and make known their concerns and claims. The presentation highlighted the project background, objectives, expected upcoming activities, social economic information, environmental concerns and land acquisition process.

5.4. Consultative meeting held with stakeholders and communities

Different meeting was organized by the study team from the earliest stage of project planning so as to present to all stakeholders the proposed project. In addition to public consultation meeting with project beneficiaries or project affected persons, the study team held technical meeting and one to one meeting with stakeholders as well. The first meeting was done at scoping phase to explain the projects to stakeholders and get feedback on key areas of concern that need to be covered. The second round of consultation meeting was held before the socio-economic survey and the third round of consultation meeting was done after socio-economic survey and assets inventory to display census results and agree on compensation measures. To avoid more unnecessary meeting and on advice from local authorities all those consultations covered both environmental assessment, socio-economic survey and resettlements implication.

5.4.1. Scoping meeting

- **Consultation at central and district level**

Consultation at central and district level consisted at explaining the proposed project, legal and regulatory requirements relevant to the project as well as roles and responsibilities of different stakeholders. It was also an opportunity to collect data and information related to the projects like existing laws, standards and policies. These consultation was done one to one interviews with guiding question institutions consulted include:

- Ministry of Environment,
- Ministry of Land and Forestry
- Rwanda Land Management and Use Authority
- Rwanda Environment Management Authority(REMA)
- Rwanda Development Board(RDB)
- Water and Sanitation Authority(WASAC)
- Kigali City Council(KCC)
- Gasabo District and Nyarugenge District

In relation to involuntary resettlement, key issues identified during one to one consultations include:

- Possibility of loss of property , crops and trees, disturbance of water table, loss of biodiversity.
- Likelihood of delays in compensation of PAPs, which could escalate into disputes, Execution period, employment for their citizen, cost and accessibility of potable water waste management and disposal, Source of construction material, health insurance; connectivity to the existing network, cost of land acquisition and eligibility criteria.;
- Possibility of low wages to local workers during construction works;
- Payment of water fees;
- Roles and responsibilities in implementation and monitoring of RAP;
- Land ownership and eligibility criteria and;
- Entitlement matrix/Compensation measures.

The list of stakeholders consulted at central level is presented in annexes.

- **Consultation with sector and cells authorities**

Before meeting potential project affected people the consulting team met with local authorities from local authorities from sector and cells. Apart from Gisozi sector where local authorities gathered at sector conference hall, other authorities were consulted at their offices. the purpose of those meetings was to introduce the consulting team. introduction of projects and likely impacts, schedule for public consultation meeting with potential affected persons. The list of people consulted at Sector an cell level is presented in annexes.

5.4.2. Scoping meetings with local communities

One meeting was held in each sector to introduce project to local authorities and local population who has land or use the land in project. These meetings were invited by WASAC Ltd and the Specialist in charge of Environment and Social attended the meeting. It was agreed that those meeting should take place in the afternoon preferably on Tuesday where local citizens have community meeting. All these meeting were chaired my sector and cells authorities and the

WASAC Ltd representative presented the project while the consultant team discusses the project environmental and social impact using the scoping matrix(see annex 4). Table 32 summarizes meeting held with communities at scoping stage and table 33 summarizes key issues raised in each meeting. Attendance list are presented in annexes.

Table 31: schedule of scoping meeting with local communities

Dates	Sector	Venue	Category of Participants
Tuesday January 9th, 2018	GATSATA	NYAMABUYE cell	- WASAC Representative - BESST LTD Team - Nyamabuye Cell local Leaders - Nyamabuye local community
	KIGALI	Nyabugogo Cell	- WASAC Representative - BESST LTD Team - Nyabugogo Cell local Leaders - Nyabugogo local community
Tuesday January 16th, 2018	KANYINYA	Nyamweru Cell	- WASAC Representative - BESST LTD Team - Nyamweru Cell Leaders and local community
Saturday January 27th, 2018	GISOZI	Ntoral Cell	- BESST LTD Team - Representative of Ruhango cell and four villages - Community of four villages

Table 32: Questions and Suggestions and responses provided in public consultation meet at scoping stage.

No.	Names	Questions/Suggestions	Responses
Nyamabuye cell in Gatsata sector, Tuesday January 9th, 2018			
1		- How many sectors will the pipeline cross?	-The proposed pipeline will be installed in four sectors Kanyinya and Kigali in Nyarugenge, Gatsata and Gisozi in Gasabo District.
		-Will the pipeline cross through people properties? If so, is there compensation planned for?	- The project is designed to avoid people houses but where structures will be affected, adequate compensation will be provided
		- It seems that there are many partners involved in the project, who is responsible for compensation issues? To witch institution shall we send our complaints?	-WASAC Ltd is the implementing agency and will be responsible institution to provide compensation but will work with district, sector, cells and resettlement committees.
		- When assets valuation will start	- There will be a cut-off date that will be agreed on and announced to the population which means that every assets putted after the cut-off date will not be considered.
3		During the previous projects that occur, we noticed that there are lands valuated and it was marked zero (0) on the certificate, and we couldn't be compensated, what does this project expect to do about it?	The consultant explained that the 0frw marked to land titles is related to Taxes but in Compensation the value of land is calculated based on full replacement cost of market value. Anyone who own a land which does not have up to one ha (1ha) and is for agriculture does not pay taxes but when the land is affected the person receives compensation.
		-There is a pipeline from Yanze river that have exploded and the water destroyed the bridge	- WASAC Ltd Representative promised to check the issue and work with the maintenance department to address the problem.
Nyabugogo cell in Kigali sector, Tuesday January 9th, 2018			
1		-We are currently working on government land, what will happen during the valuation?	-During Valuation people will have to provide evidences of assets ownership, better search for documents before.
		Have you already planned where people will relocate after the expropriation?	The first assessment involved avoiding expropriation thus not many people will be expropriated

2		After the construction works will people continue to use their land?	- The consultant replied that during construction works, they will need buffer zone but after the construction other works will continue as usual.
		Some have assets on the land which they lease, and they don't have ownership certificate what laws says about it?	Land law says that in case of project implementation, assets on land are compensated to its owner.
			The consultant mentioned also that there is a cut-off date that will be announced, thus any assets that will be added after the cut-off date will not be evaluated. He mentioned also that everyone who has land must provide the proof of ownership
Nyamweru Cell, Kanyinya sector, Tuesday January 16th, 2018			
1.		We have a local market here, what about the pollution during the construction work?	Construction works could probably have impacts like pollution which will be analysed during the studies that will be conducted.
		We are being asked taxes buy the owner of the plot and we wonder who will be compensated if the market is affected?	The compensation will be provided to land owners but if there an agreement with users then the compensation of assets will be provided to the person who owns these assets
2		What about people who are renting the land as business ground?	Disturbance allowances are provided in expropriation laws and should be added to the compensation package.
Meeting with communities in Ruhango, Gisozi Sector , January 18, 2018			
1.		Are other meeting planned with affected people?	The consultant agreed with that and he also mentioned that this was an introduction meeting and further meeting are planned.
2.		When do you think the project should start?	The project is planned to start in 2019. However the final assets valuation and compensation should be done prior construction

Source: BESST Ltd, 2018

5.4.3. Meetings at Socio-economic survey and assets inventory stage

Before starting socio economic survey and assets inventory, the consultant conducted the second round of consultation meetings in each cell. The meeting was attended by cells authorities and People who have been identified as project affected people. The purpose of the meeting was to announce the cut-off date but also to explain the purpose of the survey and assets inventory. It was an opportunity to introduce field surveyors and to request people who will participate in survey, to avail themselves or delegate someone in the household who can provide information on households and lands owned or used. The table 39 below presents the schedules of meeting conducted and table 40 presents key issues raised in these meeting. Attendance list are presented in annexes.

Table 33: Schedule of meeting conducted at Social Economic survey stage

Dates	Sector	Venue	Category of Participants
Tuesday February 6th, 2018	GATSATA	NYAMABUYE cell	- BESST LTD Team - Nyamabuye Cell Leaders - Nyamabuye local community
	KIGALI	Nyabugogo Cell	- BESST LTD Team - Nyabugogo Cell local Leaders - Nyabugogo local community
Wednesday 7th, 2018	KANYINYA	Nzove & Nyamweru Cell	- BESST LTD Team - Nyamweru Cell local Leaders - Nyamweru local community
Thursday 8th,2018	GISOZI	Ntoral Cell	- Representative of Ruhango cell-Leaders of four villages - Community of four villages

Table 34: Key issues raised in Consultation meeting at socio economic meeting

No	Question/comments	Answers provided by consultant
Consultative meeting in Nyamabuye Cell, Gatsata cell		
1	How are we going to know the value of our properties?	WASAC will hire an independent valuer who will agree with assets owner the compensation value.
2	When the project implementation will start so that we can plan for our agriculture activities?	It is anticipated that construction will start in 2019, but upon the completion of final design studies, farmers will be informed on construction schedule.
3	Will the project gives us the jobs or it will use machines?	Though some activities will require the use of machines, other works will be performed by people and affected people will be given priority.
4	What are the mechanisms that are you putting in place to ensure that local are provided with jobs?	First of all, locals will be provided with information on time but also during the preparation of construction contract WASAC shall emphasize the use of local resident in construction work where possible.
Consultative meeting in Nyabugogo Cell, Kigali Sector		
1	Sometimes the fees paid as compensation is not enough to buy another land. What are you planning to address this issue?	There will be compensation for land owners and Special attention will be taken on these who are going to lose government land. For the person who disagrees with the value assignment to his/her property appealing measures are provided.
2	When are we going to get results of your data collection?	This exercise is the initial identification of assets and PAPs and results will be included in RAP report which will be made public. However a final asset valuation will be conducted and every PAP will sign on the valuation form after verification of his attest and its value
3	Where beacons have been installed is the last limit of the land to be acquired?	Beacons were used for land survey and will be used for assets inventory.
5	Will farmers allowed to continue to use the land after pipe installation.	Yes, but the land will be used under conditions and no permanent structure may be allowed. Again above the pipe it's not allowed to conduct activities but all land in 9 m will not be required
7	What about the water point that may be affected?	The installation of water pipe will not affect the water r source because even the first pipe did not affected. However, the final design will consider the location of water source.
9	One PAPs wanted to know the size of his land that will be taken.	All affected will be measures and communicated to land owners but in general 9m will be required during contraction for excavation but also access roads.
Consultative Nzove and Nyamweru Kanyinya sector		
1	Will our land be taken without compensation?	Private land will be compensated and care will be taken to the ones who will lose government land.
2.	What kind of compensation will you give us?	Compensation measures will be provided based on eligibility criteria and the nature of impact and the compensation may include land for land compensation or monetary compensation. Especially for crops and trees.
3	When shall the construction start?	The final date for construction is not yet fixed but construction works are expected to start in 2019. Farmers will be informed about construction schedule in due time.
4	I f one people has two plots in targeted area marshland will be counted two times?	If the land is for the same use and fall in the same category these areas are to be summed up in order to avoid double counting.
5	We cannot be against public interest, but what are the support are we going to receive from the government?	Compensation will be provided to the affected people and job opportunities will be provided during construction.
Consultative meeting at Ntora, Gisozi Sector		
1	We were living for our land. What do you think for us when the project starts?	Owners of private land will be compensated and their assets. These who live by government land in affected area will be considered for different supports and follow of their living conditions
2	If 9m will be required it's likely that some structures will be affected. If that is the case what are provisions?	The assets inventory will identify both land, crops, trees but also other structure that will be affected and adequate compensation will be provided in accordance with laws.

3	The land in Road reserve have been marked as government land but we have not received any compensation. What will happen to this portion of land when the project start.	The land law is clear any land to be transferred from private to public land should be compensated. What is required is to present ownership documents.

5.4.4. Meetings at draft stage

Upon the completion of socio-economic survey and assets inventory and the preparation of the first draft, another round of meetings were held. Meetings were held at sector level and at cells levels. The meeting at sector levels discussed both EIA and RAP while the meeting at cell levels focused on RAP. These meeting were attended by local authorities, projects affected Person and local communities. Meetings at sector level are presented in the EIA report while meeting at cell levels are presented in this RAP. These meeting focused essentially on results of assets inventory, type of impacts including loss of land, structures crops and trees, compensation measures and grievance redress mechanism(GRM). In each meeting and after the presentation of the consultant, participant were provided with time for questions and response were provided by both consultant, WASAC representative or local authorities. Key issues raised and responses are provided in the following table while list of attendance are presented in annex 18,19,20 and 21.

Table 35: Issues and responses provided in consultation meeting at drafting stage

Names	Issues	Response
Meeting in Gisozi, Ruhango cell, April 21, 2018		
	What will happen if someone is not happy with the compensation cost?	Grievance redress mechanism will be established and communicated to PAPs and the expropriation law provides mechanism by which the affected people can express his complaints including the recruitment of his own valuer.
	What will happen if crops that were identified in assets inventory are harvested before the final valuation?	The final valuation will be done on assets found on the land during valuation period. If crops are harvested before valuation, then there will be no impacts on these crops
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority
Meeting at Kanyinya Sector, Nzove and Nyamweru Cell, April 24th, 2018		
	Some people have the trees and crops in government land. How they will be compensated?	Trees and crops on government will be compensated but the land is not compensated because in the government properties.
	Is there any special attention to vulnerable people?	Vulnerable people identified by project will be given priority in employment and special follow up during compensation process.
	What kind of compensation is provided for land?	The expropriation law provide both monetary and in kind compensation. However, due to the lack of free land in Kigali, the cash compensation is likely to be the only alternative.
Meeting In Kigali sector, Nyabugogo Cell, April 17, 2018		

	In the past we have seen some problems of compensation that comes after valuation and are either related to construction activities or consequence of poor water drainage. Is there any mechanism to address these issues?	If there is a new compensation issue that were not identified before or any issue that is caused by projects after construction, the resettlement committee will work with local Authority and WASAC to address the issue.
	When the construction works will start?	Construction works are expected to start in 2019 but people will be informed in due time
	-After assets inventory what are the next steps?	A final valuation will be done and compensation shall follow before and physical works
Meeting in Gatsata sector Nyamugali cell, April 20, 2018		
	What happen if people are not around during valuation?	If the land owner is not around during land valuation, the valuer carries out the valuation in the presence of local authorities.
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority
	What will happen to people who have not received land title?	People are encouraged to request land titles because all land in Kigali and elsewhere in the country have been registered and the compensation law requires land title or any other written documents issued by authority

Figure 32: Illustrative photos taken during public consultation meetings

CHAPTER VI: IMPACT ASSESSMENT AND COMPENSATION MEASURES

The project of strengthening Nzove- Ntora Pipeline in Kigali City were designed in a way that avoid or minimize resettlement impacts. However some component of the project such as the installation of pipes and associated construction roads requires land whether temporally or permanently. The initial assessment has been completed and assets inventory results are available. This section aassess the likely involuntary resettlement, projects affected households and proposes compensation measures.

6.1. Expected resettlement impacts

The field survey and public consultation revealed that Nzove-Ntora project will affected 84 households and 11 Corporation who have or use land in the project construction area. The expected resettlement impacts range from loss of shelter (two households), loss of structures such as fence, wall and concrete ground floor, loss of electrical poles, loss of land permanently or temporary, loss of perennial crops and trees. During the impact assessment and assets inventory, all Households to be affected were identified and in this identification, a surveying team identified each and every one and collected data on assets to be affected, size of the land owned or leased and the main usage of the land. This information helped the consultant to calculate the compensation package. Detailed results of this identification are presented in annexes.

6.1.1. Loss of private land

The installation of pipeline will involve land clearance in an area that can go up to 9m width where there is no construction roads. In some section such as Ntora, the excavation area have been reduced to 2m to avoid private structures such as wall and fences. The land will be lost presently or use under conditions where water pipe will be installed and maintenance area, l3m width maximum. The remaining land will be taken only during construction. The following table summarises the land that will be affected by the proposed projects.

Table 36: Permanent loss of land

District	Sector	Cell	Affected HHs	Number of plots affected	Size of land affected (m2)
Gasabo	**Gatsata**	Nyamabuye	6	5	157
		Nyamugari	8	7	445
	Gisozi	Ruhango	40	47	2,392
Nyarugenge	Kanyinya	Nyamweru	7	8	718
		Nzove	9	12	723
	Kigali	Nyabugogo	14	21	1,510
Grand Total			**80**	**100**	**5,946**

Table 37: Temporary loss of land

District	Sector	Cell	Affected HHs	Number of plots affected	Total size of land affected(m2)
Gasabo	**Gatsata**	Nyamabuye	6	6	327
		Nyamugari	8	10	1,797
	Gisozi	Ruhango	40	47	3,147
Nyarugenge	Kanyinya	Nyamweru	7	8	4,815
		Nzove	9	12	1,293
	Kigali	Nyabugogo	14	21	1,477
Grand Total			**84**	**104**	**12,855**

6.1.2. Loss of government lands

Article 19 of organic law on land use and land management sates that swamp/marsh land belongs to the State. It shall not definitively be allocated to individuals and no person can use the ground of holding it for a long time to justify the definitive takeover of the land. However, it may be lent to a person based on agreement concluded between both parties. During the identification of project affected people, the field team identified farmers who are using government land in the project area and will be affected by the project in submerged area, borrow pits, disposal, buffer zone and at camp sites. These farmers are mostly growing rain fed crops including maize, sweet potatoes and some vegetables. Only crops and trees will be compensated.

6.1.3. Loss of crops and trees

The installation of water pipe Construction works entail clearing of the vegetation inherent in the project site which includes fruit trees, trees, grass and crops that have been planted and or cultivated by the farmers. According to both national regulations and international policies on environmental and social considerations requires the compensation of affected assets including tress and perennial crops. All trees and perennial crops were counted and valuated. Below is the summary of tress and perennial crops likely to be affected. Provisional detailed list of project affected Households and their assets are presented at the end of the report as appendix 2.

Table 38: Affected trees and crops on private land

District	Sector	Cell	Affected HHs	Number/Area of trees/Crops	
				Pces	Area/ m2/ha
Gasabo	**Gatsata**	Nyamabuye	5	18	80.5
		Nyamugari	5	46	5.5
	Gisozi	Ruhango	22	278	1078.3
Nyarugenge	Kanyinya	Nyamweru	5	81	127.5
		Nzove	6	90	520
	Kigali	Nyabugogo	14	55	2596.5
Grand Total			**57**	**569**	**4,408.3**

Table 39: Affected trees on government land

District	Sector	Cell	Trees/Perennial Crops		Number/Area of trees/Crops	
					Pces	Area/ m^2
Gasabo	**Gatsata**	Nyamabuye	Trees	Private owned	31	0
				Government	15	0
			Perennial crops		0	266
		Nyamugari	Trees	Government	10	0
	Gisozi	Ruhango	Trees	Government	109	0
Nyarugenge	Kanyinya	Nyamweru	Trees	Private owned	0	0
				Government	4	0
		Nzove			0	0
	Kigali	Nyabugogo	Trees	Private owned	49	0
				Government	10	0
			Perennial crops		0	0
Grand Total					**228**	**266**

6.1.4. Loss of houses and structures

The design team has tried to avoid or minimize the physical relocation . However, the assets inventory show that two households will be relocated and other structures such as fences and concrete floor will be partially affected. The identified houses and structures are summarized in the next table.

Table 40: Houses and structures to be affected by projects

DISTRICT	SECTOR	CELL	Affected HHs	Number of Affected assets		
				Houses	Fence/Wall	Floor
Gasabo	Gatsata	Nyamabuye	0	0	0	0
		Nyamugari	0	0	0	0
	Gisozi	Ruhango	19	1	10	9
Nyarugenge	Kanyinya	Nyamweru	0	0	0	0
		Nzove	1	0	1	0
	Kigali	Nyabugogo	4	1	3	1
Grand Total			24	2	14	10

Source: BESST Ltd, 2018

6.2. Eligibility criteria and entitlement matrix

6.2.1. Eligibility criteria

Defining eligibility criteria is essential in involuntary resettlement and compensation process. The census and assets inventory provide the basis for identification of PAPs and assets. According the national expropriation regulations, the person who owns land intended for public interest shall provide evidence to confirm that he or she possesses rights on that land and among the evidence to confirm ownership of the land, there shall be included:

- written evidence indicating that he or she purchased the land, received it as a donation or as a legacy or a successor;
- a document or a statement of local administrative entities indicating rights of the expropriated person on the land;
- a document or testimony of the neighbours; confirming the ownership of the land;
- a Court certificate(art 18 expropriation law);

Furthermore, Article 27: Properties valued during expropriation in the public interest defines the properties subject to valuation for the payment of fair compensation due to expropriation in the public interest are:

- land;
- activities carried out on land for its efficient management or rational use;
- Compensation for disruption caused by expropriation which is equal to 5% of total amount of compensation;

However, JICA guidelines for environmental and social considerations request the recipient country to consider international eligibility criteria including those provided by World Bank Policy OP 4.12 on involuntarily resettlement. The WB OP 4.12 also provides eligibility of benefits including the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets, and the PAPs who have no recognizable legal rights to the land they are occupying. The eligibility criteria used in this assessment are based on the three criteria given in clause 15 of the World Bank's Operational Policy 4.12: involuntary resettlement

- Those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country);

- Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets – provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan;
- Those who have no recognizable legal rights or claim to the land they are occupying;

JICA requires recipient country to comply with JICA guidelines on environmental and social consideration and World Bank OP 4.12. Therefore the eligibility was determined in compliance with those guidelines together with national expropriation regulations and the PAPs that were considered as eligible for compensation include the following:

- Tenants leasing privately owned land;
- PAHs loosing trees and crops located on private land ,
- PAHs that are currently using government land that will be affected;
- PAHs that have structures in construction area,

6.2.2. Entitlement matrix

PAPs entitlement matrix is provided in table 41 below and it provides an indication of resettlement and measures for compensation and other supports to restore livelihoods impacted by the loss of land, crops and other structures. It is important to pay special consideration to vulnerable people, for instance, giving them high priority in recruitment of labourers.

Table 41: Proposed entitlement matrix

Type of Loss	No HH	Quantity	Unit	Eligibility Criteria	Entitlement
1.Loss of Private Land					
1.1. Permanent loss of private Land	80	5,946	m2	Land owners where the proposed pipeline will be installed	Compensation in cash because the land to be affected is small and no free land available. Compensation for loss of land will be arranged based on the full replacement cost
1.2. Temporary Loss of Private Land (1) in construction road	84	12,855	m2	Land owners where the proposed pipeline and construction roads facilities will be constructed temporarily	People will be notified on time and the construction period should have shortened. Temporary loss of land results in the loss of income, and this is covered by compensation for loss of income.
2. Loss of Government Land					
2.1. Loss of government land	9 + 23	4,917	m2	Current users of affected land	No compensation required because it's government land and only small portion will be affected. Affected households should be allowed to use the land outside the pipeline area
2.2. Loss of trees and crops on government land	9 + 23	228 **249.5**	Pies M2	Current users of affected land	Cash compensation based on the market value and 5% disturbance allowances
3. Loss of assets in the private land					
3-1 Perennial crops and trees	57	241 4,158.7	Pies Are	Various rights and interest holders	Cash compensation based on the market value and 5% disturbance allowances per as expropriation law
3-2 Loss of houses	2	2	Unit	Land owner	Compensation of the house at replacement cost, based on the market value such as materials and labor cost
3-3 Loss of other structures	22	22	Unit	Various rights and interest holders	Compensation of the house at replacement cost based on the market value such as materials and labor cost
4. Loss of income					
4-1 Temporary loss of income for business	1	2	Weeks	Business owner in the projects construction area such as driving school	Disturbance allowances to be included in compensation of assets
4-2 Temporary loss of income for farmers	57			Current users of affected land	Cash compensation for one-year crop for one season and 5% disturbance allowances
4-3 Permanent loss of	2	2	HHs	HHs who will lose Farming	Priority in employment during

income (farmers)				income	construction
5. Support for vulnerable people					
5-1 Vulnerable people	7	7	HHs	Households where the head of household is vulnerable	Priority in employment during construction

6.3. Assets valuation and compensation

6.3.1. Cut-off date

The cut-off date is the date on which assets inventory starts and for the Project the provisional date was fixed on February 1st, 2018 the date on which field survey started. This date was communicated to all potential PAPs in the project affected area with sufficient time for these people to ensure their availability for the census. To ensure all the stakeholders and PAPs are informed, WASCAC Ltd wrote officially to all sectors and the communication was handed to all village leaders and communicated to local communities during monthly community work..

However, this date is provisional and may be revised depending on the progress of the project and a new date will be required if the projects delayed too much. According to the expropriation law, the valuation of assets expires in 120 if the payment is done before this time. The establishment of a cut-off date is required to prevent opportunistic invasions/rush migration into the chosen land areas. Persons who encroach on the area after the cut-off date are not entitled to compensation. It should be noted that the cut-off date should be determined before the census is conducted and agreed by all the stakeholders especially the PAPs.

6.3.2. Assets valuation

The consultant has conducted initial assets inventory and has estimated the value of different assets and properties likely to be affected. However, upon the completion of final detailed design, WASAC should hire an independent valuer to carry out the final assets valuation. Reference made to the law n°17/2010 of 12/05/2010 establishing and organising the real property valuation profession in Rwanda, the valuation of land and property incorporated thereon shall be conducted by valuers certified by the Institute of Real Property Valuers in Rwanda (IRPVR).

The district and local authorities must inform the persons to be expropriated in the public interest of the expected start date of measurement of land and inventory of property incorporated thereon. The valuation of land and property incorporated thereon shall be conducted in the presence of land owner and that of the owner of property incorporated on land or their lawful representatives and in the presence of representatives of local administrative entities. The owner of land designated for expropriation in the public interest shall provide land titles and documentary evidence that he/she is the owner of property incorporated on land. He/she shall also provide a civil status certificate and a document evidencing his/her chosen matrimonial regime in case of a married person. However, a person dispossessed of land or unlawfully occupying land or having developed activities on land on which such activities are prohibited after the enactment of relevant laws shall receive no compensation. The properties subject to valuation for the payment of fair compensation due to expropriation in the public interest are:

- land;
- activities carried out on land for its efficient management or rational use;
- Compensation for disruption caused by expropriation. The new law has added 5% of total compensation fees for disturbance allowances.

Article 27 of valuation law allows the independent valuer to apply one or more valuation methods provided by this law or any other method accepted by the IRPVR Council. Valuation methods proposed by the law include:

- **Comparable prices methods** where by the proposed price for the affected property shall be close or equal to the market value. The valuer shall compare prices by referring to the prices recently assigned to a real property that is similar or comparable to the real property subject to valuation.

- **Comparison of land values countrywide as an alternative land valuation method:** Where comparable prices are not available for land in a particular area, the valuer may use comparable prices of similarly classified land from other areas of the country. Prices shall vary depending on the quality and location of the land. The valuer shall fulfil his/her valuation duties in compliance with principles and regulations governing the valuation profession and the Council.

- **Replacement cost approach as an alternative valuation method for improvements:** Where sufficient comparable prices are not available to determine the value of improved land, the replacement cost approach shall be used to determine the value of improvements to land by taking real property as a reference;

- **Use of multiple valuation methods** where real property valuation requires special skills, the valuer shall use whatever combination of the methods he/she considers best suited to determine the current market value. The methods used shall be clearly explained in the valuation report.

- Upon approval by the council, a valuer may use any other relevant worldwide methods not provided in this Law in order to carry out the assigned work.

To comply with both national and international policies such as World Bank OP. 4.12 on involuntary resettlement and JICA guidelines on environmental and social considerations, the consultant recommend to use the replacement cost approach as an alternative valuation method. This method does not consider only the assets value but also administrative cost and other costs required to have a new assets or property.

6.3.3. Compensation

When the land owner or the owner of property incorporated on land is satisfied with the valuation, he/she shall sign or fingerprint the approved fair compensation reports. The deadline for signing or fingerprinting approved fair compensation reports may not be less than seven (7) days or more than twenty- one (21) days from the publication of the valuation report. Within seven (7) days after the approval of the valuation report by the expropriator, any person to be expropriated who is not satisfied with the assessed value of his/her land and property incorporated thereon shall indicate in writing grounds for his/her dissatisfaction with the valuation report. Any person contesting the assessed value shall, at his/her own expense, engage the services of a valuer or a valuation firm recognized by IRPVR to carry out a counter-assessment of the value. The counter-assessment report must be available within ten (10) days from the application for counter valuation by the person to be expropriated. Compensation can be paid in monetary form in the Rwandan currency or in any other form mutually agreed upon by the

expropriator and the person to be expropriated. In reference to national laws, WB OP 4.12 and JICA guidelines for environmental and social consideration the consultant recommend the following compensation measures.

a) Compensation for land

Land for land compensation is desirable where feasible, however, it can be challenge for WASAC to find alternative lands for the persons to be expropriated, because district does not have enough free lands. Therefore, cash compensation based on the replacement cost may be provided if there is no free land available. The value should be based on the prevailing market value in the locality and in reference to other compensation done recently in the project area. In addition, any associated costs of purchasing the land including land rates, registration fees will need to be included in the compensation calculation. Where land lost is only a small proportion of total land owned by the PAP, but renders the remaining land as unusable, the compensation provided should be calculated based on the total land affected (the actual land lost plus the remaining unusable land). Disturbance allowances equivalent to 5% will be provided.

b) Compensation for crops and trees

PAPs will be encouraged to harvest their produce before the construction start for short term crops In order to ensure that this is possible, there needs to be sufficient consultation beforehand so that harvesting can be properly planned. In the event that crops cannot be harvested, compensation for loss of crops and trees including value of fruit trees will be provided as follows.

- Provision of cash compensation for value of crops lost, at current market value;
- Provision of seed or seedlings appropriate for the resettled areas;

The cash compensation will be equivalent to the value of crop production lost, until the replacements are yielding to the same level (i.e., the period until the replacement seed/seedlings are producing whether the same year for annual crops, or longer in the case of shrub or tree crops).

- For fruit trees that take longer to mature and yield and are seasonal, the cost of the yields for the period that the tree will take to mature should be calculated including future price.

c) Compensation for houses and other structures.

One household will lose its house. during consultation the owner expressed the need to be compensated in cash. Therefore, a replacement cost should be calculated by the independent valuar and compensation provided prior any construction. the households should be also provided with the time to leave the house and take movable materials. This should be the case for other structures except the time for leaving the area.

Based on cost recently used in other projects under implementation in Kigali Such as Kigali-Gatuna Road, Rwanda Urban Development projects, the consultant has estimated the compensation cost for planning purposes but the assets valuation should be done in due time and paid prior in construction works.

CHAPTER VII: RAP IMPLEMENTATION ARRANGEMENTS

The overall coordination of the RAP implementation will be provided by the Ministry of Infrastructure through Water and Sanitation Corporation(WASAC Ltd). Other stakeholders that will be involved in the implementation of the RAP are described in detail below. The implementation arrangement builds on responsibilities already in place to ensure that the requirements of this RAP are met. At local level, Gasabo and Nyarugenge districts are responsible institution of RAP implementation while Kigali City ensures the proposed projects comply with Urban land use Master plan.

7.1. National level implementing institutions

7.1.1. Ministry of Infrastructures

Government of Rwanda represented by Ministry of Infrastructure and WASAC Ltd is responsible for land acquisition and hence responsible for RAP implementation. The RAP implementation will be done through Water and Sanitation Corporation(WASAC Ltd which is the main agency involved in implementation of the project of strengthening Nzove- Ntora Principal Pipeline. Ministry of Infrastructure will work together with Ministry of Finance to ensure that compensations funds are secured on time and compensation is made in due time.

7.1.2. Ministry of Land and Forestry/MINILAF

MINILAF governs the implementation and application of the organic land law and the Land Use Master Plan. While the Ministry deals with overall land policy and the alignment with these laws at the national level, responsibilities for their implementation locally has been devolved, following decentralization, to Rwanda Land Management and Use Authority (RLMUA) and district land bureau. MINILAF is the institution that has the authority to lease all land and resolve any dispute over land ownership. The ministry is also responsible for issuing authorization to use government and land titles. For this reason, MINILAF will play a critical role in ensuring that appropriate and consistent compensation is provided to all affected persons resulting from this project and provides data where there is grievance on land ownership and local authority fail to solve it.

7.1.3. Water and Sanitation Corporation Limited

WASAC Ltd is the technical institution responsible for the project on government side. Therefore, WASAC Ltd will be the leading institution in the implementation of the RAP. The role of WASAC Ltd will be to implement the RAP provisions including the recruitment of independent assets valuer, coordination of monitoring activities, building the capacity of other stakeholders in collection and analysis of monitoring data. WASAC Ltd has an environmental and social safeguard specialist and she will be the focal point for RAPs implementation and will liaise with other stakeholders. WASAC Ltd will also act as the central agency responsible for holding all information relevant to the RAP.

The designated staff will ensure that procedures and requirements of the Rwandan laws and JICA consideration on environment and social consideration are complied with. A key role will be to implement the RAP and other resettlement-related activities and to ensure that all procedures have been adhered to and that there is consistency in approach between sub-projects activities. She will also undertake the main monitoring and evaluation role of resettlement activities during and post implementation.

7.1.4. Rwanda Land Management and Use Authority/ RLMUA

RLMUA through its department of land management and use is the organ responsible for overall management and coordination of all activities related to land administration, land use planning and management in Rwanda. The role of RLMUA in RAP process will be to advise on matters related to land ownership and expropriation. District land bureau in close collaboration with project staff will check and approve valuation forms, various maps and approve land surveys carried out during valuation exercise. After compensation RLMUA will also participate in the process of transferring land titles as appropriate.

7.2. Implementation arrangement at district level

The direct implementation of RAP is done at district level and different key player are presented below.

7.2.1. Nyarugenge and Gasabo district

Reference made to the section 3.6 of land law, the District Land Bureau (DLB) is a district based institution authorized by law to manage land. The DLB will be responsible for ensuring activities undertaken comply with the national and district level Land Use Master Plans. They will assess the validity of land tenure rights of affected persons and eventually provide the land use permit for the new activity proposed by the sub-project. In addition to that, they will be responsible for ensuring effective grievance mechanisms are in place. They will also be used in the implementation of RAP as much as possible in order to ensure that community buy in is present at an early stage hence reducing disputed or grievances. Their activities will be monitored by the district Executive Committee.

The DLB will play a major role in RAP implementation by:

- Monitor and approve activities pertaining to valuation of land and other immovable property;
- Demarcate and approve land cadastral;
- Establishing project level resettlement and compensation committees at Site and district levels;
- Clarifying the policies and operational guidelines of these resettlement and compensation;
- Establishing standards for unit rates of affected assets and compensation estimates, according to the standard units appended to the RAP, adjusted for local conditions where necessary; and
- Coordinating and supervising implementation of A-RAP provisions;

The land Bureau will be supported with land office at sector level and community development officer at cell level.

7.2.2. District Resettlement and Compensation Committee

WASAC will work closely with Gasabo and Nyarugenge district in the implementation of this RAP. A team that includes District Community Development Officer, a Civil Engineer, District Land Bureau officer, and Environmental specialist WASAC, Executive secretaries of affected sectors and PAPs representatives will be responsible for resettlement and ensure that the RAP is properly applied.

7.2.3. Resettlement and ccompensation ccommittees

Due to linear nature of this projects, each sector will put in place a resettlement committee for the e sole purpose of RAP implementation arrangements, and will operate at sector level. It is proposed

to be supported technically by in charge of land and settlement at sector level and community development officer at cell level. The committee would comprise the following:

- Representative from sectors
- Representative of cells that are affected
- Representative from any other key sector office involved in the project;
- Two representatives of PAP by cells (equal gender representation).

The Resettlement and Compensation Committee would have responsibility for:

- Verifying PAPs documentation;
- Validate inventories of PAPs and valuation of affected assets;
- Allocate land, where required, to permanently PAPs;
- Monitor the disbursement of funds;
- Facilitate conflict resolution and addressing grievances; and
- To ensure the support and assistance to vulnerable groups including disable, orphans, and the old persons among others.

This committee should meet on a regular basis (as determined by the needs of the project) to ensure that compensation activities are appropriately designed and executed.

7.2.4. Project Affected Persons

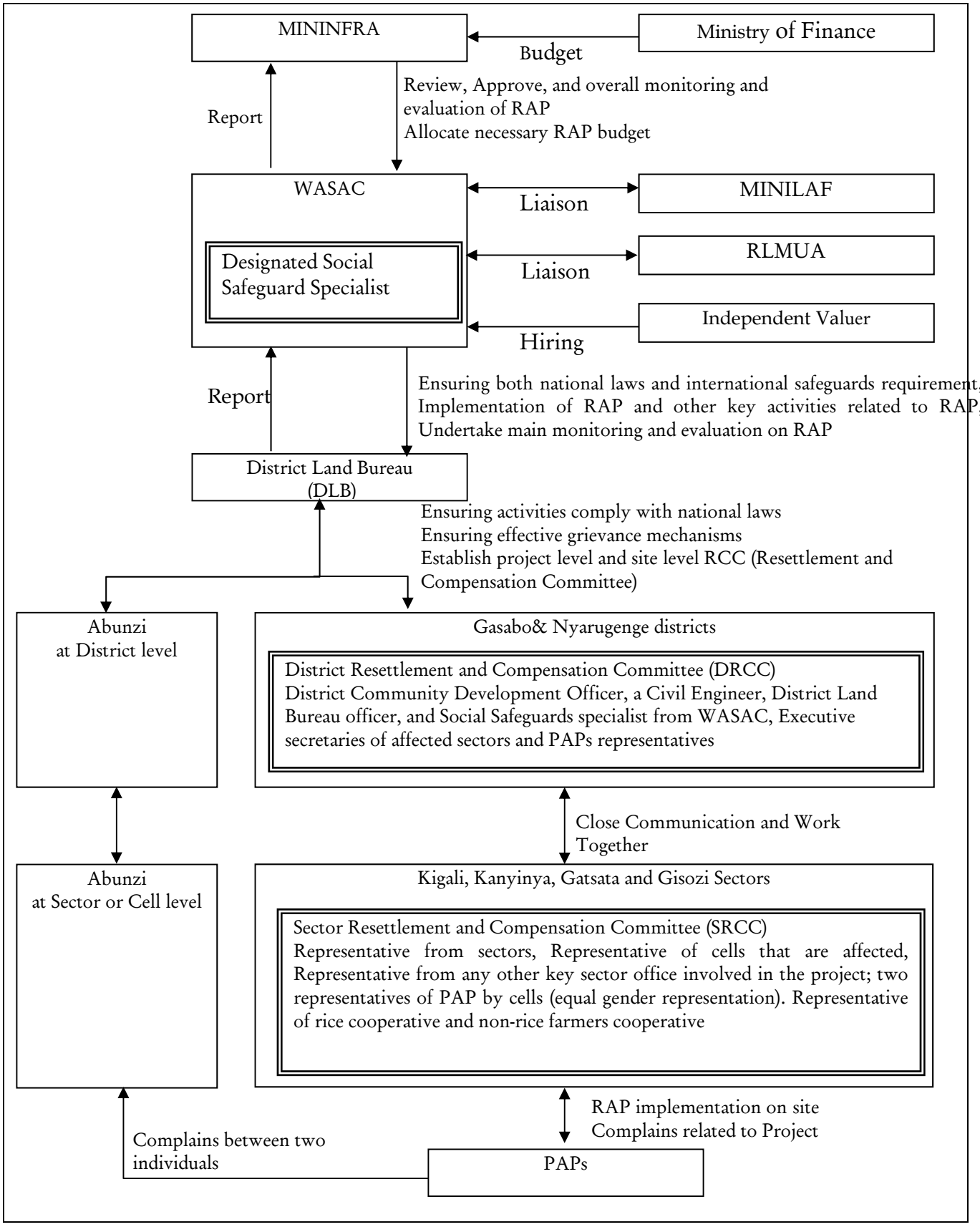
This group of people will also help identify community affected by the projects, be present during final valuation and participate in complaints resolutions.

Table 42: Summary of institutional responsibilities for RAP implementation

Institutions	Responsibilities
WASAC Ltd	– Designate a social safeguard specialist(s) who will be the focal point for RAPs implementation and will liaise with other stakeholders. – Initiate the expropriation process and compensation requirements; – Preparation and signature of compensation grant agreement with the district; – To establish Resettlement and Compensation Committee in consultation with District Land Bureau; – Have a representation in District Resettlement and Compensation Committee – Provision of capacity building and technical support relating to expropriation and compensation activities; – Ensure funds allocated appropriately, according to RAP; – Prepare the RAP closure report and file all documentation related to RAP implementation; – Hire independent assets valuar upon the completion of final detailed design study.
MINILAF	– To ensure that the expropriation process is done in compliance with land policies, land law and expropriation law; – Ensure the RAP is within the context of national land use plan.
RLMUA	– To advise on matters related to land ownership and expropriation activities; – To participate in verification of land ownership and land titles.
Districts	– Verify land owners from records of land register; – Monitor and approve activities pertaining to valuation of land and other immovable property;

Institutions	Responsibilities
	- Approve land expropriated land surveys; - Coordinate the establishment of Resettlement Committees; - Work in collaboration with the Resettlement and Compensation Committees to ensure that the valuation and compensation is done in accordance with the law and the requirements of this RAP. - To facilitate the PAPs to purchase new land; - Facilitate the transfer of land titles after;
District Resettlement Committee	- Verifying PAPs - Validate inventories of PAPs and valuation affected assets; - Allocate land, where required, to permanently affected households; - Facilitate conflict resolution and addressing grievances.
Site resettlement Committee	- Help in creating awareness on expropriation process; - Monitor the implementation of expropriation closely with environment protection committees to monitor the use of marshlands and reserved areas; - Conflicts resolution; - Help in land demarcation confirm holders of land rights during land resettlement process, participate in the identification of community settlement sites, identify and list escheat land, and serve as witnesses in compensation and resettlement
Mediators/ Abunzi	- Resolving disputes - Provide grievances mechanism following land acquisition. - Help in designing RAP at the community level to ensure community buy in.
Project Affected Persons	- Be present when the land survey and inventory is being carried out - Provides all required information in regards to resettlement activities - Participate in expropriation activities

Figure 33: RAP implementation flow



7.3. Grievance Redress Mechanism (GRM)

The district is an acknowledged institution for which the PAPs have been made aware of as avenues for expressing discontent and disapproval to the resettlement and compensation process. Article 26 of the expropriation law N0 18/2015 of 19/04/2015 provides complaints procedures for individuals dissatisfied with the value of their compensation. The law stipulates that dissatisfied

persons have a period of 30 days after project approval decision has been taken to appeal (Article 19). Grievance procedures are required to ensure that PAPs are able to lodge complaints or concerns, without cost, and with the assurance of a timely and satisfactory resolution of the issue. The procedures also ensure that the entitlements are effectively transferred to the intended beneficiaries. Stakeholders will be informed of the intention to implement the grievance mechanism, and the procedure will be communicated at the time that the RAPs are finalized. Grievances may arise from members of communities who are dissatisfied with eligibility criteria use, community planning and actual implementation or compensation.

7.3.1. Process of grievance

The overall process of grievance is as follows:

1. During the initial stages of the valuation process, the affected persons will be given copies of grievance procedures as a guide on how to handle the grievances.
2. The process of grievance redress will start with registration of the grievances to be address for reference, and to enable progress updates of the cases.
3. The project will use a local mechanism, which includes resettlement committees, peers and local leaders of the affected people. These will ensure equity across cases, eliminate nuisance claims and satisfy legitimate claimants at low cost.
4. The response time will depend on the issue to be addressed but it should be addressed with efficiency.
5. Compensation will be paid to individual PAPs only after a written consent of the PAPs, including both husband and wife.

7.3.2. Procedure of grievance

The aggrieved person should file his/ her grievance, relating to any issue associated with the resettlement process or compensation, in writing to the sub-project Resettlement and Compensation Committee. The grievance note should be signed and dated by the aggrieved person. The designated WASAC officer and the Resettlement and Compensation Committee will consult to determine the validity of claims. If valid, the Committee will notify the complainant and s/he will be assisted. The Resettlement and Compensation Committee will respond within 7 days during which time any meetings and discussions to be held with the aggrieved person will be conducted. If the grievance relates to valuation of assets, a second or even a third valuation will be undertaken, until it is accepted by both parties. These should be undertaken by separate independent valuers than the person who carried out the initial valuation.

If the aggrieved person does not receive a response or is not satisfied with the outcome within the agreed time, she/he may lodge his/her grievance to the relevant local administration such as the District Land Bureau, also mandated to help resolve such matters. If requested, or deemed necessary by the subproject Committee, the District Project Coordination officer will assist the aggrieved person in this matter. The relevant Local Administration will then attempt to resolve the problem (through dialogue and negotiation) within 30 days of the complaint being lodged. If no agreement is reached at this stage, then the complaint is dealt with through the local courts (Abunzi) where possible. Where matters cannot be resolved through local routes, the grievance will be referred to higher authorities at the national level. The Resettlement and Compensation Committee will provide assistance at all stages to the aggrieved person to facilitate resolution of their complaint and ensure that the matter is addressed in the optimal way possible. If

administrative ways of grievance redress is not enough to address the complaint, then the unsatisfied person may refer to judicial system. Based on the nature of complaints, the process will start from mediators for assets below 3 million Rwandan francs and if the value is more than three million, the process will start from intermediate courts, high court and to Supreme Court. The proposed grievance redress system is as illustrated follows:

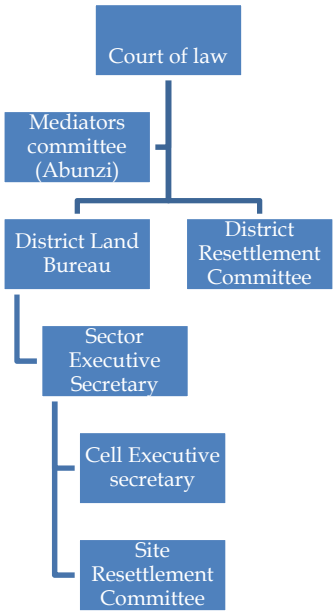


Figure 34: Proposed GRM flow chart

7.3.3. Grievance log

The District Land Bureau will ensure that each complaint has an individual reference number, and is appropriately tracked and recorded actions are completed. The log will contain record of the person responsible for an individual complaint, and records dates for the following events:

- Date the complaint was reported;
- Date the Grievance Log was added onto the project database;
- Date information on proposed corrective action sent to complainant (if appropriate);
- The date the complaint was closed out; and
- Date response was sent to complainant.
- Providing the resettlement and compensation committee with a weekly report detailing the number and status of complaints;
- Any outstanding issues to be addressed; and
- Monthly reports, including analysis of the type of complaints, levels of complaints, actions to reduce complaints and initiator of such action.

Table 43: RAP implementation schedule

Year / Items	2018					2019											2020												2021									
Month accumulated	8	9	10	11	12	1	2	3	4	5	5	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
RAP preparation																																							
RAP Confirmation																																							
Final detailed design and tendering																																							
Confirmation of eligibility																																							
Final cut-off date																																							
Establishment of resettlement committee																																							

Final assets valuation and compensation agreement																																				
Compensation																																				
Construction																																				
Monitoring and grievance redress																																				
RAP closure report																																				

7.5. Monitoring

The objective of the monitoring and evaluation process will be to determine whether PAPs have been paid in full and before implementation of the subproject, and people who were affected by the subproject have been affected in such a way that they are now living a higher standard than before, living at the same standard as before, or they are they are actually poorer than before. The arrangements for monitoring the compensation activities will fit into the overall monitoring program of the entire Nzove- Ntora Project, which will fall under the overall responsibility of the JICA and WASAC.

7.5.1. Monitoring indicators

A number of indicators would be used in order to determine the status of affected people (land being used compared to before, standard of house compared to before, level of participation in project activities compared to before, how many kids in school compared to before, health standards and so on). Therefore, the resettlement and compensation plans will set two major socio-economic goals by which to evaluate its success: Affected individuals, households, and communities are able to maintain their pre-project standard of living, and even improve on it; and the local communities remain supportive of the project. In terms of the resettlement process, the following indicators could be used to understand the success of the measures identified and the working of the relevant parties in implementation the RAP:

- Percentage of individuals selecting cash or a combination of cash and in-kind compensation;
- The number of contentious cases as a percentage of the total cases;
- The number of grievances and time and quality of resolution;
- Number of impacted locals employed by the civil works contractors; and
- General relations between the project and the local communities.

These will be determined through the following activities:

- Questionnaire data will be entered into a database for comparative analysis at all levels of local government;
- Each individual will have a compensation dossier recording his or her initial situation, all subsequent project use of assets/improvements, and compensation agreed upon and received.

The District authorities will maintain a complete database on every individual impacted by the sub-project land use requirements and compensation, land impacts or damages; and WASAC should prepare Resettlement Completion Reports for RAP, in addition to other regular monitoring reports.

The project Resettlement and Compensation Committee will facilitate coordination of information collation activities (such as surveys, supervising documentation) in accordance with procedures put in place. WASAC will provide training, technical support and funds to ensure that this happens. In order to assess whether these goals are met, the RAP will indicate parameters to be monitored, institute monitoring milestones and provide resources necessary to carry out the monitoring activities.

7.5.2. Monitoring of livelihood restoration

The purpose of socio-economic monitoring is to ensure that PAPs are compensated and recovering on time. A number of indicators will be used to determine the status of affected people and appropriate parameters and verifiable indicators will be used to measure the resettlement and compensation plans performance. As part of the preparation of RAP a baseline study was conducted this will provide baseline data against which to monitor the performance of the RAP.

7.5.3. Monitoring of RAP implementation

Local government authorities from district level will assist in compiling basic information from the project, and convey this information to RAB, on a quarterly basis.

They will compile the following statistics:

- Number of households and individuals physically or economically affected;
- Length of time from project identification to payment of compensation to PAPs;
- Timing of compensation in relation to commencement of physical works;
- Amount of compensation paid to each PAP household (if in cash), or the nature of compensation (if in kind);
- Number of people raising grievances in relation to project; and
- Number of resolved grievances.
- Number of unresolved grievances.

Table 44: Sample format for monitoring

Work	Planned in total	Progress in quantity	Progress in percentage
Identification of final PAPs			
Preparation of RAP			
Announcement to the affected people			
Cost estimation for expropriation			
Consultation meeting			
Revise of the RAP and signing based on the feedback at the consultation meeting			
Compensation in cash			
Compensation by land			
Social supports such as job training			
Number of unresolved grievances.			

WASAC will scrutinize these statistics in order to determine whether the compensation arrangement is done as planned in the RAP. The project team will alert WASAC, if there appears to be any discrepancies. Financial records will be maintained by the district land bureau to permit calculation of the final cost of resettlement and compensation per individual or household. The indicators that will be used to monitor implementation of the RAP include.

- Outstanding compensation cases;
- Grievances recognized as legitimate out of all complaints lodged;
- Grievance resolved and unresolved by levels

Financial records will be maintained by Project District officers and WASAC, to permit calculation of the final cost of resettlement and compensation per individual or household.

7.5.3. Record keeping

Each PAP household will be provided with a signed report recording his or her assets and compensation agreed upon and received. At the same time, before compensation all household heads representing the PAPs will be required to provide passport size photographs. The Local Authority and project management team will maintain a complete database on every individual

impacted by the project land use requirements including compensation, land impacts or damages. Each recipient of compensation will have a record containing individual bio-data, number of household dependents and amount of land available to the individual or household when the report is opened. Additional information to be acquired for individuals eligible for resettlement and/or compensation include the level of income and of production, inventory of material assets and improvements in land and debts.

CHAPTER VII: COST ESTIMATION FOR RAP IMPLEMENTATION

Based on the impacts described earlier, this section present the budget estimates according to the aforementioned valuation methodologies and unit value rates. The estimated budget for RAP is implementation summarized in the following table.

Table 45: Cost estimation for RAP implementation

No	Item description	HHs/Corporation	Unit	Quantity	Total Cost(frw)
1	Permanent loss of land	80	SQ	5,947	62,257,509
2	Loss of trees and crops	57	Pces Sqm	569 4408	6,914,742
3	Loss of houses & structures	2	House	2	62,834,470
		22	Structure	21	
4	Final valuation	-	Ls	1	20,010,000
		95			**152,016,721**

Table 46: Estimated monitoring cost

Activity	Indicator	Qty	Unit cost (FRW)	Total Cost (FRW)
Meeting for set up resettlement committees	Established committee	5	100,000	500,000
Follow up valuation and compensation process	Field report	7	360,000	2,520,000
Meetings for grievance redress	Meetings/grievance resolved	12	100,000	1,200,000
PAPs Livelihoods assessment	Assessment report	1	5,000,000	5,000,000
Total				**9,220,000**

CHAPTER IX: RAP DISCLOSURE

JICA and other international policies on environmental and social safeguards require the implementing agency to disclose publicly the RAP. Therefore,WASAC will disclose this RAP by making copies available at its head office and at District and sector offices. The RAP will be disclosed to the WASAC Websites and the Government of Rwanda will also authorize JICA to disclose this RAP electronically.

A completion report of the entire resettlement/compensation process for this project will be prepared and will include a hand over certificate which will ostensibly provide a verification of when the compensation and assistance were undertaken and to whom these services were provided as well as to indicate that indeed all the compensation has been delivered. This report will be prepared and submitted to JICA months after the end of compensation payment by WASAC. The RAP implementation report should include (but not be limited to) the following information:

- Background of the RAP preparation including a description of the project activities, scope of impacts, number of affected persons, and estimate budget;
- Update of its implementation with actual numbers of displaced persons by segments; compensation paid, issues/complaints raised and solutions provided;
- Complains status;
- Early assessment of the impacts of resettlement and compensation on affected categories at the time of the report production;
- Total sum disbursed;
- Lessons learned from the RAP implementation;

Suggested annexes:

- List of people affected as per the RAP report;
- List of people compensated during implementation;

ANNEXES

Annex 1: List of affected structures

No	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Structures		Unit	Qty	Unit cost	Total cost(RWF)
									Nature	Materials				
1		Nyarugenge	Kinyinya	Nzove	1/01/02/02/5102	121886	Private	3536	Fence	Steel Frame	m2	12.5	10,000	125,000
2		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/1621	288	Private	116.5	House	Tree Trunk with mud and concrete	units	4	3,500,000	14,000,000
3		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3433	5694	Private	437	Fence	Concrete Block	m3	114	55,000	6,270,000
									Storage 1 behind fence	Concrete Block	m3	7.5	55,000	412,500
									Tap Water	Steel Frame	Pces	1	8,000	8,000
									Storage 2	Cement Brick	m3	8.5	55,000	467,500
4		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3434	5507	Private	335	Fence	Steel Frame	m2	182	10,000	1,820,000
5		Gasabo	Gisozi	Ruhango	1/02/04/02/685	571	Private	44	Fence	Steel Frame	m2	26	10,000	260,000
6		Gasabo	Gisozi	Ruhango	1/02/04/02/1260	2307.11	Private	80	House	Mud bricks	unit	2	ff	7,500,000
7		Gasabo	Gisozi	Ruhango	1/02/04/02/131	350	Private	30	Paves	Concrete	m2	21.75	3,500	76,125
									Fence	Bricks	m3	76.3	60,000	4,578,000
									Gate	Steel	Pces	1	90,000	90,000
8		Gasabo	Gisozi	Ruhango	1/02/04/02/4023	916	Private	15.46	Entrance	Ciment	m2	3.85	15,000	57,750
9		Gasabo	Gisozi	Ruhango	1/02/04/02/88	761	Private	24	Paves Floor	concrete	m2	17.4	55,000	957,000
10		Gasabo	Gisozi	Ruhango	1/02/04/02/89	729	Private	30	Paves Floor	concrete	m2	21.75	55,000	1,196,250
									Fence	Bricks+Grasses	m3	106.7	45,000	4,801,500
11		Gasabo	Gisozi	Ruhango	1/02/04/02/95	1914.65	private	60	Paves	concrete	m2	43.5	55,000	2,392,500
									gate house foundation	stones and cement	m3	12.6	55,000	693,000
									walls	oven fired bricks	m3	12.87	45,000	579,150
									Door	metal and glass	Pces	1	90,000	90,000
									roof	metallic sheet	m2	24.75	50,000	1,237,500
									Entrance	Ciment	m2	5.4	15,000	81,000
									Fence	Stones	m2	19.5	55,000	1,072,500
12		Gasabo	Gisozi	Ruhango	1/02/04/02/274	1097.96	Private	18.7	Paves Floor	Bricks	m2	18.7	55,000	1,028,500
13		Gasabo	Gisozi	Ruhango	1/02/04/02/90	1000	Private	40	Paves Floor	concrete	m2	29	55,000	1,595,000
					1/02/04/02/273	342.23	Private	11	concrete base	concrete and stones	m3	7.7	55,000	423,500
14		Gasabo	Gisozi	Ruhango	1/02/04/02/272	313.85	Private	11	concrete base	concrete and stones	m3	7.7	55,000	423,500
15		Gasabo	Gisozi	Ruhango	1/02/04/02/253	1192.48	Private	15.58	Fence wall	Concrete blocks	m3	8.7	70,000	609,000
16		Gasabo	Gisozi	Ruhango	1/02/04/02/252	2173.63	Private	30.38	Paves Floor	Concrete	m2	30.38	55,000	1,670,900
									Fence	Metal	m2	78	10,000	780,000
17		Gasabo	Gisozi	Ruhango	1/02/04/02/251	563.5	Private	30	Paves Floor	concrete	m2	30	55,000	1,650,000
18		Gasabo	Gisozi	Ruhango	1/02/04/02/250	1625.4	Private	20	Fence wall	concrete blocks	m2	103	30,000	3,090,000
19		Gasabo	Gisozi	Ruhango	1/02/04/02/201	1743.74	Private	19.904	Paves Floor	concrete	m2	19.404	55,000	1,067,220
20		Gasabo	Gisozi	Ruhango	1/02/04/02/662	162	Private	5.565	Stairs	concrete	m2	4.565	55,000	251,075
21		Gasabo	Gisozi	Ruhango	1/02/04/02/664	368	Private	8.5	Stairs	Concrete	m2	8.5	55,000	467,500
22		Gasabo	Gisozi	Ruhango	1/02/04/02/2972	410	Private	30	Basement stairs	Cement and stones	m3	1.5	55,000	82,500

No	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Structures		Unit	Qty	Unit cost	Total cost(RWF)
									Nature	Materials				
									windows + protective screen	metallic	m2	1.2	45,000	54,000
									Door	metallic	pces	1	90,000	90,000
									Partial House wall	mud bricks	m3	14.3	55,000	786,500
23		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3435		Gov							
24		Gasabo	Gisozi	Ruhango	1/02/04/02/94		Gov							
Total														62,834,470

Annex 2:List of affected crops and trees

No	NAME/User	ID	District	Sector	CELL	Village	UPI	Total land	Ownership	Affected Land (Sqm)	Affected Trees & Crops		Unit	Quantity	Unit cost	Total cost(Rwf)
											Local Name	Age				
1		101374021	Nyarugenge	Kinyinya	Nzove	Ruyenzi	1/01/02/02/5102	1,218	Private	353.6	Papaya	2	Pces	4	2,000	8,000
2		1197980001030000	Nyarugenge	Kinyinya	Nzove	Ruyenzi	1/01/02/02/5182	1,2406	Private	420	Banana		Pces	2	3,500	7,000
3			Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/3420	5797	Gov	3,251	Sugar Cane		are	7	50,000	350,000
4											Urubingo		are	3.2	1,000	3,150
5											Sugar Cane		are	3.5	50,000	175,000
6		1196270000327130	Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/1621	288	Private	116.5	Ipera		Pces	2	4,000	8,000
							1/01/03/03/3489	370		370	Flowers tree		m	4	100	400
7			Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/3128	292	Gov	270.5	Urubingo		are	2.5	1,000	2,500
			Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/3432	6208	Gov	75	Urubingo		are	0.75	1,000	750
8		1196480004601050	Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/2132	433	Private	66	Cypres	5	Pces	2	2,000	4,000
9		1196680063432 60	Nyarugenge	Kigali	Nyabugogo	Kamenge	1/01/03/03/2129	465	Private	75	Urubingo		are	1.3	1,000	1,250
			Nyarugenge	Kigali	Nyabugogo	Nyabugogo	1/01/03/03/2301	960.26	Gov	52.5	Umunyinya		Pces	2	8,000	16,000
											Ipera		Pces	2	4,000	8,000
10		1196780020551100	Nyarugenge	Kigali	Nyabugogo	Nyabugogo	1/01/03/03/3433	5694	Private	437	Umugano		Pces	1	3,000	3,000
11		1196270005079040	Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/3434	5507	Private	335	Garden		m2	241	200	48,200
											Umukindo		Pces	2	9,000	18,000
											Umunyinya		Pces	3	8,000	24,000
											Ipera		Pces	1	4,000	4,000
			Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/3235	5226.76	Gov	224	Urubingo		are	0.4	1,000	450
											Mango		Pces	1	5,000	5,000
											Ipera		Pces	3	4,000	12,000
12		1196780004891010	Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/1693	287	Private	84	Umusave	5	Pces	13	3,000	39,000
13		1198380010080 60	Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/1692	269	Private	84	Indimu	5	Pces	2	4,000	8,000

			Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/3422	46025	Gov	3512	Vegetables	1	are	2.9	81,000	240,570
											Imihati		m	10	200	2,000
											Indimu		Pces	1	4,000	4,000
											Papaya	3	Pces	1	3,000	3,000
											Banana	4	Pces	30	4,000	120,000
											Bobere	3	Pces	1	100	100
											umugano	10	Pces	5	3,000	15,000
											Sugar Cane	1	are	0.6	50,000	29,750
14		1195870000215060	Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/3452	1326	Private	13.5	Mango	5	Pces	1	5,000	5,000
15		1195770000206070	Nyarugenge	Kigali	Nyabugogo	Giticyinyoni	1/01/03/03/2619	1121	Private	140	Mango	5	Pces	4	5,000	20,000
											Imiyenzi	1	Pces	1	300	300
											Banana	4	Pces	17	4,000	68,000
											Avocat	5	Pces	2	15,000	30,000
16		119637000280070	Nyarugenge	Kanyinya	Nzove	Rutagara I	1/01/02/02/4790	645	Private	184	Banana		Pces	30	4,000	120,000
											Bamboo		Pces	1	3,000	3,000
17		1195070000072090	Nyarugenge	Kanyinya	Nzove	Rutagara I	1/01/02/02/4803	1171	Private	122.5	Banana		Pces	40	10,000	400,000
							1/01/02/02/4432	1501	Private	52.5	Banana		Pces	10	10,000	100,000
18		1195880002168050	Nyarugenge	Kanyinya	Nzove	Rutagara I	1/01/02/02/4816	5225.2	Private	160	Urubingo		are	2.8	1,000	2,800
							1/01/02/02/4415	3331		120	Urubingo		are	2.4	1,000	2,400
19		1196080001239010	Nyarugenge	Kanyinya	Nzove	Rutagara I	1/01/02/02/4927	6972	Private	455	Banana		Pces	3	4,000	12,000
20		1197980004613090	Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/3359	5505	Private	927.5	Urubingo		are	0.7	1,000	750
											Banana		Pces	56	10,000	560,000
											Umurehe		Pces	1	500	500
21		1196270000607120	Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/3361	2565.28	Private	350	Umusave		Pces	2	3,000	6,000
											Banana		Pces	1	4,000	4,000
											Umugano		Pces	2	3,000	6,000
											Ipera		Pces	1	4,000	4,000
			Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/2603	223.59	Gov	17.5	Banana		Pces	1	4,000	4,000
											Umusave		Pces	2	3,000	6,000
			Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/2595	447.32		70	Mango	20	Pces	1	5,000	5,000
											Banana	5	Pces	3	4,000	12,000
											Umukindo	3	Pces	2	9,000	18,000
22		1196780001018030	Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/3296	501.31	Private	29.75	Banana		Pces	3	4,000	12,000
23		1194070001283040	Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/2593	1001.758	Private	79	umugano	5	Pces	1	3,000	3,000
											Banana	3	Pces	1	4,000	4,000
			Nyarugenge	Kanyinya	Nyamweru	Bwimo	1/01/02/01/2586	2648.33	Gov	80.5	Cypres	3	Pces	1	2,000	2,000
24		STATE_O2_ID_CARD_NO	Nyarugenge	Kanyinya	Nyamweru	Gatare	1/01/02/01/3357	7188.83		378	Umusave	2	Pces	1	3,000	3,000
											Banana	1	Pces	6	4,000	24,000
											Sugar Cane	1	are	0.5	50,000	26,250
			Gasabo	Gatsata	Nyamabuye	Rubonobono	1/02/02/02/2097	35564.26	Gov	1200	Urubingo		are	0.7	1,000	700
											Bamboo	10	Pces	10	3,000	30,000
											Imisave	3	Pces	4	4,000	16,000
											Banana	5	Pces	10	10,000	100,000

25		1198380007514080	Gasabo	Gatsata	Nyamabuye	Agakomeye	1/02/02/02/2088	666.35	Private	66.5	Grevellia	10	Pces	1	6,000	6,000
			Gasabo	Gatsata	Nyamabuye	Runyonza & Nyakabande	1/02/02/02/2095	11112.27	Gov	1064	Urubingo		are	0.7	1,000	700
											Bamboo	10	Pces	1	3,000	3,000
											Cypres	5	Pces	19	2,000	38,000
											Papaya	5	Pces	3	3,000	9,000
											Umusave	3	Pces	6	4,000	24,000
											Banana	1	Pces	1	4,000	4,000
											Sugar Cane	1	are	1.26	50,000	63,000
26		1196780001713020	Gasabo	Gatsata	Nyamabuye	Runyonza	1/02/02/02/1893	894.24	Private	259	Bamboo	10	Pces	3	3,000	9,000
											Umusave	5	Pces	3	4,000	12,000
											Cypres	5	Pces	5	2,000	10,000
											Sugar Cane	1	are	0.8	50,000	40,250
											Avocat	10	Pces	2	15,000	30,000
											Banana	1	Pces	1	4,000	4,000
27		1197470003854050	Gasabo	Gatsata	Nyamabuye	Nyakabande	1/02/02/02/297	650	Private	87.5	Flower Tree		Pces	2	100	200
			Gasabo	Gatsata	Nyamabuye	Nyakabande	1/02/02/02/280	1859.76	Gov	416	Umunyinya	10	Pces	10	8,000	80,000
28		1195580001977170	Gasabo	Gatsata	Nyamabuye	Kibaya	1/02/02/02/282	316.9	Private	47	Grevellia	2	Pces	2	800	1,600
29		1196080001495070	Gasabo	Gatsata	Nyamabuye	Kibaya	1/02/02/02/2091	663.52	Private	22						0
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/151	1233.5	Gov	272	Grevellia	10	Pces	1	4,000	4,000
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/150	1350.86	Gov	101.5						0
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/152	3128.5	Gov	560	Grevellia	10	Pces	4	4,000	16,000
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/153	1027.46	Gov	168						0
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/160	1829.3	Gov	224	Grevellia	5	Pces	2	2,000	4,000
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/-2/02/03/161	1770.24	Gov	240	Grevellia	10	Pces	1	4,000	4,000
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/162	1904.24	Gov	312	Grevellia	10	Pces	1	4,000	4,000
			Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/167	728.54	Gov	144	Grevellia	20	Pces	1	6,000	6,000
30		1196280018708010	Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/1532	10800	Private	344	Flowers		m2	5.5	200	1,100
											Avocat		Pces	1	15,000	15,000
											Grevellia	10	Pces	7	4,000	28,000
											Papaya		Pces	3	3,000	9,000
											Umuyenzi		Pces	1	500	500
											Ipera		Pces	14	4,000	56,000
											Mango		Pces	1	5,000	5,000
31		1198570175969060	Gasabo	Gatsata	Nyamugari	Akarubimbur	1/02/02/03/1538	2780	Private	304	Ipera		Pces	1	4,000	4,000
32			Gasabo	Gatsata	Nyamugali	Akarubimbur	1/02/02/03/1795	401273.5	Gov	904	Vegetables		are	1.6	81,000	129,600
33		1197780020811020														

34		1199180003300010														
35		1192170000023050	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/3185	87	Private	80	Urubingo		are	0.8	1,000	800
							1/02/04/02/1852	2829		319.5	Mango		Pces	2	5,000	10,000
											Urubingo		are	3.2	1,000	3,195
36		1195580000997160	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1853	990	Private	184.5	Urubingo		are	1.845	1,000	1,845
							1/02/04/02/19178	657	Private	208.4	Urubingo	5	are	2.1	1,000	2,085
37		1195780001220010	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1854	1178.26	Private	263.7	Banana	5	pce	63	10,000	630,000
											papayer	10	pce	2	3,000	6,000
38		119808008598040	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1859	987.4	Private	132.7	Urubingo	2.5	are	1.8	1,000	1,845
											Grevellia	7	pce	4	4,000	16,000
39		1198580008542050	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1904	3143.7	Private	398.7	Banana	8	group	43	10,000	430,000
											Papayer	5	pce	1	3,000	3,000
40		1193180000187000	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1905	536.88	Private	101.2	Eucalyptus	3	pce	9	3,000	27,000
											Urubingo	1	are	1.1	1,000	1,100
41		119427005646040	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1912	396.7	Private	101.5	imiyenzi (fence)	6	m	45	1,000	45,000
											umusave	3	pce	1	3,000	3,000
							1/02/04/02/1913	62.39	Private	69.8	Banana	3	Plant	32	10,000	320,000
											umusave	2	pce	2	3,000	6,000
											ipera	7	pce	5	4,000	20,000
42		1197780002417090	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1914	155.08	Private	56.84	Banana	3	Plant	9	4,000	36,000
											umwembe	10	group	1	5,000	5,000
											Grevellia	10	pce	1	4,000	4,000
											imiyenzi (fence)	3	m	10	1,000	10,000
43		119638008199060	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1919	503.37	Private	172.9	imiyenzi (fence)	4	m	12	1,000	12,000
44		119748004348500	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1922	1324.22	Private	352.2	Banana	6	group	35	10,000	350,000
											Eucalyptus	15	pce	6	12,000	72,000
											ipera	10	pce	1	4,000	4,000
45		1195680005109180	Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/1924	3033.75	Private	270.7	Banana		Pces	2	4,000	8,000
											Mango		Pces	1	5,000	5,000
			Gasabo	Gisozi	Ruhango	Kanyinya	1/02/04/02/2962	62164.88	Gov	632	Eucalyptus	10	Pces	91	6,000	546,000
											Cypres	5	Pces	7	2,000	14,000
											Filao	5	Pces	8	1,000	8,000
46		1198580008734100	Gasabo	Gisozi	Ruhango	Rukeri	1/02/04/02/1260	2307.11	Private	80	Eucalyptus	5	Pces	7	3,000	21,000
			Gasabo	Gisozi	Ruhango	Rukeri	102/04/02/1265	1228.48	Gov	336.	Eucalyptus		Pces	3	3,000	9,000
47		1195970001584050	Gasabo	Gisozi	Ruhango	Rukeri	1/02/04/02/1266	459.83	Private	200	Grevellia		Pces	1	4,000	4,000
48		LD164992	Gasabo	Gisozi	Ruhango	Rukeri	1/02/04/02/1267	2140.46	Private	584	Mango		Pces	1	5,000	5,000
							1/02/04/02/1255	3661		702	Banana		Pces	8	4,000	32,000
											Eucalyptus	4	Pces	5	3,000	15,000
											Avocat	10	Pces	12	15,000	180,000
											Grevellia	15	Pces	11	6,000	66,000
49		1197280004055010	Gasabo	Gisozi	Ruhango	Umurava	1/02/04/02./709	965.37	Private	184	Avocat		Pces	1	15,000	15,000
											Grevellia		Pces	3	4,000	12,000
											Mango		Pces	2	5,000	10,000

50		193770000256107	Gasabo	Gisozi	Ruhango	Umurava	1/02/04/02/3026	158.14	Private	38.5	Cypres		Pces	4	2,000	8,000
51		1197480010721130	Gasabo	Gisozi	Ruhango	Umurava	1/02/04/02/685	571	Private	44	Flower	1	pces	10	200	2,000
											Flower Tree	1.5	pces	1	100	100
52		1194580000197070	Gasabo	Gisozi	Ruhango	Umurava	1/02/04/02/677	839	Private	24	Mango	20	Pces	1	5,000	5,000
53		119538004996060	Gasabo	Gisozi	Ruhango	Umurava	1/02/04/02/2968	3217	Private	120	Mango	20	pces	1	5,000	5,000
											Cypres	10	pces	2	3,000	6,000
54		1198180019282040	Gasabo	Gisozi	Ruhango	Ntora	1/02/04/02/89	729	Private	30	Umukindo	1	Pces	1	9,000	9,000
55		1196180053382060	Gasabo	Gisozi	Ruhango	Ntora	1/02/04/02/95	1914.65	private	60	Umukindo	5	Pces	5	9,000	45,000
56		1197080003327100	Gasabo	Gisozi	Ruhango	Ntora	1/02/04/02/251	563.5	Private	40	Cypres	5	Pces	2	9,000	18,000
57		1196280002500010	Gasabo	Gisozi	Ruhango	Ntora	1/02/04/02/252	2173.63	Private	100	Umukindo		Pces	5	9,000	45,000
total																6,914,742

Annex 3: List of affected land including government owned land plots

No	HH*	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Land to be lost permanently	Unit	Unit cost	Total Cost(RWF)
1	C-		Nyarugenge	Kinyinya	Nzove	1/01/02/02/5102	121886	Private	3536	36	m2	2000	72,000
2	C4268		Nyarugenge	Kinyinya	Nzove	1/01/02/02/4268	925	Private	164.5	54.8	m2	2000	109,667
						1/01/02/02/2638	7153	Private	7	7	m2	2000	14,000
3	5182		Nyarugenge	Kinyinya	Nzove	1/01/02/02/5182	12406	Private	420	38	m2	2000	76,000
4	4806		Nyarugenge	Kinyinya	Nzove	1/01/02/02/4806	3970	Private	224	74.7	m2	2000	149,333
			Nyarugenge	Kinyinya	Nzove	1/01/02/02/4827	42,768	Gov	815				
5	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3420	5797.2	Gov	3251.5				
6	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3420							
7	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3420							
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3249	84.31	Gov	31				
8	1621		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/1621	288	Private	116.5	*288	m2	4500	1,296,000
						1/01/03/03/3489	370	Private	370	*370	m2	4500	1,665,000
9	27		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3128	292.34	Gov	270.5				
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3432	6208.15	Gov	75				
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3248	167.43	Gov	25.5				
10	2133		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2133	288	Private	43.5	43	m2	4500	193,500
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3493	332	Private	43.5	43	m2	4500	193,500
11	2132		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2132	433	Private	66	30	m2	4500	135,000
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3423	21512	Private	91.5	55	m2	4500	247,500
12	2131		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2131	279	Private	42	6	m2	4500	27,000
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3521	71	Private	42	6	m2	4500	27,000
13	2130		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3477	517	Private	30	30	m2	4500	135,000
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2130	202	Private	30	30	m2	4500	135,000
14	2129		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2129	465	Private	75	39	m2	4500	175,500
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3430	7839	Private	75	39	m2	4500	175,500
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2048	330	Gov	55.5				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3443	2604.1	Gov	54				-

No	HH*	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Land to be lost permanently	Unit	Unit cost	Total Cost(RWF)
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2046	924.46	Gov	177				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3429	7906	Gov	177				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2045	496.43	Gov	118.5				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3427	10937	Gov	120				-
15	3428		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2308	620	Private	276.5	92.2	m2	4500	414,750
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3428	10585	Private	20	20	m2	4500	90,000
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2301	960.26	Gov	52.5				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3435	5320.9	Gov	315				-
16	C3433		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3433	5694	Private	437	146	m2	4500	655,500
17	3434		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3434	5507	Private	335	111.7	m2	4500	502,500
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3235	5226.76	Gov	224				-
18	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/1693	287	Private	84	28	m2	4500	126,000
19	1692		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/1692	269	Private	84	48	m2	4500	216,000
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3422	46025.74	Gov	2526				-
20	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3452	1326	Private	13.5	13.5	m2	4500	60,750
21	2619		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2619	1121	Private	140	47	m2	4500	210,000
22	-		Nyarugenge	Kigali	Nyabugogo	1/01/03/03/2618	449	Private	77	25.7	m2	4500	115,500
23	4790		Nyarugenge	Kanyinya	Nzove	1/01/02/02/4790	645	Private	184	61	m2	2000	122,667
24	4803		Nyarugenge	Kanyinya	Nzove	1/01/02/02/4803	1171	Private	122.5	40.8	m2	2000	81,667
						1/01/02/02/4432	1501	Private	52.5	16.5	m2	2000	33,000
			Nyarugenge	Kanyinya	Nzove	1/01/02/02/4718	919.7	Gov	49				-
25	4816		Nyarugenge	Kanyinya	Nzove	1/01/02/02/4816	5225.2	Private	160	124	m2	2000	248,000
						1/01/02/02/4415	3331	Private	120	84	m2	2000	168,000
26	-		Nyarugenge	Kanyinya	Nzove	1/01/02/02/4927	6972	Private	455	151.7	m2	2000	303,333
27	4801		Nyarugenge	Kanyinya	Nzove	1/01/02/02/4801	230	Private	87.5	29.17	m2	2000	58,333
28	-		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/3359	5505	Private	927.5	309.2	m2	10000	3,091,667
29	3360		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/3360	487.64	Private	175	58.3	m2	10000	583,333
30	3361		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/3361	2565.28	Private	350	116.7	m2	10000	1,166,667
			Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/2603	223.59	Gov	17.5				-
			Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/2595	447.32	Private	70	34	m2	10000	340,000
31	3296		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/3296	501.31	Private	29.75	29	m2	10000	290,000
32	2593		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/2593	1001.758	Private	79	43	m2	10000	430,000
33	2592		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/2592	361.89	Private	7	7	m2	10000	70,000
			Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/2586	2648.33	Gov	80.5				-
34	C0		Nyarugenge	Kanyinya	Nyamweru	1/01/02/01/3357	7188.83	Private	378	126	m2	10000	1,260,000
			Gasabo	Gatsata	Nyamabuye	1/02/02/02/2097	35564.26	Gov	1200				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3424	18029.42	Gov	2768				-
			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3431	7805.83	Gov	1528				-
			Nyarugenge	Kimisagara	Kimisagara	1/01/04/03/2349	3153.4	Gov	280				
35	2088		Gasabo	Gatsata	Nyamabuye	1/02/02/02/2088	666.35	Private	66.5	30.5	m2	10000	305,000

No	HH*	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Land to be lost permanently	Unit	Unit cost	Total Cost(RWF)
			Gasabo	Gatsata	Nyamabuye	1/02/02/02/2095	11112.27	Gov	1064				-
36	-		Gasabo	Gatsata	Nyamabuye	1/02/02/02/1893	894.24	Private	259	86.3	m2	10000	863,333
37	-		Gasabo	Gatsata	Nyamabuye	1/02/02/02/1875	11.25	Private	2	2	m2	10000	20,000
38	297		Gasabo	Gatsata	Nyamabuye	1/02/02/02/297	650	Private	87.5				-
			Gasabo	Gatsata	Nyamabuye	1/02/02/02/280	1859.76	Gov	416				-
39	-		Gasabo	Gatsata	Nyamabuye	1/02/02/02/282	316.9	Private	47	16	m2	10000	156,667
40	-		Gasabo	Gatsata	Nyamabuye	1/02/02/02/2091	663.52	Private	22	22	m2	10000	220,000
			Gasabo	Gatsata	Nyamugari	1/02/02/03/151	1233.5	Private	272	90.7	m2	7500	680,000
			Gasabo	Gatsata	Nyamugari	1/02/02/03/150	1350.86	Private	101.5	33.8	m2	7500	253,750
			Gasabo	Gatsata	Nyamugari	1/02/02/03/152	3128.5	Gov	560				
			Gasabo	Gatsata	Nyamugari	1/02/02/03/153	1027.46	Gov	168				
41	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/156	1900	Private	336				
			Gasabo	Gatsata	Nyamugari	1/02/02/03/158	1122.3	Gov	160				
42	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/159	1404	Private	216				
			Gasabo	Gatsata	Nyamugari	1/02/02/03/160	1829.3	Gov	224				-
			Gasabo	Gatsata	Nyamugari	1/-2/02/03/161	1770.24	Gov	240				-
			Gasabo	Gatsata	Nyamugari	1/02/02/03/162	1904.24	Gov	312				-
			Gasabo	Gatsata	Nyamugari	1/02/02/03/163	48.7	Gov	28				-
			Gasabo	Gatsata	Nyamugari	1/02/02/03/164	1037.73	Gov	208				-
			Gasabo	Gatsata	Nyamugari	1/02/02/03/165	621.11	Gov	80.5				-
43	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/166	2404	Private	336				
			Gasabo	Gatsata	Nyamugari	1/02/02/03/167	728.54	Gov	144				-
44	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/1762	749	Private	176	58.7	m2	7500	440,000
45	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/1761	273	Private	112	37.3	m2	7500	280,000
46	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/1760	400	Private	44	8	m2	7500	60,000
			Gasabo	Gatsata	Nyamugari	1/02/02/03/170	297	Gov	176	58.7	m2		
47	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/1532	10800	Private	344	114.7	m2	7500	860,000
48	-		Gasabo	Gatsata	Nyamugari	1/02/02/03/1538	2780	Private	304	101.3	m2	7500	760,000
			Gasabo	Gatsata	Nyamugari	1/02/02/03/1794	58911.28	Gov	1632				-
49	19		Gasabo	Gisozi	Ruhango	1/02/02/03/1795	401273.5	Gov	800		m2		
50	20		Gasabo	Gisozi	Ruhango			Gov	180		m2		
51	21		Gasabo	Gisozi	Ruhango			Gov	160		m2		
52	22		Gasabo	Gisozi	Ruhango			Gov	112		m2		
53	24		Gasabo	Gisozi	Ruhango			Gov	112		m2		
54	-		Gasabo	Gisozi	Ruhango	1/02/04/02/3477	467461	Private	30	30	m2	17,500	525,000
55	3185		Gasabo	Gisozi	Ruhango	1/02/04/02/3185	87	Private	80	44	m2	17,500	770,000
			Gasabo	Gisozi	Ruhango	1/02/04/02/1852	2829	Private	319.5	28	m2	17,500	490,000

No	HH*	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Land to be lost permanently	Unit	Unit cost	Total Cost(RWF)
56	3533		Gasabo	Gisozi	Ruhango	1/02/04/02/3533	1740	Private	160	53.3	m2	17,500	933,333
57	1853		Gasabo	Gisozi	Ruhango	1/02/04/02/1853	990	Private	184.5	61.5	m2	17,500	1,076,250
						1/02/04/02/1918	657	Private	208.49	69.5	m2	17,500	1,216,192
58	1854		Gasabo	Gisozi	Ruhango	1/02/04/02/1854	1178.26	Private	263.7	87.9	m2	17,500	1,538,250
59	1859		Gasabo	Gisozi	Ruhango	1/02/04/02/1859	987.4	Private	132.75	96.75	m2	17,500	1,693,125
60	1904		Gasabo	Gisozi	Ruhango	1/02/04/02/1904	3143.7	Private	398.7	132.9	m2	17,500	2,325,750
61	1905		Gasabo	Gisozi	Ruhango	1/02/04/02/1905	536.88	Private	101.25	33.75	m2	17,500	590,625
62	1912		Gasabo	Gisozi	Ruhango	1/02/04/02/1912	396.7	Private	101.5	33.8	m2	17,500	592,083
						1/02/04/02/1913	62.39	Private	69.8	23.3	m2	17,500	407,167
63	1914		Gasabo	Gisozi	Ruhango	1/02/04/02/1914	155.08	Private	56.84	20.84	m2	17,500	364,700
			Gasabo	Gisozi	Ruhango	1/02/04/02/1920	2899.67	Gov	206.5				-
64	1919		Gasabo	Gisozi	Ruhango	1/02/04/02/1919	503.37	Private	172.94	57.6	m2	17,500	1,008,817
65	1922		Gasabo	Gisozi	Ruhango	1/02/04/02/1922	1324.22	Private	352.22	117.41	m2	17,500	2,054,617
66	1923		Gasabo	Gisozi	Ruhango	1/02/04/02/1923	1877.85	Private	40	13.3	m2	17,500	233,333
						1/02/04/02/1924	3033.75	Private	270.72	90.24	m2	17,500	1,579,200
			Gasabo	Gisozi	Ruhango	1/02/04/02/2962	62164.88	Gov	632				-
67	1260		Gasabo	Gisozi	Ruhango	1/02/04/02/1260	2307.11	Private	80	44	m2	17,500	770,000
68	1261		Gasabo	Gisozi	Ruhango	1/02/04/02/1261	1085.22	Private	264	88	m2	17,500	1,540,000
			Gasabo	Gisozi	Ruhango	102/04/02/1265	1228.48	Gov	336.96				-
69	-				Ruhango	1/02/04/02/1249	1104	Private	225	150	m2	17,500	2,625,000
70	1266		Gasabo	Gisozi	Ruhango	1/02/04/02/1266	459.83	Private	200	66.7	m2	17,500	1,166,667
71	-		Gasabo	Gisozi	Ruhango	1/02/04/02/1267	2140.46	Private	584	54	m2	17,500	945,000
						1/02/04/02/1255		Private	706	460	m2	17,500	8,050,000
72	685		Gasabo	Gisozi	Ruhango	1/02/04/02/685	571	Private	22	22	m2	17,500	385,000
73	677		Gasabo	Gisozi	Ruhango	1/02/04/02/677	839	Private	24	24	m2	17,500	420,000
74	131		Gasabo	Gisozi	Ruhango	1/02/04/02/131	350	Private	30	30	m2	17,500	525,000
75	4023		Gasabo	Gisozi	Ruhango	1/02/04/02/4023	916	Private	14	14	m2	17,500	245,000
76	88		Gasabo	Gisozi	Ruhango	1/02/04/02/88	761	Private	24	24	m2	17,500	420,000
77	89		Gasabo	Gisozi	Ruhango	1/02/04/02/89	729	Private	30	30	m2	17,500	525,000
78	90		Gasabo	Gisozi	Ruhango	1/02/04/02/273	342.23	Private	37.4	37.4	m2	17,500	654,500
						1/02/04/02/90	1000	Private	40	40	m2	17,500	700,000
			Gasabo	Gisozi	Ruhango	1/02/04/02/94	308.62	Gov	24				-
79	95		Gasabo	Gisozi	Ruhango	1/02/04/02/95	1914.65	private	24	24	m2	17,500	420,000
80	274		Gasabo	Gisozi	Ruhango	1/02/04/02/274	1097.96	Private	14	14	m2	17,500	245,000
81	272		Gasabo	Gisozi	Ruhango	1/02/04/02/272	313.85	Private	11	11	m2	17,500	192,500
						1/02/04/02/275	5712.58	Private	40	40	m2	17,500	700,000
82	253		Gasabo	Gisozi	Ruhango	1/02/04/02/253	1192.48	Private	15.5	15.58	m2	17,500	272,650
83	C252		Gasabo	Gisozi	Ruhango	1/02/04/02/252	2173.63	Private	33.3	33.3	m2	17,500	583,333
84	251		Gasabo	Gisozi	Ruhango	1/02/04/02/251	563.5	Private	19.9	19.9	m2	17,500	348,250
85	250		Gasabo	Gisozi	Ruhango	1/02/04/02/250	1625.4	Private	20	20	m2	17,500	350,000
86	C201		Gasabo	Gisozi	Ruhango	1/02/04/02/201	1743.74	Private	19.9	19.9	m2	17,500	348,250
87	C-		Gasabo	Gisozi	Ruhango	1/02/04/02/203	136	Private	11	11	m2	17,500	192,500
88	C200		Gasabo	Gisozi	Ruhango	1/02/04/02/200	23921	Private	36	36	m2	17,500	630,000
89	C202		Gasabo	Gisozi	Ruhango	1/02/04/02/202	2459.63	Private	25	25	m2	17,500	437,500

No	HH*	NAME/User	DISTRICT	SECTOR	CELL	UPI	Total land	OWNER SHIP	Affected Land/Qty	Land to be lost permanently	Unit	Unit cost	Total Cost(RWF)
90	3026		Gasabo	Gisozi	Ruhango	1/02/04/02/3026	158.14	Private	2	2	m2	17,500	35,000
91	-		Gasabo	Gisozi	Ruhango	1/02/04/02/662	162	Private	5.5	5.5	m2	17,500	96,250
92	-		Gasabo	Gisozi	Ruhango	1/02/04/02/664	368	Private	8.5	8.5	m2	17,500	148,750
93	-		Gasabo	Gisozi	Ruhango	1/02/04/02/2972	410	Private	30	30	m2	17,500	525,000
94			Nyarugenge	Kigali	Nyabugogo	1/01/03/03/3435		Gov					
95			Gasabo	Gisozi	Ruhango	1/02/04/02/94		Gov					
Total									40,493				62,257,509

*: Since the project affected area accounts for more than 20% of the premises, whole the areas of the premises become the target of land expropriation.

Annex 4: Assets inventory form

Umushinga /Project : Strengthening of Nzove Ntora Principal Pipeline In Kigali city
Form title:/izina rya fishe:
mu karere ka (valuation of assets affected in district of)……

Amazina ya nyiri umutungo/Owner :…… Nimero ya telefone/Phone Number…… Nimero y'indangamuntu/Id Number …… Nimero ya konti/Account Number:…… Izina rya banki/name of the bank…… Akarere/District ……Umurenge/Sector:…… …… Akagali(cell):……Umudugudu/Village:…… ……					Byemejwe n'Akarere ka/Approved by the District Names:…… …… …… …… **Signature & Stamp**		**Amazina n'umukono** ry'umugenagaciro wemewe/Names and signature of certified valuer Names:…… …… …… **Signature & Stamp:**	
No	Affected area	Location	Umutungo wangijwe/ Affected assets	Igipimo/Unit	Ingano/ Quantity	Imyaka /Year	Igiciro cya kimwe/ unit cost	Igiciro cya byose Total cost
1								
2								
.								
.								
IGITERANYO CYA BYOSE/ GENERAL TOTAL								
Amazina n'umukono bya nyir'umutungo/Names and Signature of owner …… …… ……		Amazina n'umukono by'Umuyobozi w'Akagali/Names and signature of executive secretary of cell …… …… ……			Amazina n'umukono by'Umukozi w'umurenge ushinzwe imitungo/ Names and signature of sector agronomist or in charge of land and resettlement …… …… ……		Izina n'umukono by'Umunyamabanga Nshingwabikorwa w'Umurenge/ Names and signature of Sector Executive Secretary …… …… …	

Annex 5: Sample grievance redresses form

Grievance Form		
Grievance Number		**Copies to forward to:**
Name of the recorder		(Original) Receiver Party
District/ Sector/Cell		(Copy)- Responsible Party
Date		
INFORMATION ABOUT GRIEVANCE		
Define The Grievance		
INFORMATION ABOUT THE COMPLAINANT		**Forms of Receive**
Name-Surname		Phone line Community/Information meetings Mail Informal Other
Address		
Village/ Cell		
Sector/ District		
Signature of Complainant		

Details of Grievance

6.Incidents Regarding Expropriation and Compensation (Specify)	**7.**Resettlement Process (specify)	**8.**Employment and recruitment (Specify)	**9.**Construction workers and Community Relations - Nuisance from dust - Nuisance from noise - Vibrations due to explosions - Misconduct of the project personal/worker - Complaint follow up Other	**10.**Other (specify)

Grievances Close Out Form

Grievance Number:.....

Define immediate action required:.....

Define long term action required (if necessary).....

Verification of corrective action and sign off

Corrective action taken	Due date

Responsible party

Notes: This part will be filled in and signed by the complainant when he/she receives the compensation or file is closed out
Complainant:..... Name and Signature..... Date Representative of Responsible Party Title, Name and Signature..... Date:.....

Annex 6: Consulted people at central and district level

No	Institution	Contact person	Position	Contact
1	Rwanda Environment Management Authority		Environmental Inspector	
2	Rwanda Water and Forest Authority		In charge of Water Quality	
3	Water and Sanitation Corporation		In Charge of Planning	
4	Gasabo District		Land Survey & GIS	
5	Gasabo District		Environmental Officer	

6	Nyarugenge District		Land Management Team Leader	
7	Nyarugenge District		Environmental Officer	

Annex 7: People consulted at sector and cell level

No	Institution	Contact person	Position	Contact
1	Gisozi Sector		Land & Infrastructure Officer	
2	Gisozi Sector		In charge of development of Umurava village	
3	Gisozi Sector		Ubudehe President	
4	Gisozi Sector		In charge of communication and training in Ntora village	
5	Gisozi Sector		Leader of village in Gisozi Sector	
6	Gisozi Sector		In charge of development in Kanyinya village	
7	Gisozi Sector		SEDO/Masezero	
8	Gisozi Sector		In charge of social affaires	
9	Gisozi Sector		C/o In charge of development	
10	Gisozi Sector		Leader of Rukeli village	
11	Kigali Sector		Executive Secretary	
12	Kigali Sector		Executive secretary of Nyabugogo cell	
13	Kanyinya Sector		Executive secretary of Nzove cell	
14	Kanyinya Sector		Executive secretary of Sector	
15	Kanyinya Sector		Executive secretary of Nyamweru cell	
16	Gatsata Sector		Executive secretary/ Nyamabuye cell	
17	Gatsata Sector		SEDO/Nyamugali cell	
18	Gatsata Sector		Executive secretary of Sector	
19	Gisozi Sector		Executive Secretary of Sector	
20	Gisozi Sector		Executive Secretary/ Ruhango cell	

Annex 8: Participants to the scoping meeting Kanyinya sector, January 16th, 2018

No	Names	Institution/cell	Position/profession	Contact
1		Nyamweru	Photograph	
2		Nyamweru	Farmer	
3		Nyamweru	Farmer	
4		Nyamweru	Farmer	
5		Nyamweru	Farmer	
6		Nyamweru	Farmer	
7		Nyamweru	Farmer	
8		Nyamweru	Farmer	
9		Nyamweru	Trader	
10		Nyamweru	Trader	
11		Nyamweru	Motorcycle conductor	
12		Nyamweru	Farmer	
13		Nyamweru	Village representative	
14		Nyamweru	Housewife	
15		Nyamweru	Housewife	
16		Nyamweru	Trader	
17		Nyamweru	Housewife	
18		Nyamweru	Housewife	
19		Nyamweru	Housewife	
20		Nyamweru	Trader	
21		Nyamweru	Socio development	
22		Nyamweru	Security in village	

23		Nyamweru	Security in village	
24		Nyamweru	Housewife	
25		Nyamweru	Trader	
26		Nyamweru	Trader	
27		Nyamweru	-	
28		Nyamweru	Farmer	
29		Nyamweru	Farmer	
30		Nyamweru	Housewife	
31		Nyamweru	Farmer	
32		Nyamweru	Constructor	
33		Nyamweru	Farmer	
34		Nyamweru	Farmer	
35		Nyamweru	Commercial	
36		Nyamweru	Tailoring	
37		Nyamweru	Farmer	
38		Nyamweru	Commercial	
39		Nyamweru	Farmer	
40		Nyamweru	Farmer	
41		Nyamweru	Agricultural	
41		Nyamweru	Agricultural	
43		Nyamweru	Tailoring	
44		Nyamweru	-	
45		Nyamweru	Broker	
46		Nyamweru	Broker	
47		Nyamweru	Taxi Moto	
48		Nyamweru	Housewife	
49		Nyamweru	Housewife	
50		Nyamweru	Housewife	
51		Nyamweru	Farmer	
52		Nyamweru	Commercial	
53		Nyamweru	Farmer	
54		Nyamweru	Executive Secretary	
55		WASAC	Planning	

Annex 9: Participant to the scoping meeting in Gatsata sector, January 9th, 2018

N0	Names	Institution/cell	Position/Profession	Contact
1		Nyamabuye	Technician	
2		Nyamabuye	House wife	
3		Nyamabuye	Security	
4		Nyamabuye	House wife	
5		Nyamabuye	Commercial	
6		Nyamabuye	House wife	
7		Nyamabuye	Commercial	
8		Nyamabuye	House wife	
9		Nyamabuye	chef of village	
10		Nyamabuye	Commercial	
11		Nyamabuye	Film player	
12		Nyakabande	Security	
13		Nyakabande	-	
14		Nyakabande	Commercial	
15		Nyakabande	-	
16		Nyakabande	Commercial	
17		Nyakabande	Commercial	
18		Nyakabande	House wife	
19		Nyakabande	House wife	
20		Nyakabande	Security	
21		Nyakabande	Commercial	
22		Nyamabuye	Technician	
23		Nyamabuye	Commercial	
24		Nyakabande	Technician	

25		Nyamabuye	House wife	
26		Nyakabande	-	
27		Nyakabande	Cell communication	
28		Nyakabande	-	
29		Nyamabuye	-	
30		Nyamabuye	-	
31		Nyakabande	Commercial	
32		Nyakabande	Commercial	
33		Nyamabuye	Umwunzi	
34		Runyonza	Umujyanama	
35		Nyakabande	-	
36		Kibaya	Social affairs	
37		Nyakabande	House wife	
38		Nyamabuye	-	
39		Nyamabuye	-	
40		Nyamabuye	-	
41		Nyamabuye	-	
42		Nyamabuye	Commercial	
43		Kanunga	-	
44		Nyamabuye	Commercial	
45		Nyamabuye	Farmer	
46		Nyamabuye	-	
47		Nyamabuye	Commercial	
48		Nyamabuye	Commercial	
49		Nyamabuye	-	

Annex 10:Participants to the scoping meeting with leaders in Gisozi sector , January 18th, 2018

No	Names	Institution/cell	Position/Profession	Contact
1		Gisozi sector	Land and infrastructure officer	
2.		Gisozi sector	In charge of development in Murava village	
3.		Gisozi sector	Executive secretary of Musezero	
4.		Gisozi sector	Communication and training officer at Ntora	
5.		Gisozi sector	Chef of village	
6.		Gisozi sector	Ubudehe President	
7.		Gisozi sector	Development in Kanyinya village	
8.		Gisozi sector	SEDO/MASESERO	
9.		Gisozi sector	Social affairs officer	
10.		Gisozi sector	C/O Development	
11.		Gisozi sector	Chef of Rukeri village	
12.		BESST LTD	Consultant	
13.		BESST LTD	GIS	
14.		BESST LTD	EIA	
15.		WASAC	Planning	

Annex 11: Participants to scoping meeting with local community in Gisozi, February 27, 2018

No	Names	Telephone
1		
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Annex 12: Participants to the scoping meeting Kigali Sector, Nyabugogo cell, January 9th, 2018

No.	Names	Institution/cell	Profession/Position	Contact
1		Nyabugogo	E/S	
2		Nyabugogo	Pension	
3		Nyabugogo	commercial	
4		Gatare	commercial	
5		Nyabugogo	Farmer	
6		Kamenge	Village leader	
7		Nyabugogo	Farmer	
8		Kamenge	Farmer	
9		Kamenge		
10		Kamenge		
11		Kamenge		
12		Nyabugogo		
13		Nyabugogo		
14		Nyabugogo		
15		Kamenge		

16		Kamenge		
17		Kamenge		
18		Kamenge		
19		Kamenge		
20		Kamenge		
21		Nyabugogo	Farmer	
22		Nyabugogo	Farmer	
23		Nyabugogo	V&C	
24		Kamenge	Farmer	
25		Kamenge	Plumber	
26		Kamenge	Farmer	
27		Kamenge	Farmer	
28		Kamenge	Farmer	
29		Kamenge	Farmer	
30		Kamenge	Farmer	
31		Kamenge	Farmer	
32		Kamenge	Farmer	
33		Kamenge	Farmer	
34		Nyabugogo	Farmer	
35		Kamenge	Farmer	
36		Nyabugogo	Trader	
37		Nyabugogo	Farmer	
38		WASAC	Planning	

Annex 13: Participants the meeting before survey in Ruhango cell, Feb.5th 2018

No	Names	Cell	Village	Contact
1		Ruhango	Umurava	
2		Ruhango	Umurava	
3		Ruhango	Umurava	
4		Ruhango	Umurava	
5		Ruhango	Umurava	
6		Ruhango	Umurava	
7		Ruhango	Umurava	
8		Ruhango	Rukeri	
9		Ruhango	Umurava	
10		Ruhango	Umurava	
11		Ruhango	Umurava	
12		Ruhango	Umurava	
13		Ruhango	Kanyinya	
14		Ruhango	Kanyinya	
15		Ruhango	Kanyinya	
16		Ruhango	Kanyinya	
17		Ruhango	Kanyinya	
18		Ruhango	Kanyinya	
19		Ruhango	Kanyinya	
20		Ruhango	Kanyinya	
21		Ruhango	Kanyinya	
22		Ruhango	Kanyinya	
23		Ruhango	Kanyinya	
24		Ruhango	Rukeri	
24		Ruhango	Rukeri	
26		Ruhango	Umurava	
27		Ruhango	Kanyinya	
30		Ruhango	Ntora	
31		Ruhango	Ntora	
32		Ruhango	Ntora	
33		Ruhango	Ntora	
34		Ruhango	Ntora	
35		Ruhango	Ntora	
36		Ruhango	Ntora	

37		Ruhango	Ntora	
38		Ruhango	Ntora	
39		Ruhango	Trinity Nursery and Primary School	
40		Ruhango	Ntora	
41		Ruhango	Ntora	
42		Ruhango	Umurava	
43		Ruhango	Ntora	
44		Ruhango	Umurava	
45		Ruhango	Ntora	

Annex 14: Participants to the meeting before survey in Nyabugogo Cell, February 6th 2018

No	Names	Cell	Village	Contact
1		Nyabugogo	Kamenge	
2		Nyabugogo	Kamenge	
3		Nyabugogo	K amenge	
4		Nyabugogo	Kamenge	
5		Nyabugogo	Kamenge	
6		Nyabugogo	Kamenge	
7		Nyabugogo	Kamenge	
8		Nyabugogo	Gitikinyoni	
9		Nyabugogo	Gitikinyoni	
10		Nyabugogo	Gitikinyoni	
11		Nyabugogo	Gitikinyoni	
12		Nyabugogo	Gitikinyoni	

Annex 15: Participants the meeting before survey in Nzove cell, February 7th 2018

No	**Names**	**Cell**	**Village**	**Phone**
1		Nzove	Rutagara I	
2		Nzove	Rutagara I	
3		Nzove	Ruyenzi	
4		Nzove	Rutagara I	
5		Nzove	Rutagara I	
6		Nzove	Rutagara I	
7		Nzove	Rutagara I	
8		Nzove	Ruyenzi	
9		Nzove	Ruyenzi	

Annex 16: Participants the meeting before survey in Nyamweru& Nyamabuye cell,9th 2018

No	Names	Cell	Village	Contact
1		Nyamweru	Bwimo	
2		Nyamweru	Bwimo	
3		Nyamweru	Bwimo	
4		Nyamweru	Bwimo	
5		Nyamabuye	Agakomeye	
6		Nyamabuye	Nyakabande	
7		Nyamabuye	Agakomeye	
8		Nyamabuye	Nyakabande	
9		Nyamabuye	Agakomeye	
10		Nyamabuye	Nyakabande	
11		Nyamabuye	Agakomeye	
12		Nyamabuye	Nyakabande	
13		Nyamabuye	Agakomeye	
14		Nyamabuye	Nyakabande	
15		Nyamabuye	Agakomeye	
16		Nyamabuye	Nyakabande	
17		Nyamabuye	Agakomeye	
18		Nyamabuye	Nyakabande	

Annex 17: Participants the meeting before survey in Nyamugali cell, February 14th 2018

1		Gatsata	Nyamugari	
2		Gatsata	Nyamugari	

3		Gatsata	Nyamugari	
4		Gatsata	Nyamugari	
5		Gatsata	Nyamugari	
6		Gatsata	Nyamugari	
7		Gatsata	Nyamugari	
8		Gatsata	Nyamugari	
9		Gatsata	Nyamugari	
10		Gatsata	Nyamugari	
11		Gatsata	Nyamugari	
12		Gatsata	Nyamugari	
13		Gatsata	Nyamugari	
14		Gatsata	Nyamugari	
15		Gatsata	Nyamugari	
16		Gatsata	Nyamugari	

Annex 18: List of presence for meeting in Gisozi sector, Ruhango Cell at drafting stage

No	Names	Cell	Contact
1.		Ruhango	
2.		Ruhango	
3.		Ruhango	
4.		Ruhango	
5.		Ruhango	
6.		Ruhango	
7.		Ruhango	
8.		Ruhango	
9.		Ruhango	
10.		Ruhango	
11.		Ruhango	
12.		Ruhango	
13.		Ruhango	
14.		Ruhango	
15.		Ruhango	
16.		Ruhango	
17.		Ruhango	
18.		Ruhango	
19.		Ruhango	
20.		Ruhango	
21.		Ruhango	
22.		Ruhango	
23.		Ruhango	
24.		Ruhango	
25.		Ruhango	
26.		Ruhango	
27.		Ruhango	

Annex 19: List of presence for meeting in Kanyinya sector, in Nyamweru and Nzove cell.

N	NAMES	Position/Profession	SECTOR	CELL	CONTACT
1		Leader of Village	Kanyinya	**Nyamweru**	
2		Farmer	Kanyinya	Nyamweru	
3		Farmer	Kanyinya	Nyamweru	
4		commercial	Kanyinya	Nyamweru	
5		Farmer	Kanyinya	Nzove	
6		Farmer	Kanyinya	Nyamweru	
7		Farmer	Kanyinya	Nyamweru	
8		Self-employment	Kanyinya	Nyamweru	
9		Farmer	Kanyinya	Nyamweru	
10		Commercial	Kanyinya	Nyamweru	
11		Commercial	Kanyinya		
12		Farmer	Kianyinya	Nzove	
13		Driver	Kanyinya	Nyamweru	

14		Farmer	Kanyinya	Nyamweru	
15		Commercial	Kanyinya		
16		Farmer	Kanyinya		
17		Farmer	Kanyinya		
18		Commercial	Kanyinya		
19		Farmer	Kanyinya		
20		Farmer	Kanyinya		
21		Commercial	Kanyinya		
22		Farmer	Kanyinya		
23		Farmer	Kanyinya		
24		Farmer	Kanyinya		
25		Farmer	Kanyinya		
26		commercial	Kanyinya		
27		Commercial	Kanyinya		
28		Farmer	Kanyinya		
29		Farmer	Kanyinya		
30		Commercial	Kanyinya		
31		SEDO CELL	Kanyinya		

Annex 20: List of presence for meeting in Kigali sector, Nyabugogo Cell

N	NAMES	Position/Profession	Sector	Cell	Contact
1		Farmer	Kigali	Nyabugogo	
2		Farmer	Kigali	Nyabugogo	
3		Farmer	Kigali	Nyabugogo	
4		commercial	Kigali	Nyabugogo	
5		Farmer	Kigali	Nyabugogo	
6		Farmer	Kigali	Nyabugogo	
7		Farmer	Kigali	Nyabugogo	
8		Self-employment	Kigali	Nyabugogo	
9		Farmer	Kigali	Nyabugogo	
10		Commercial	Kigali	Nyabugogo	
11		Commercial	Kigali	Nyabugogo	
12		Farmer	Kigali	Nyabugogo	
13		Driver	Kigali	Nyabugogo	
14		Farmer	Kigali	Nyabugogo	
15		Farmer	Kigali	Nyabugogo	
16		Farmer	Kigali	Nyabugogo	
17		Commercial	Kigali	Nyabugogo	
18		Farmer	Kigali	Nyabugogo	
19		Commercial	Kigali	Nyabugogo	
20		Farmer	Kigali	Nyabugogo	
21		Farmer	Kigali	Nyabugogo	
22		Farmer	Kigali	Nyabugogo	
23		Leader Nyabugogo village	Kigali	Nyabugogo	
24		Farmer	Kigali	Nyabugogo	
25		Farmer	Kigali	Nyabugogo	
26		Village Leader	Kigali	Nyabugogo	
27		Executive Secretary	Kigali	Nyabugogo	

Annex 21: List of presence for meeting in Gatsata sector, Nyamweru Cell, 20, 2018

No	Names	Institution/Cell	Profession	Contact
1.		Nyamweru	Wasac	
2.		Nyamweru	Chauffeur	
3.		Nyamweru	Commercial	
4.		Nyamweru	Commercial	
5.		Nyamweru	Commercial	
6.		Nyamweru	Agriculture	
7.		Nyamweru	Agriculture	
8		Gatsata	Nyamugari	
9		Gatsata	Nyamugari	

10		Gatsata	Nyamugari	
11		Gatsata	Nyamugari	
12		Gatsata	Nyamugari	
13		Gatsata	Nyamugari	
14		Gatsata	Nyamugari	
15		Gatsata	Nyamugari	