6. Outline Design Drawing

6. Outline Design Drawing

Substation Facilities

DWG No.	Title
SS-01	New Gasogi Substation Single line Diagram
SS-02	New Gasogi Substation Arrangement Drawing (Plan) of 110 kV Switchyard
SS-03	New Gasogi Substation Layout Plan of Central Control Room
SS-04	New Gasogi Substation Control System Diagram

Architect Facilities

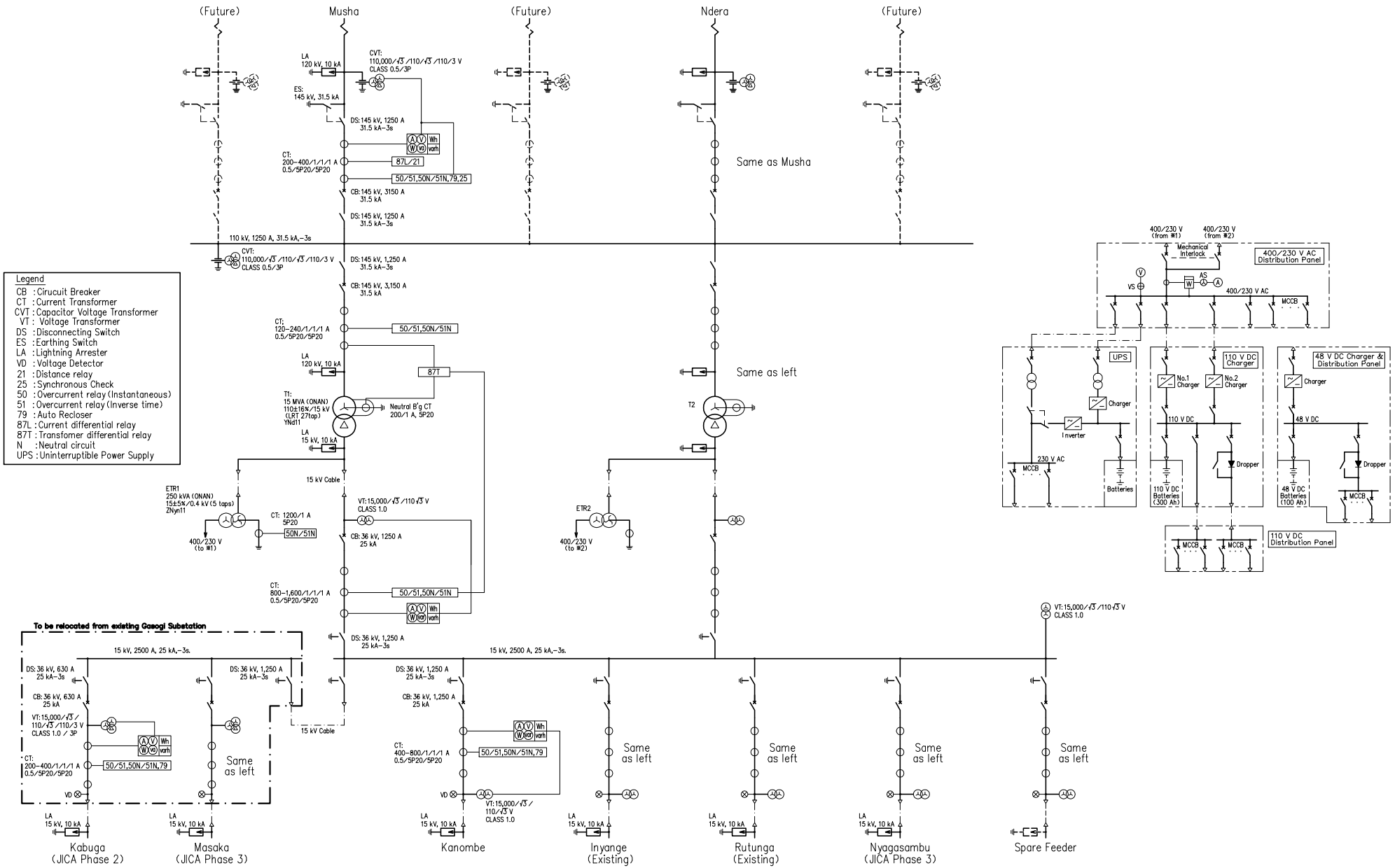
DWG No.	Title
A-01	New Gasogi Substation Building Site Layout
A-02	New Gasogi Substation Building Finishing Schedule
A-03	New Gasogi Substation Building Ground Floor Plan
A-04	New Gasogi Substation Building Roof Plan 1
A-05	New Gasogi Substation Building Roof Plan 2
A-06	New Gasogi Substation Building Elevation 1
A-07	New Gasogi Substation Building Elevation 2
A-08	New Gasogi Substation Building Section 1
A-09	New Gasogi Substation Building Section 2
A-10	New Gasogi Substation Building Section Detail
A-11	New Gasogi Substation Building Fitting Schedule

Transmission and Distribution Line Facilities

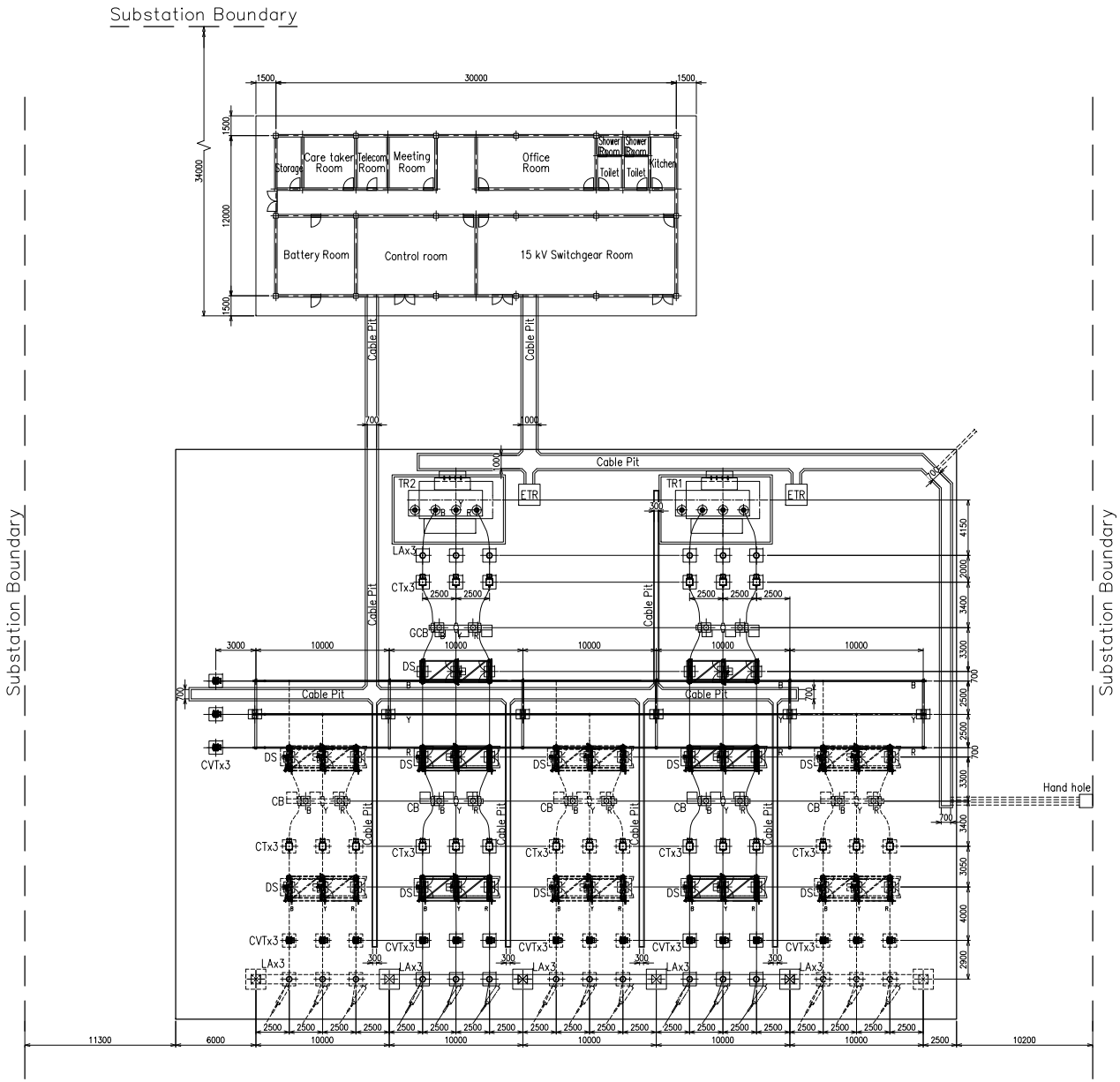
DWG No.	Title
DR-01	15 kV Transmission Line Route KEY PLAN
DR-02	15 kV Transmission Line Route (New Gasogi Substation – Nyagasambu: Approx. 11.5 km)
DR-03	15 kV Transmission Line Route (New Gasogi Substation - Masaka Hospital: Approx. 8.5 km)
LP-01	110 kV Transmission Line; Line Profile (Existing Transmission Line – New Gasogi Substation)
LP-02	110 kV Transmission Line; Line Profile (Existing Transmission Line – New Gasogi Substation) (Close-up)
LP-21	15kVDistribution Line; Route-1, Line Profile (1/5) (New Gasogi Substation – Nyagasambu)
LP-22	15kVDistribution Line; Route-1, Line Profile (2/5) (New Gasogi Substation – Nyagasambu)
LP-23	15kVDistribution Line; Route-1, Line Profile (3/5)

DWG No.	Title
	(New Gasogi Substation – Nyagasambu)
LP-24	15kVDistribution Line; Route-1, Line Profile (4/5) (New Gasogi Substation – Nyagasambu)
LP-25	15kVDistribution Line; Route-1, Line Profile (5/5) (New Gasogi Substation – Nyagasambu)
LP-31	15kVDistribution Line; Route-1, Line Profile (1/4) (New Gasogi Substation – Masaka Hospital)
LP-32	15kVDistribution Line; Route-1, Line Profile (2/4) (New Gasogi Substation – Masaka Hospital)
LP-33	15kVDistribution Line; Route-1, Line Profile (3/4) (New Gasogi Substation – Masaka Hospital)
LP-34	15kVDistribution Line; Route-1, Line Profile (4/4) (New Gasogi Substation – Masaka Hospital)
TL-41	110 kV Tower Skelton, Type: 110-E1
TL-42	110 kV Gantry Tower Skelton in New Gasogi Substation
TL-51	110 kV Tower Foundation, Type: 110-E1
TL-52	110 kV Gantry Tower Foundation in New Gasogi Substation
DL-61	15 kV Tower Skelton, Type: 15-TA1
DL-62	15 kV Tower Skelton, Type: 15-TB1
DL-63	15 kV Tower Skelton, Type: 15-TD1
DL-64	15 kV Tower Skelton, Type: 15-TD1D
DL-65	15 kV Tower Skelton, Type: 15-TD2D
DL-66	15 kV Tower Skelton, Type: 15-TL1
DL-67	15 kV Pole Skelton, Type: 15-PA1
DL-68	15 kV Pole Skelton, Type: 15-PB1
DL-69	15 kV Pole Skelton, Type: 15-PD1
DL-71	15 kV Tower Foundation, Type: 15-TA1
DL-72	15 kV Tower Foundation, Type: 15-TB1
DL-73	15 kV Tower Foundation, Type: 15-TD1
DL-74	15 kV Tower Foundation, Type: 15-TD1D
DL-75	15 kV Tower Foundation, Type: 15-TD2D
DL-76	15 kV Tower Foundation, Type: 15-TL1

Substation Facilities

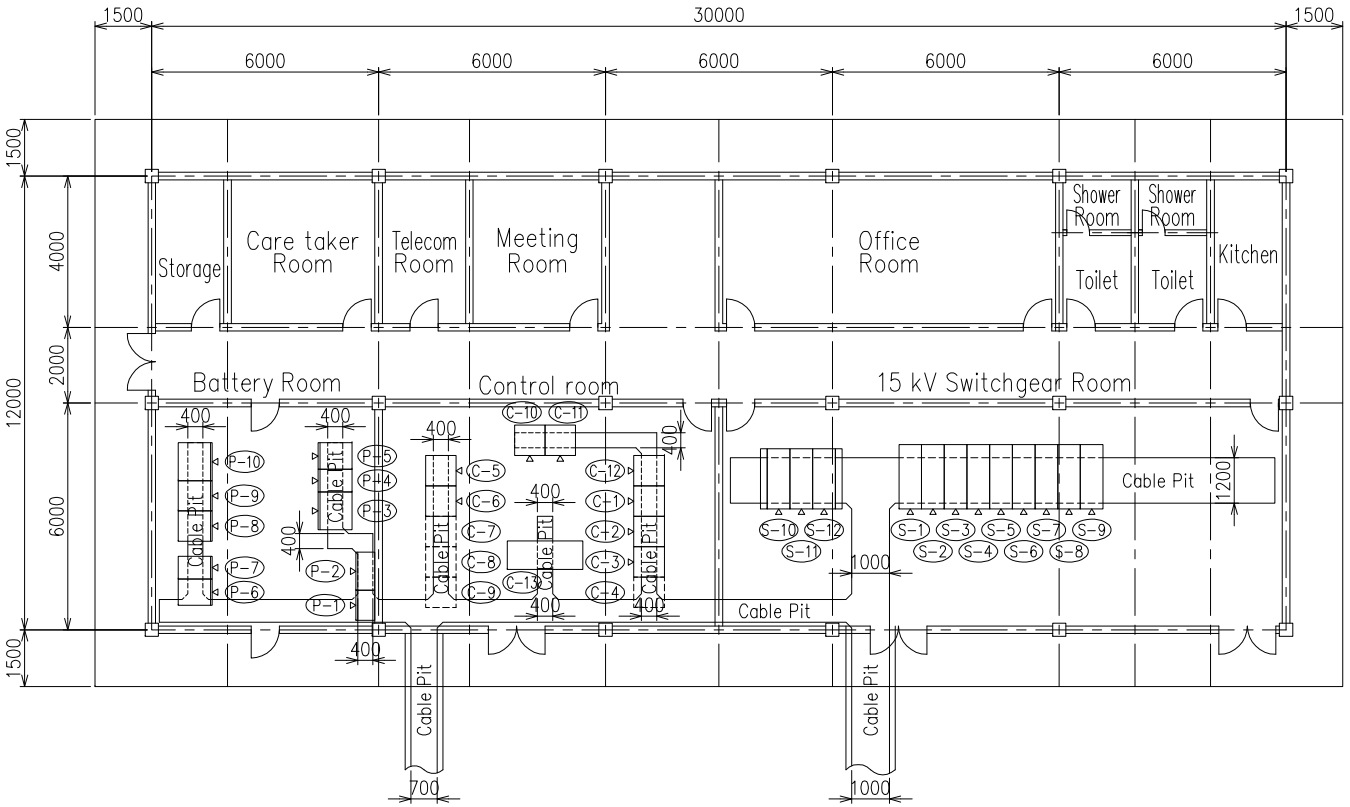


Dwg. No. SS-01: New Gasogi Substation Single line Diagram



14-00-00

Dwg. No. SS-02: New Gasogi Substation Arrangement Drawing (Plan) of 110 kV Switchyard



Battery Room

No.	Panel	Note
P-1	DC Distribution panel	
P-2	AC Distribution panel	
P-3	UPS (Inverter)	
P-4	UPS (Battery Charger)	
P-5	UPS (Battery)	
P-6	48 V DC Battery Charger	
P-7	48 V DC Battery panel	
P-8	110 V DC No.2 Battery Charger panel	
P-9	110 V DC No.1 Battery Charger panel	
P-10	110 V DC Battery panel	

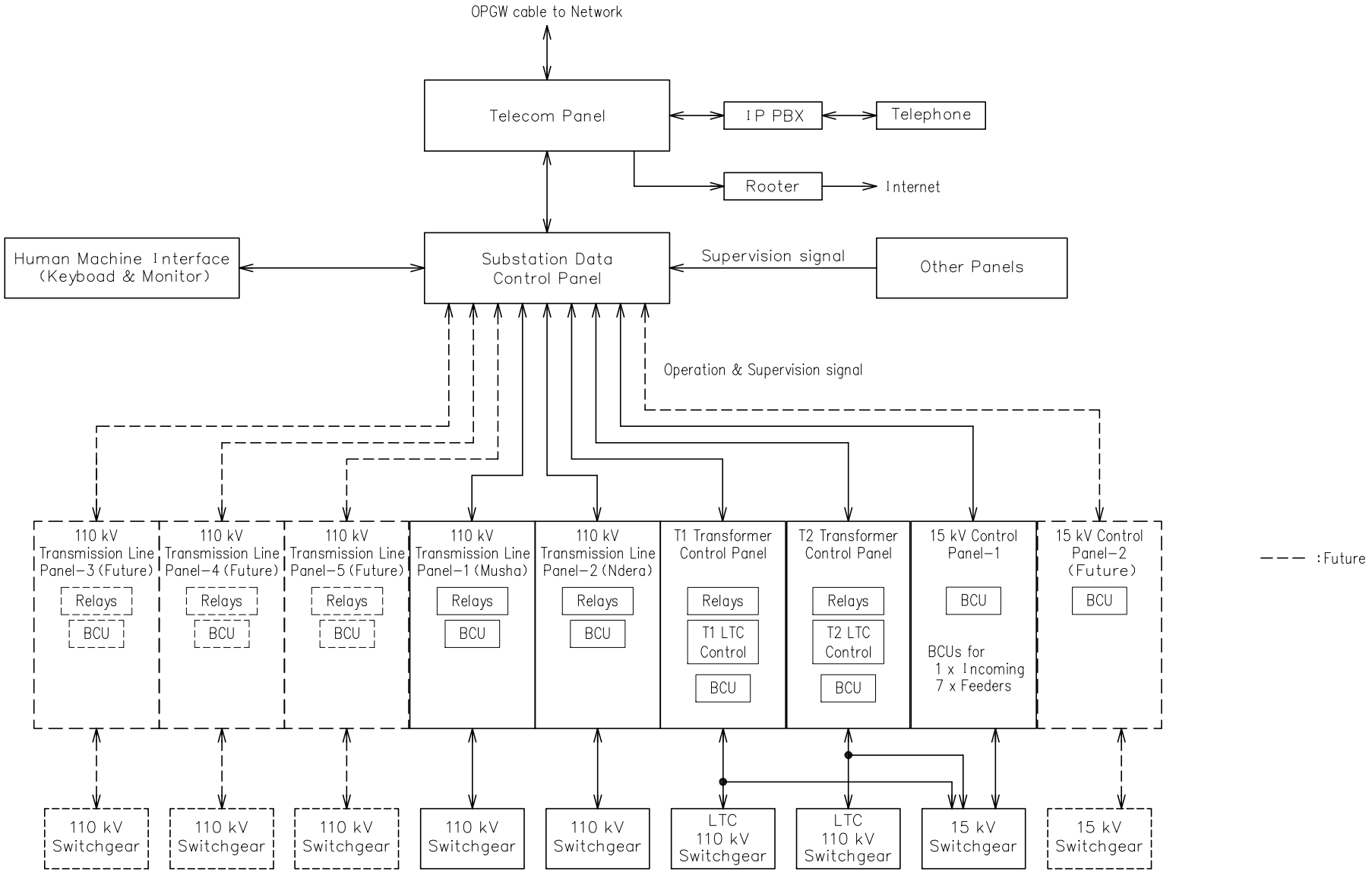
Control Room

No.	Panel	Note
C-1	Substation Control Panel 1	
C-2	Substation Control Panel 2	
C-3	15 kV Control Panel 1	
C-4	15 kV Control Panel 2	(Future)
C-5	110 kV Transmission Line panel 1	To Ndera
C-6	110 kV Transmission Line panel 2	To Musha
C-7	110 kV Transmission Line panel 3	(Future)
C-8	110 kV Transmission Line panel 4	(Future)
C-9	110 kV Transmission Line panel 5	(Future)
C-10	T1 Transformer Control Panel	
C-11	T2 Transformer Control Panel	
C-12	Telecom Panel	
C-13	Desk for SCADA	

15 kV Switchgear Room

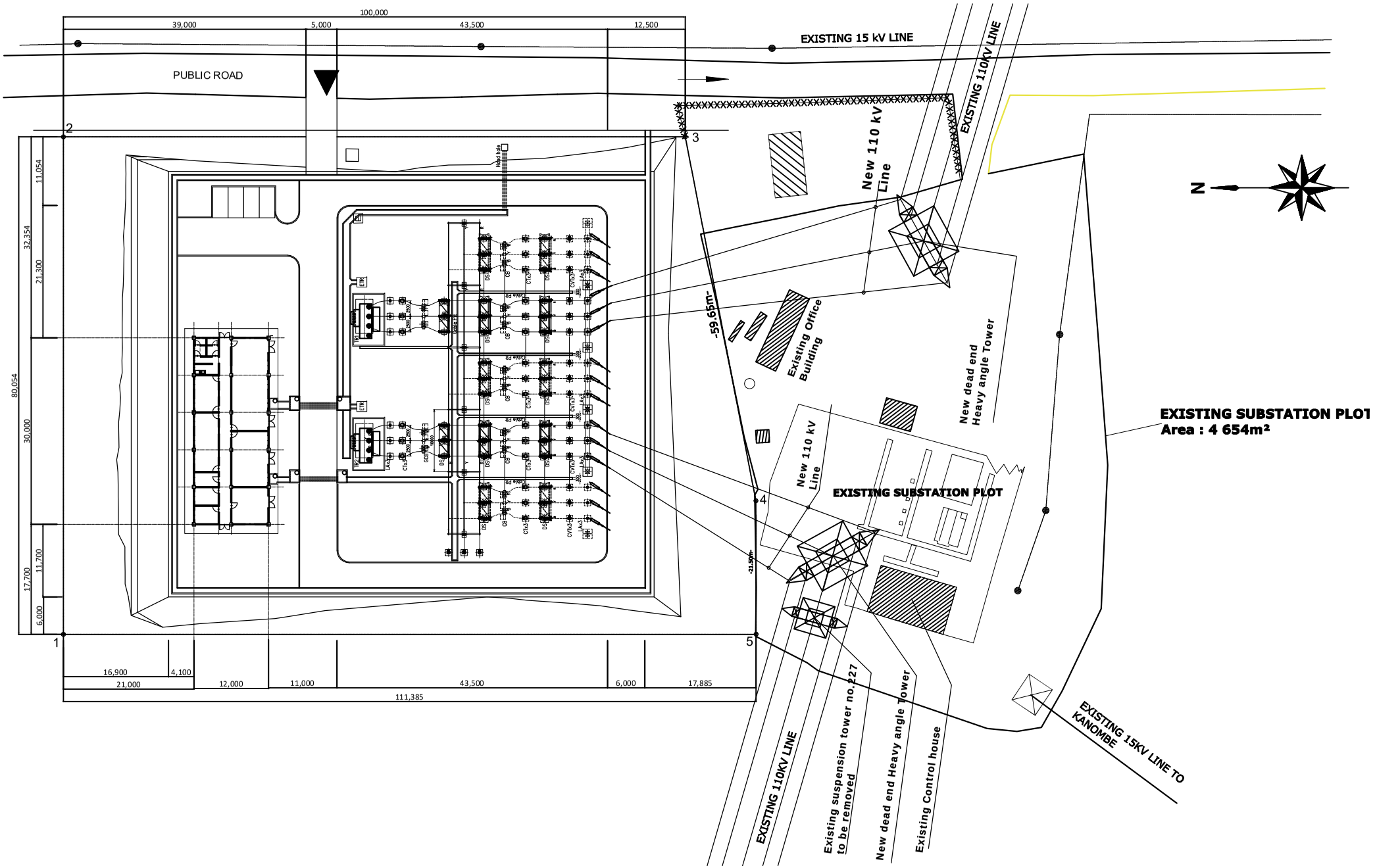
No.	Panel	Note
S-1	T1 Transformer	
S-2	Bus Connection (to S-10)	
S-3	Busbar VT	
S-4	Kanombe (existing)	
S-5	Inyange (existing)	
S-6	Rutunga (existing)	
S-7	Nyagasambu (JICA Phase 3)	
S-8	Spare Feeder	
S-9	T2 Transformer	
S-10	Bus Connection (to S-2)	Existing
S-11	Kabuga (JICA Phase 2)	Existing
S-12	Masaka (JICA Phase 3)	Existing

Dwg. No. SS-03: New Gasogi Substation Layout Plan of Central Control Room



Dwg. No. SS-04: New Gasogi Substation Control System Diagram

Architect Facilities



Dwg. No. A-01: New Gasogi Substation Building Site Layout

GENERAL

BUILDING AREA	
TOTAL FLOOR AREA	360 m2
STRUCTURE	REINFORCED CONCRETE

EXTERIOR FINISHING SCHEDULE

LOCATION	SPECIFICATION
ROOF	CONCRETE STEEL TROWEL ON PROTECTION CONCRETE WITH WELDED WIRE MESH ASPHALT MEMBRANE WATER PROOFING
DRAIN	ROOF DRAIN : CASTIRON ϕ 100mm DOWNSPOUT : PVC PIPE ϕ 100mm
WALL	PAINT FINISH (A.E.P) ON 150mm THK. CONCRETE BLOCK WITH MORTAR STEEL TROWEL 25mm THK.
COLUMN	FINISH (A.E.P) ON MORTAR STEEL TOROWEL 25mm THK.
BEAM	FINISH (A.E.P) ON MORTAR STEEL TOROWEL 25mm THK.
TERRACE	CONCRETE STEEL TROWEL

INTERIOR FINISHING SCHEDULE

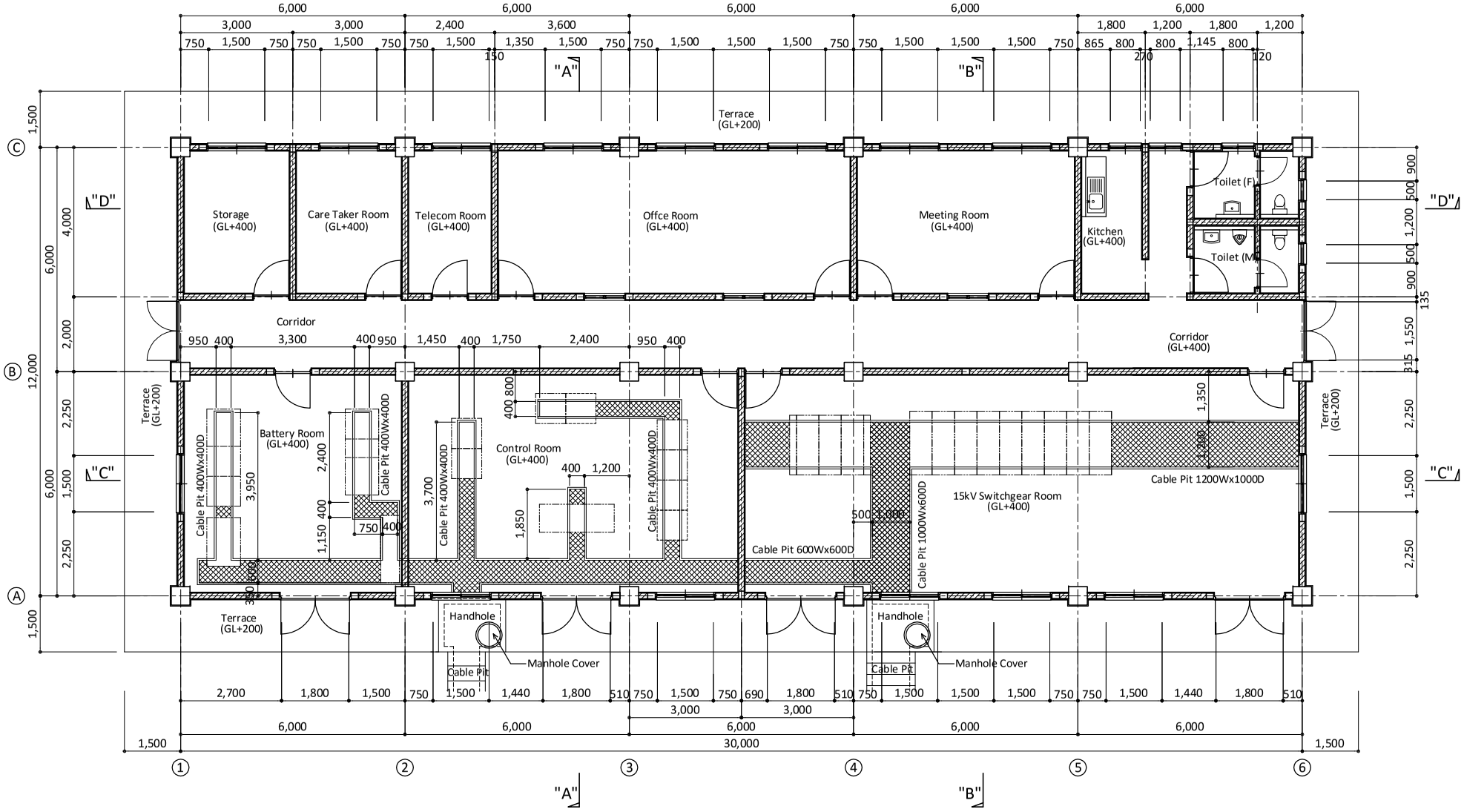
ROOM NAME	FLOOR	BASEBOARD	WALL	CEILING	REMARKS
SWITCHGEAR ROOM	CERAMIC TILE 300 X 300 ON MORTAR BED FINISH THK. 50mm	CERAMIC TILE H=100 ON MORTAR BED FINISH THK. 30mm	PAINT FINISH(A.E.P) MORTAR STEEL TROWEL 20mm THK. ON 150mm THICKNESS CONCRETE BLOCK	PAINT FINISH (A.E.P) EXPOSED CONCRETE	FIRE EXTINGUISHER 1 SET, ROOM NAME PLATE, EXHAUST FAN
CONTROL ROOM	DITTO	DITTO	DITTO	DITTO	AIR CONDITIONING, NAME PLATE FIRE EXTINGUISHER 1 SET
BATTERY ROOM	DITTO	DITTO	DITTO	DITTO	FIRE EXTINGUISHER 1 SET, ROOM NAME PLATE
CARE TAKER ROOM	DITTO	DITTO	DITTO	DITTO	ROOM NAME PLATE
TELECOM ROOM	DITTO	DITTO	DITTO	DITTO	AIR CONDITIONING, ROOM NAME PLATE FIRE EXTINGUISHER 1 SET
OFFICE ROOM	DITTO	DITTO	DITTO	DITTO	ROOM NAME PLATE
MEETING ROOM	DITTO	DITTO	DITTO	COSMETIC GYPSAM BOARD 9.5mm THK. WITH ALUMINUM SUSPENDED FRAME	ROOM NAME PLATE
KITCHEN ROOM	DITTO	DITTO	DITTO	DITTO	EXHAUST FAN WITH HOOD, FIRE EXTINGUISHER 1 SET SINK 1 SET, ROOM NAME PLATE
TOILET (MEN & FEMEN)	DITTO	——	CERAMIC TILE 300 X 300 ON MORTAR BED FINISH THK. 30mm ON CONCRETE BLOCK	DITTO	EXHAUST FAN WITH HOOD, MIRROR TOILET PAPER HOLDER, WASH BASIN URINAL, ROOM NAME PLATE
STRAGE	DITTO	PAINT FINISH(A.E.P) EXPOSED CONCRETE H=100	PAINT FINISH(A.E.P) MORTAR STEEL TROWEL 20mm THK. ON 100 or 150mm THHK. CONCRETE BLOCK	PAINT FINISH (A.E.P) EXPOSED CONCRETE	ROOM NAME PLATE
CORRIDOR	DITTO	DITTO	DITTO	COSMETIC GYPSAM BOARD 9.5mm THK. WITH ALUMINUM SUSPENDED FRAME	FIRE EXTINGUISHER 2 SETS

NOTES

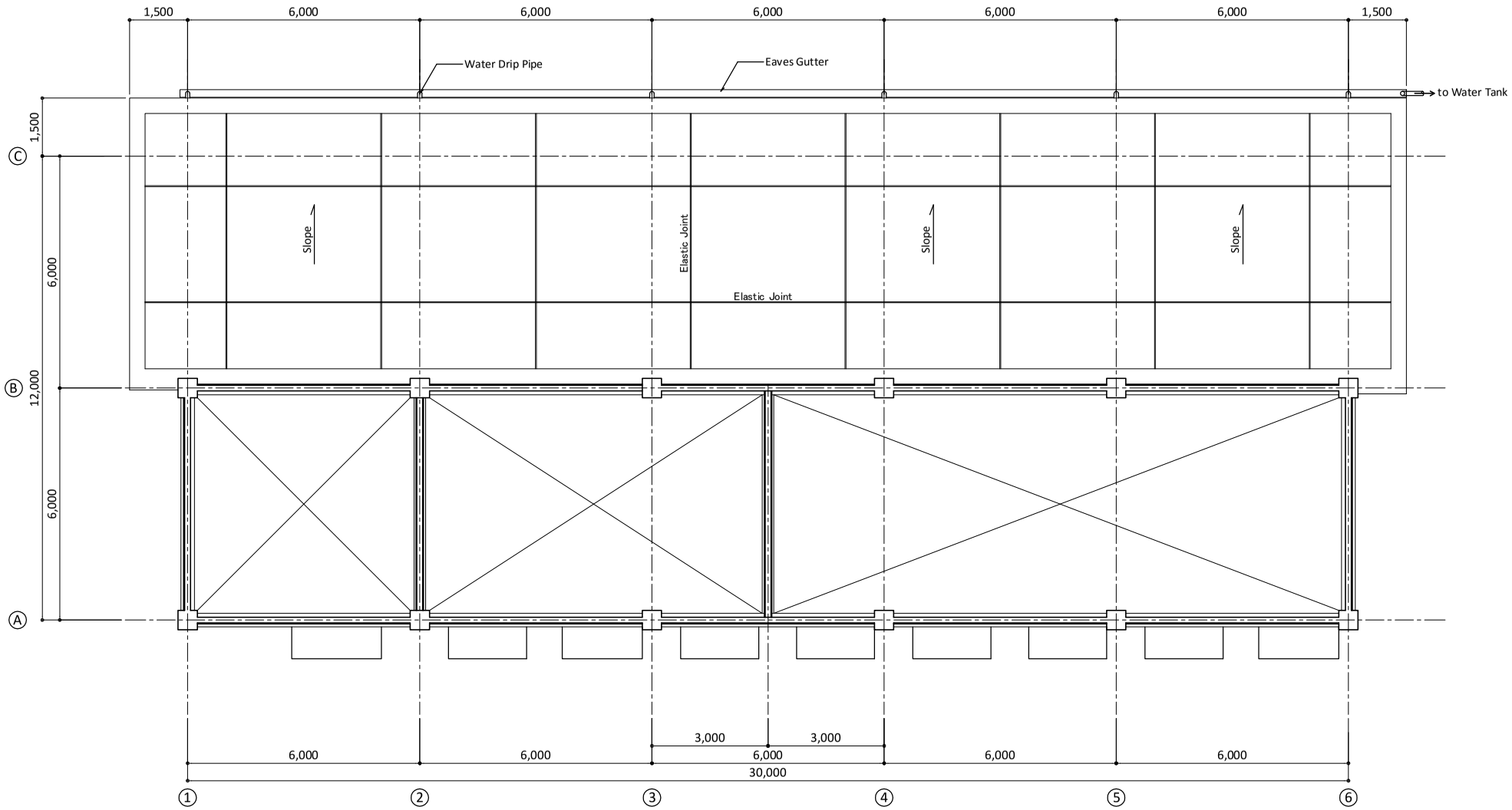
THK. : THCKNESS

ROOM NAME PLATE : MATERIAL SHALL PLASTIC PLATE 5.0mm THK.

Dwg. No. A-02: New Gasogi Substation Building Finishing Schedule



Dwg. No. A-03: New Gasogi Substation Building Ground Floor Plan

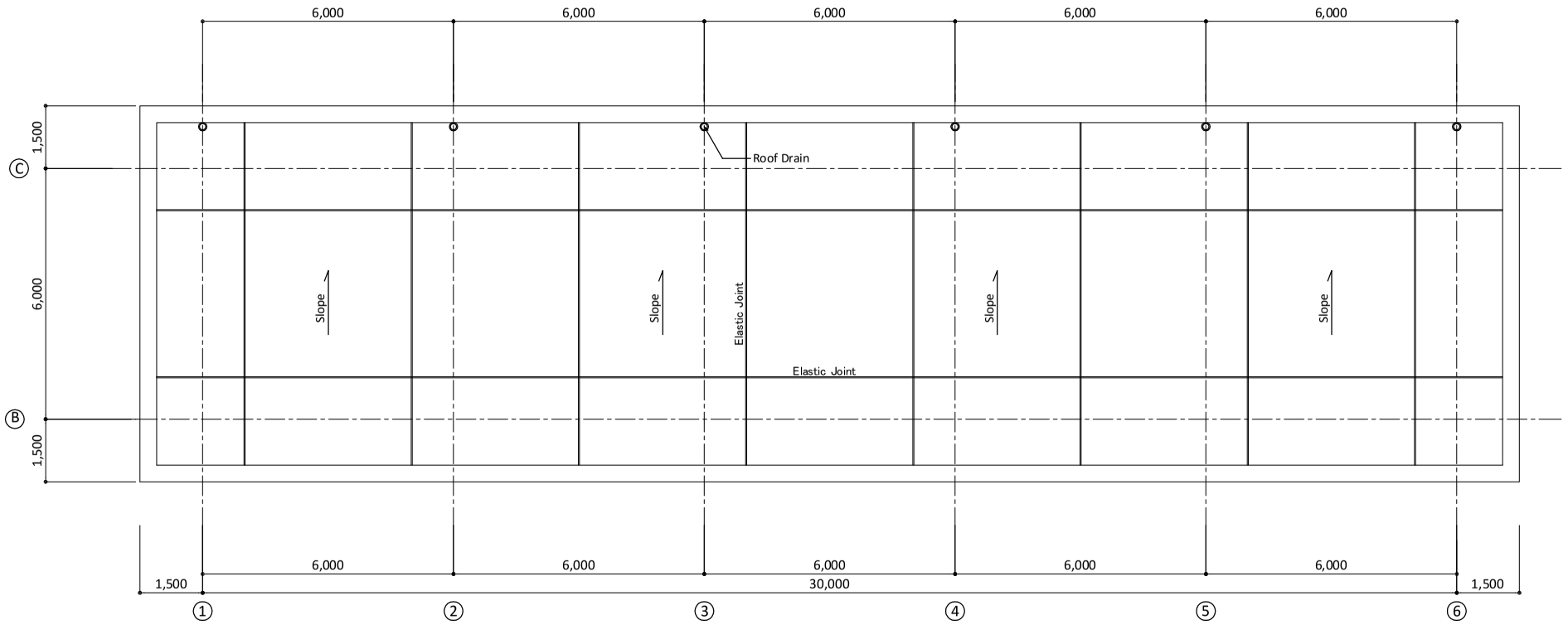


REMARK

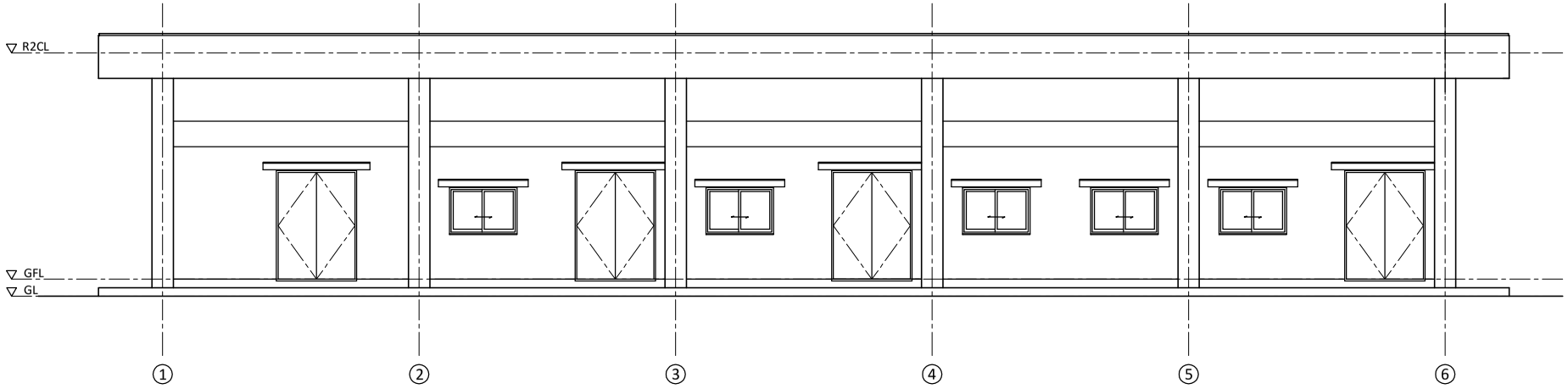
: Concrete Block

: Concrete

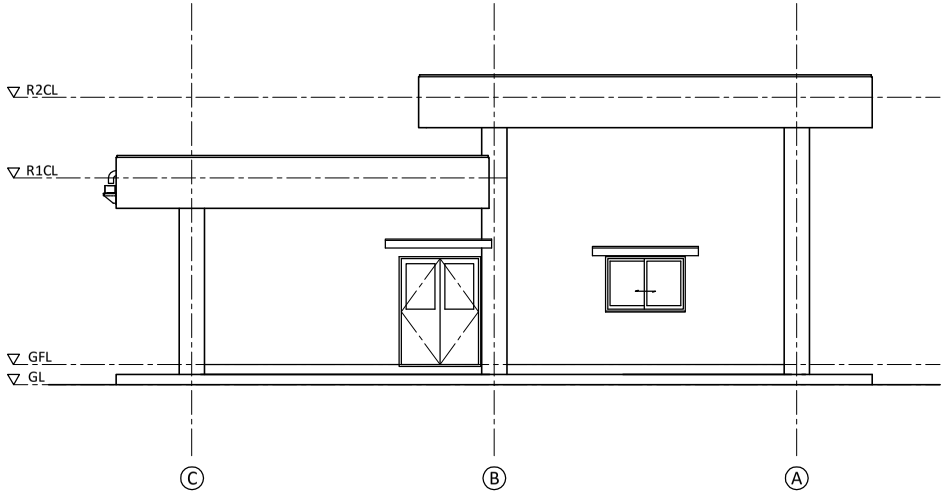
Dwg. No. A-04: New Gasogi Substation Building Roof Plan 1



Dwg. No. A-05: New Gasogi Substation Building Roof Plan 2

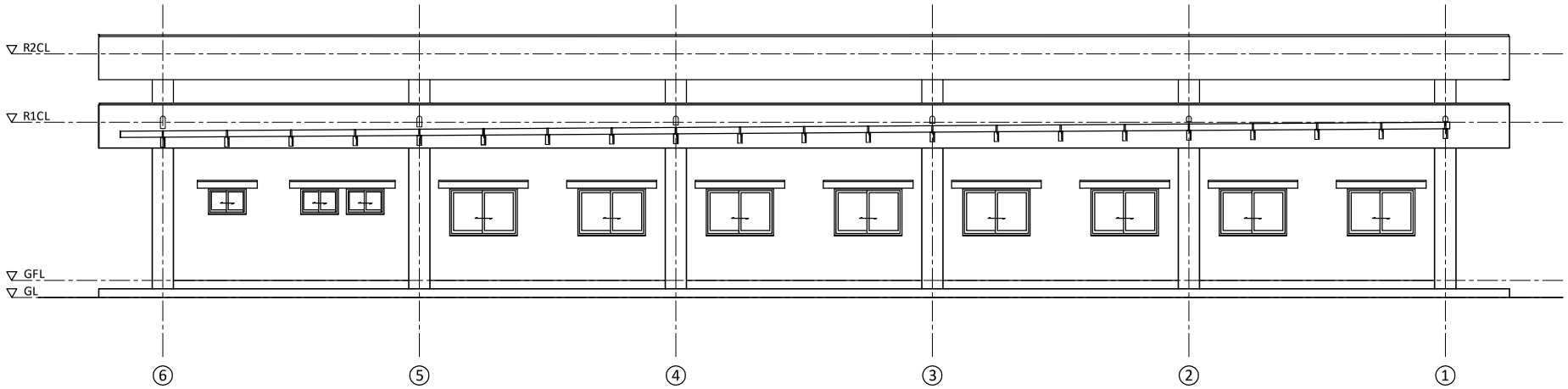


SOUTH ELEVATION

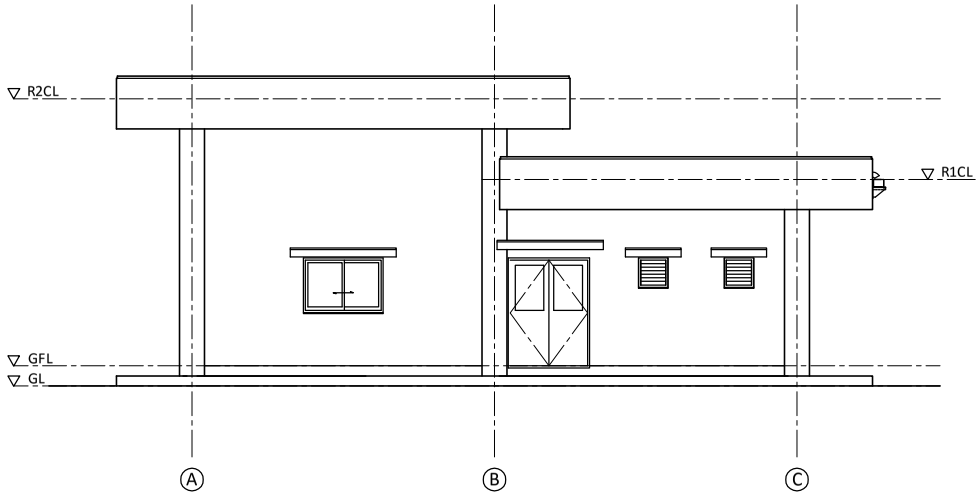


WEST ELEVATION

Dwg. No. A-06: New Gasogi Substation Building Elevation 1

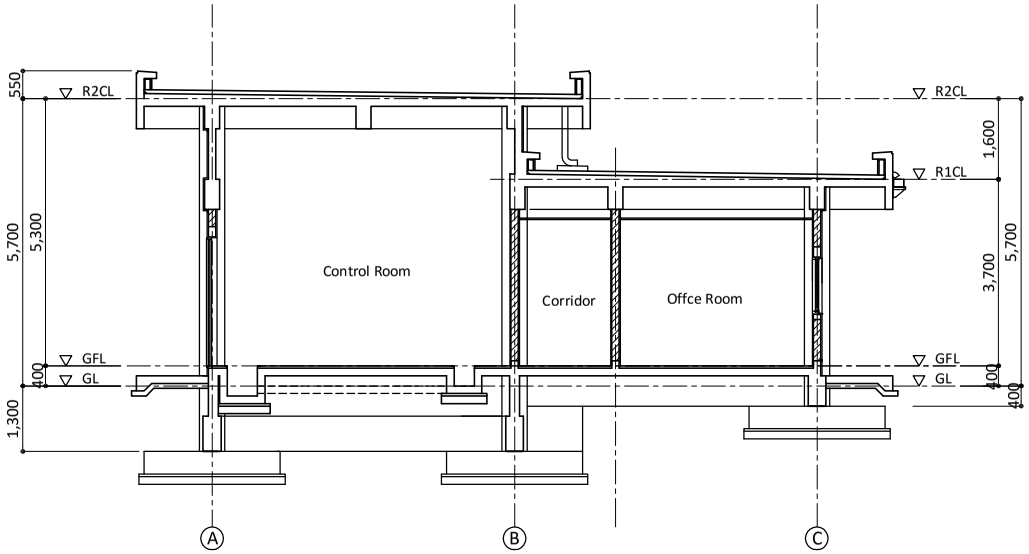


NORTH ELEVATION

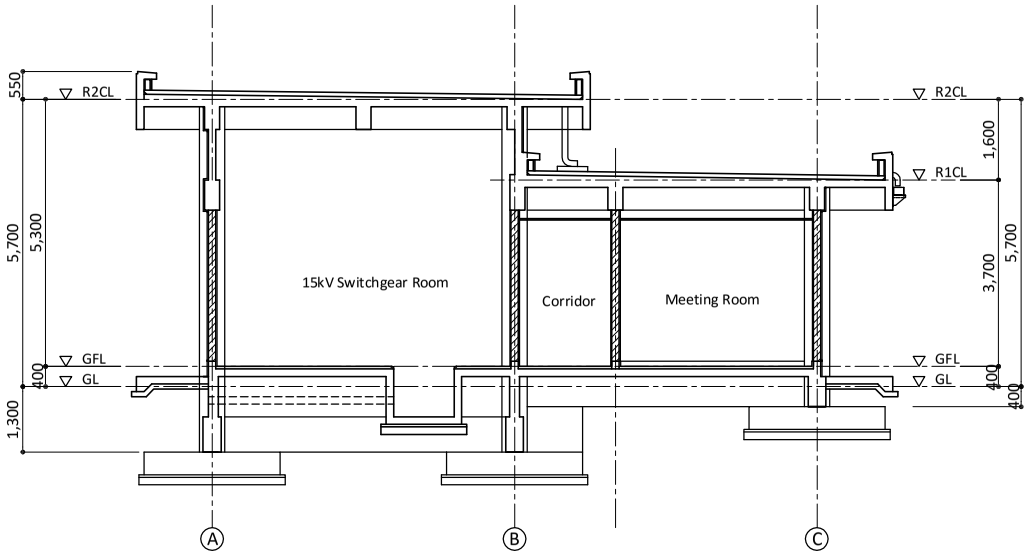


EAST ELEVATION

Dwg. No. A-07: New Gasogi Substation Building Elevation 2

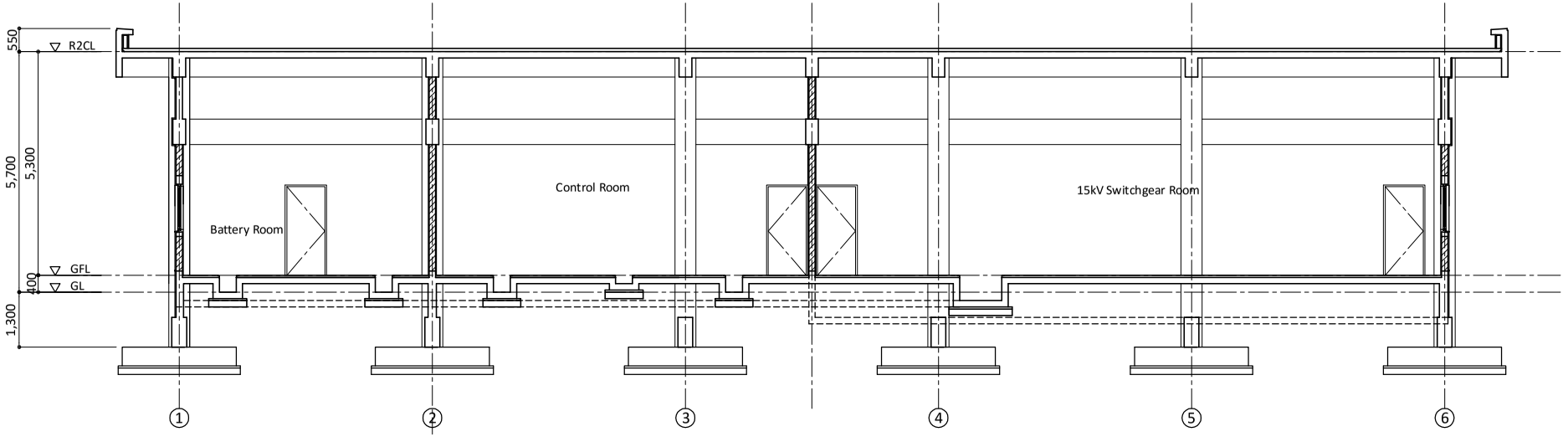


SECTION "A" - "A"

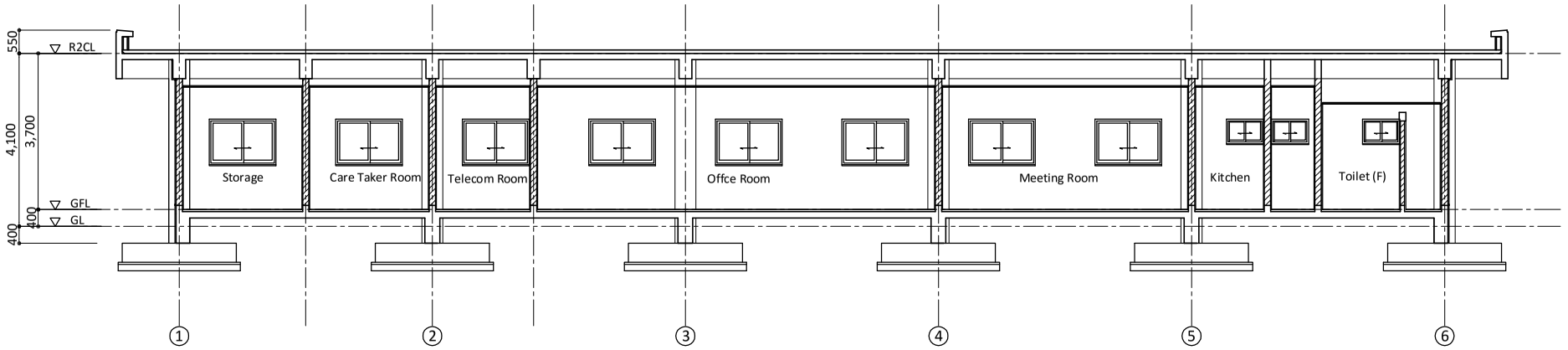


REMARK

Dwg. No. A-08: New Gasogi Substation Building Section 1

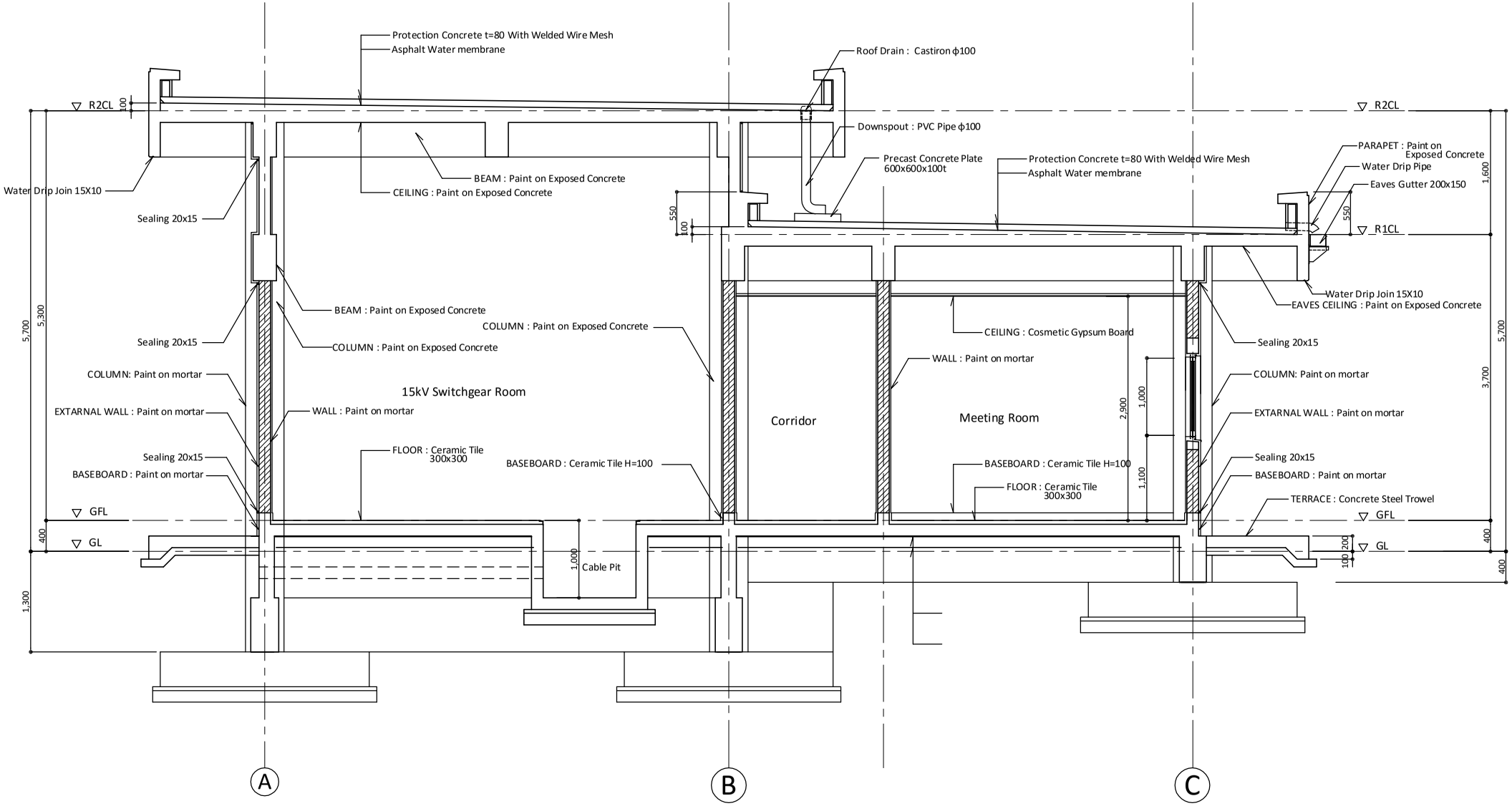


SECTION "C" - "C"

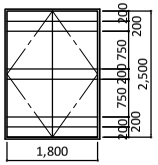
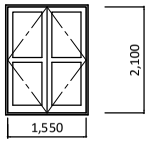
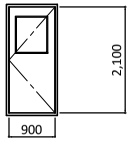
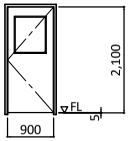
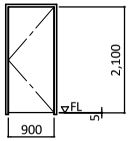
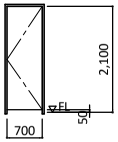
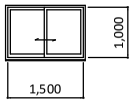
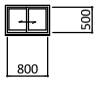
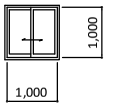


SECTION "D" - "D"

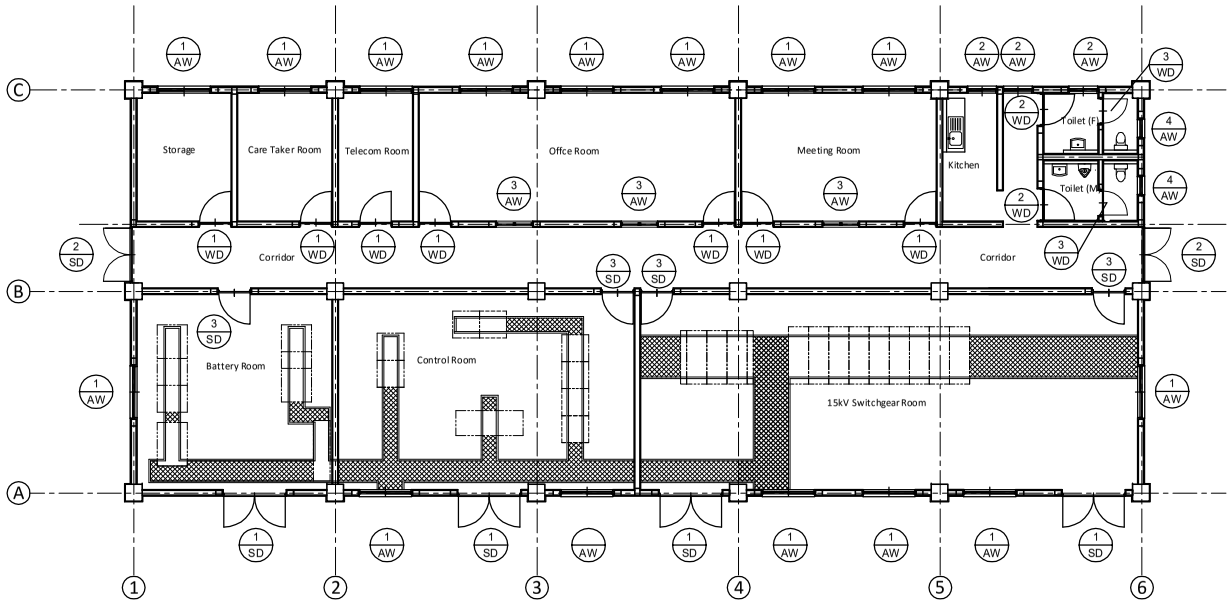
Dwg. No. A-09: New Gasogi Substation Building Section 2



Dwg. No. A-10: New Gasogi Substation Building Section Detail

SYMBOL & Qty.	1 SD X 4	2 SD X 2	3 SD X 4	1 WD X 7	2 WD X 2	3 WD X 2	1 AW X 15	2 AW X 3	3 AW X 3
ELEVATION									
TYPE	DOUBLE SWING DOOR	DOUBLE SWING DOOR	SINGLE SWING DOOR	SINGLE SWING DOOR	SINGLE SWING DOOR	SINGLE SWING DOOR	SLIDING WINDOW	SLIDING WINDOW	SLIDING WINDOW
MATERIAL & FINISH	STEEL PAINT(OP)	STEEL PAINT(OP)	STEEL PAINT(OP)	WOODEN FLASH DOOR (OP)	WOODEN FLASH DOOR (OP)	WOODEN FLASH DOOR (OP)	ALUMINUM ·ELECTRO COLOR	ALUMINUM ·ELECTRO COLOR	ALUMINUM ·ELECTRO COLOR
GLASS		CLEAR GLASS t=5	CLEAR GLASS t=5				CLEAR GLASS t=5	CLEAR GLASS t=5	CLEAR GLASS t=5
HARDWEAR	HINGE, LEVER HANDLE, STOPPER DOOR CLOSER, CYLINDER LOCK	HINGE, LEVER HANDLE, STOPPER DOOR CLOSER, CYLINDER LOCK	HINGE, LEVER HANDLE, STOPPER DOOR CLOSER, CYLINDER LOCK	HINGE, LEVER HANDLE, DOOR CLOSER	HINGE, LEVER HANDLE, DOOR CLOSER	HINGE, LEVER HANDLE, DOOR CLOSER	CRESCENT LOCKL ANTI MOSQUITO NET WINDOW	CRESCENT LOCKL ANTI MOSQUITO NET WINDOW	CRESCENT LOCK ANTI MOSQUITO NET WINDOW
REMARK									

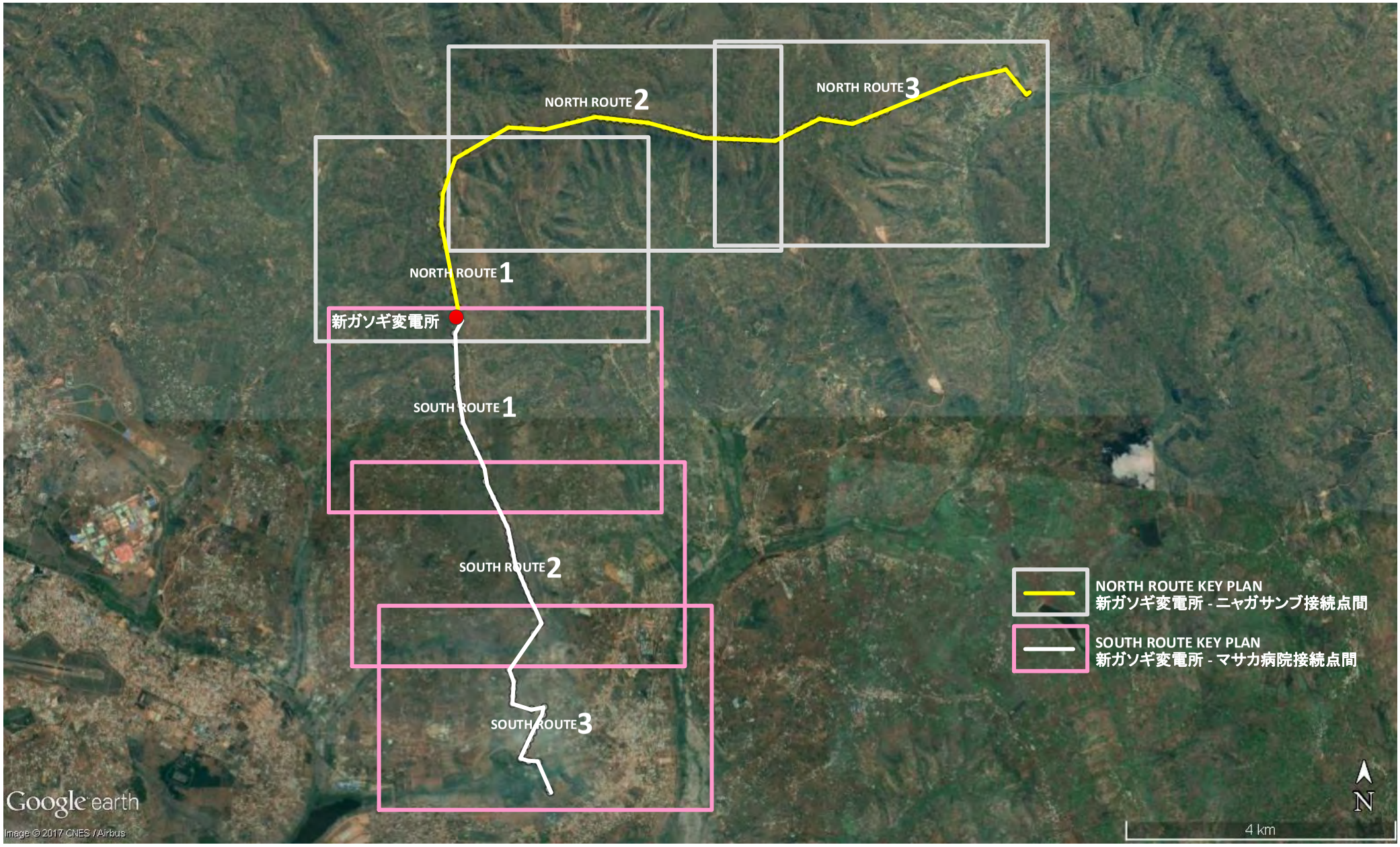
SYMBOL & Qty.	4 AW X 2
ELEVATION	
TYPE	JALOSIE WINDOW
MATERIAL & FINISH	ALUMINUM ·ELECTRO COLOR
GLASS	CLEAR GLASS t=5
HARDWEAR	ANTI MOSQUITO NET WINDOW
REMARK	



FITTING KEY-PLAN

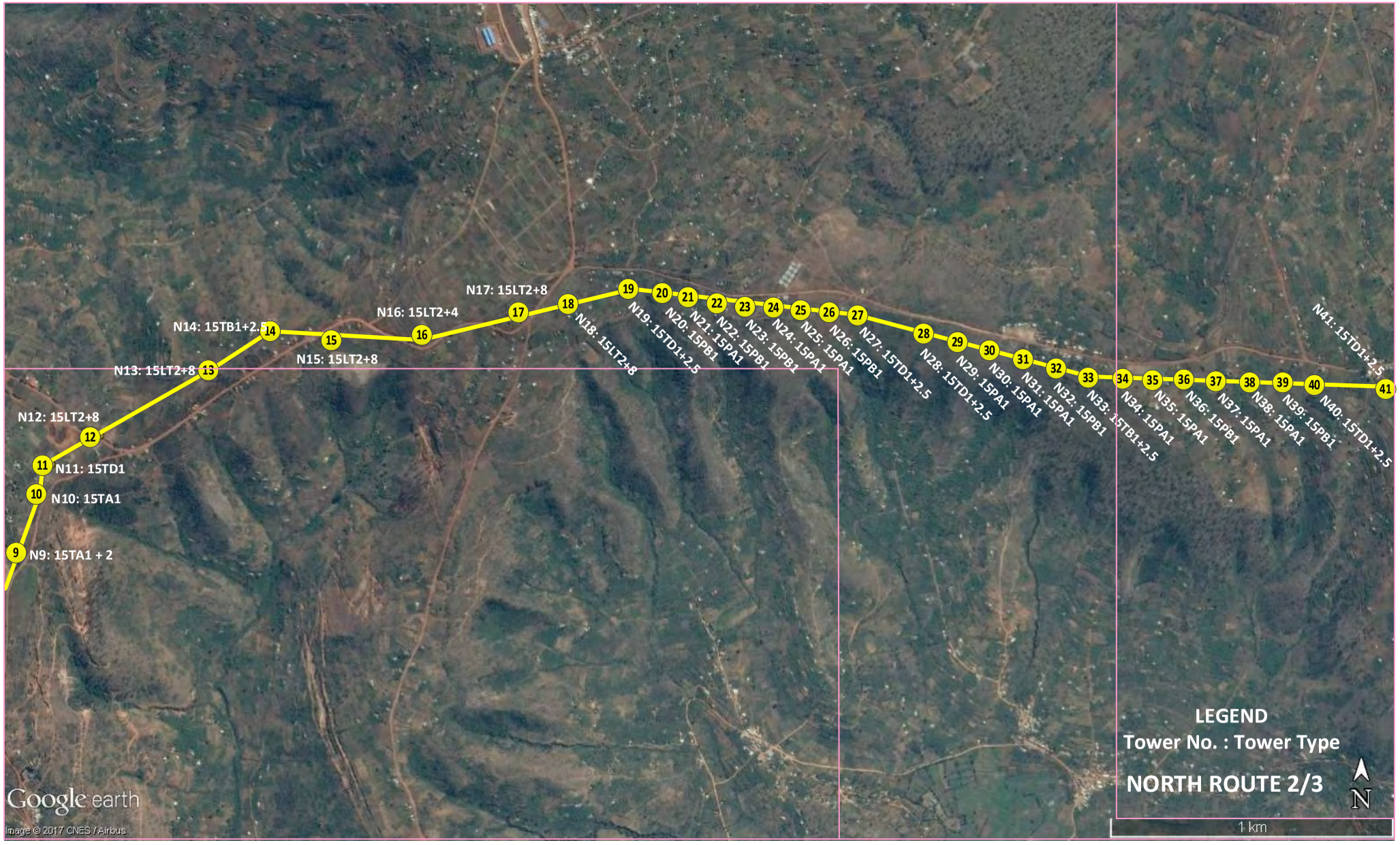
Dwg. No. A-11: New Gasogi Substation Building Fitting Schedule

Transmission and Distribution Line Facilities

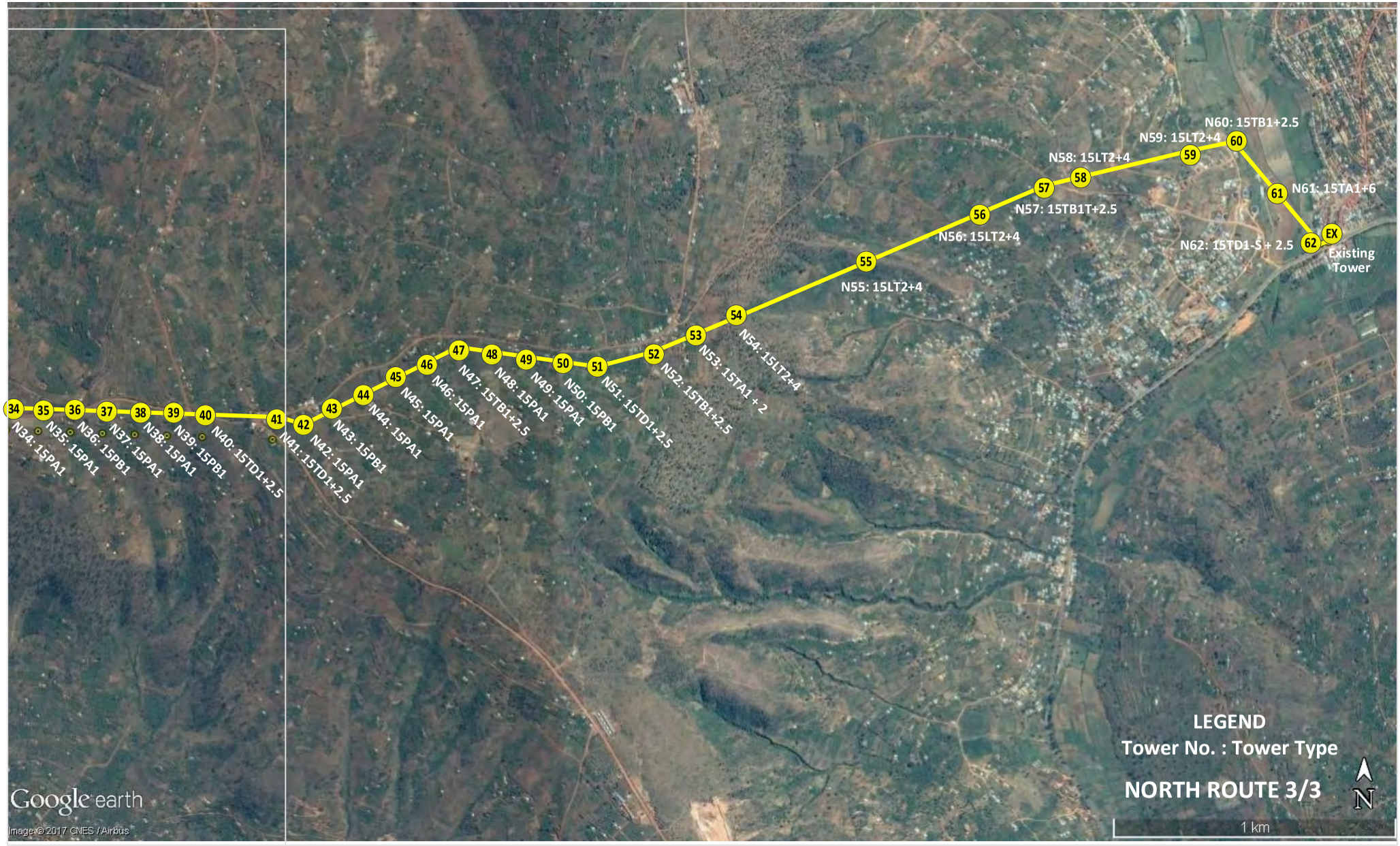


Dwg. No. DR-01: 15 kV Transmission Line Route KEY PLAN

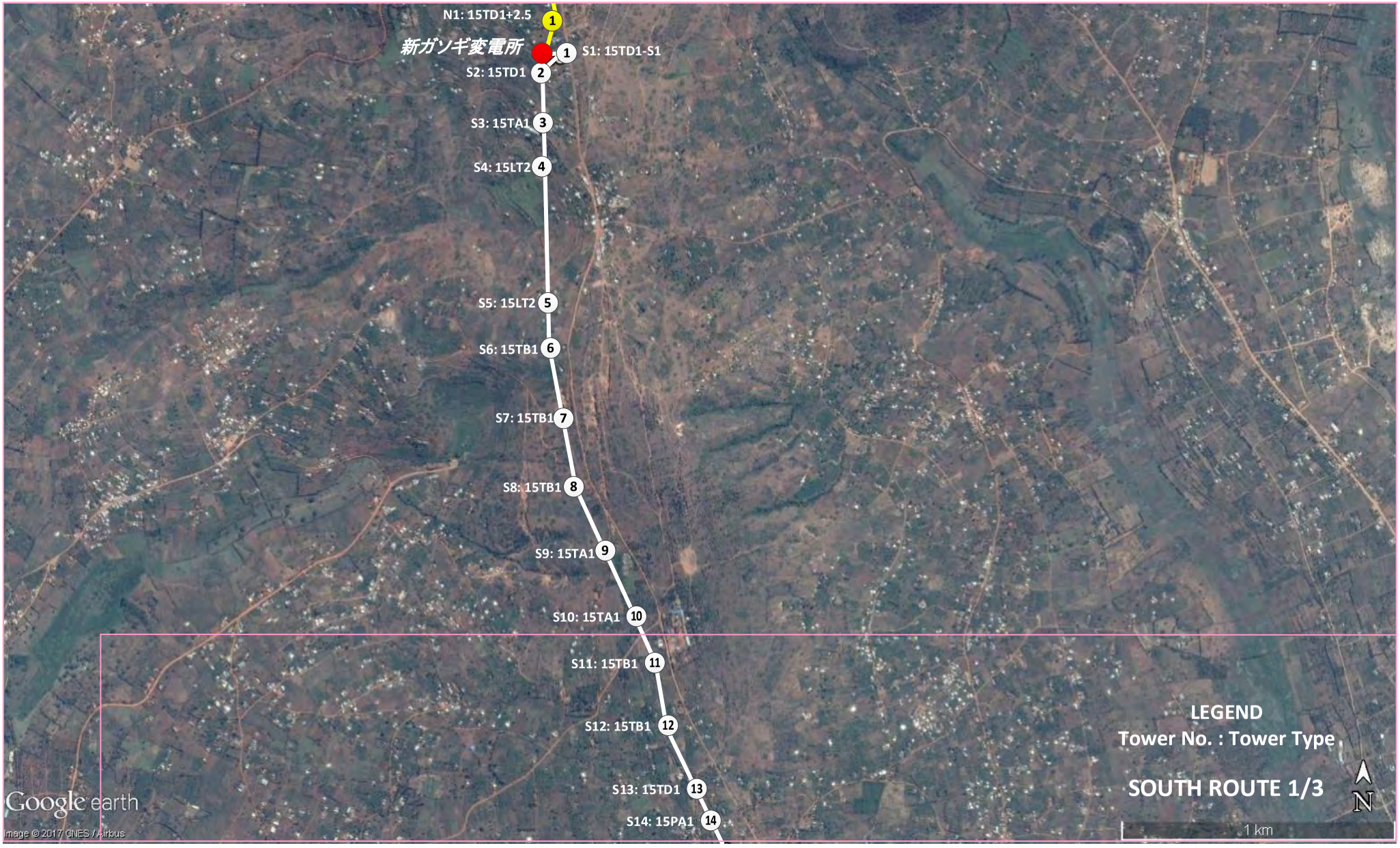
Dwg. No. DR-02: 15 kV Transmission Line Route
(New Gasogi Substation – Nyagasambu: Approx. 11.5 km) 1/3



Dwg. No. DR-02: 15 kV Transmission Line Route
(New Gasogi Substation – Nyagasambu: Approx. 11.5 km) 2/3



Dwg. No. DR-02: 15 kV Transmission Line Route
(New Gasogi Substation – Nyagasambu: Approx. 11.5 km) 3/3

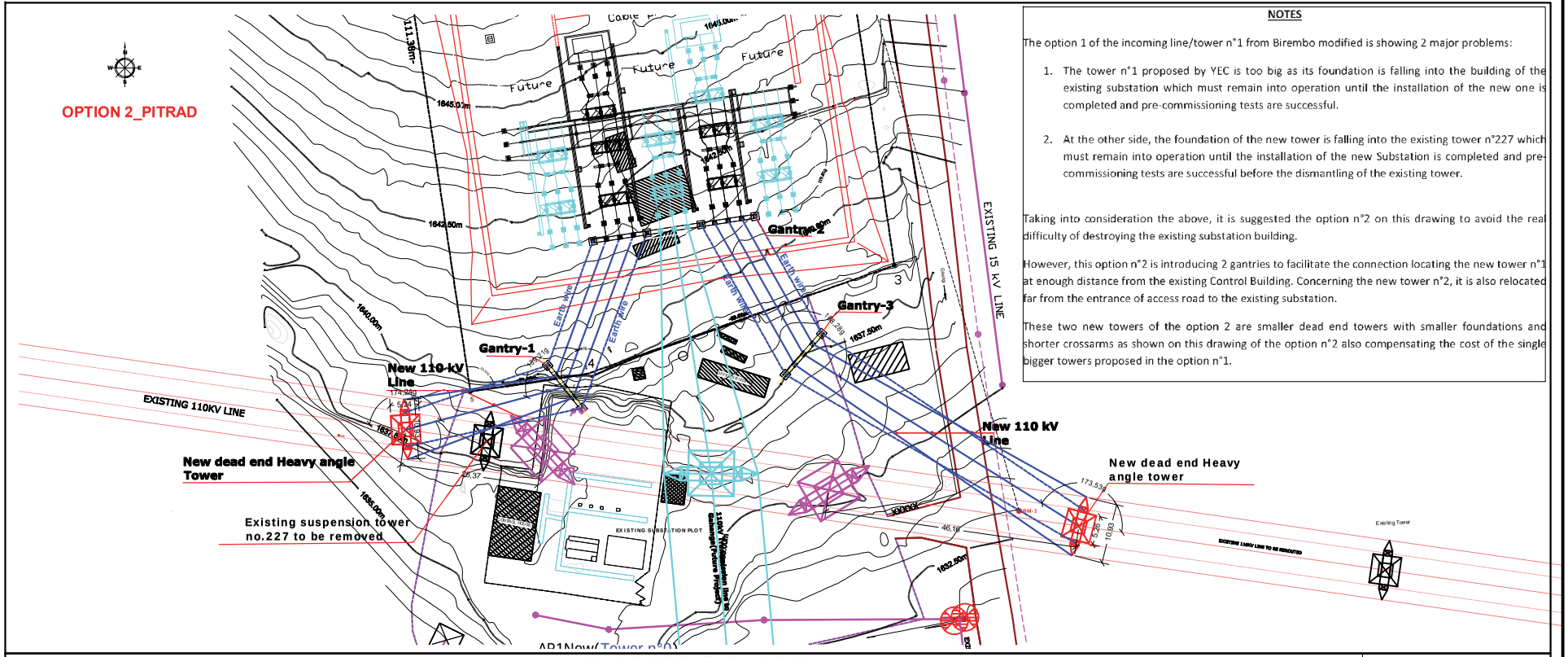


Dwg. No. DR-03: 15 kV Transmission Line Route
(New Gasogi Substation – Masaka Hospital: Approx. 8.5 km) 1/3

Dwg. No. DR-03: 15 kV Transmission Line Route
(New Gasogi Substation – Masaka Hospital: Approx. 8.5 km) 2/3

Dwg. No. DR-03: 15 kV Transmission Line Route
(New Gasogi Substation – Masaka Hospital: Approx. 8.5 km) 3/3

PLAN VIEW OF OUTGOING LINES FROM NEW SUBSTATION
Scale 1 : 250



NOTES

The option 1 of the incoming line/tower n°1 from Birembo modified is showing 2 major problems:

1. The tower n°1 proposed by YEC is too big as its foundation is falling into the building of the existing substation which must remain into operation until the installation of the new one is completed and pre-commissioning tests are successful.

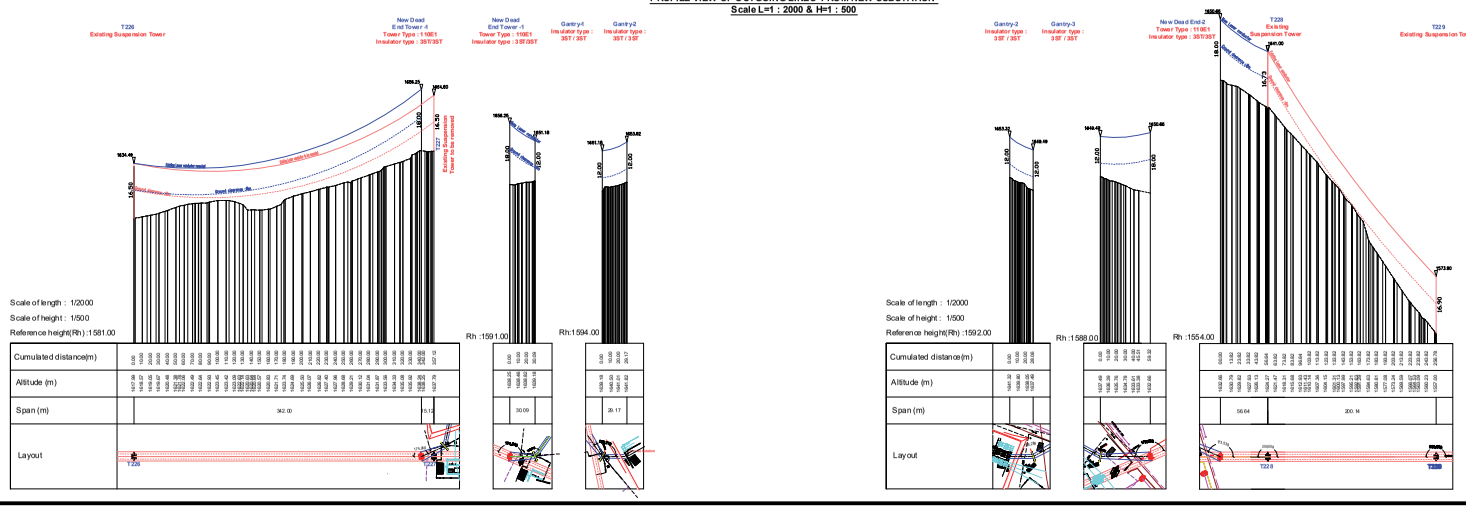
2. At the other side, the foundation of the new tower is falling into the existing tower n°227 which must remain into operation until the installation of the new Substation is completed and pre-commissioning tests are successful before the dismantling of the existing tower.

Taking into consideration the above, it is suggested the option n°2 on this drawing to avoid the real difficulty of destroying the existing substation building.

However, this option n°2 is introducing 2 gantries to facilitate the connection locating the new tower n°1 at enough distance from the existing Control Building. Concerning the new tower n°2, it is also relocated far from the entrance of access road to the existing substation.

These two new towers of the option 2 are smaller dead end towers with smaller foundations and shorter crossarms as shown on this drawing of the option n°2 also compensating the cost of the single bigger towers proposed in the option n°1.

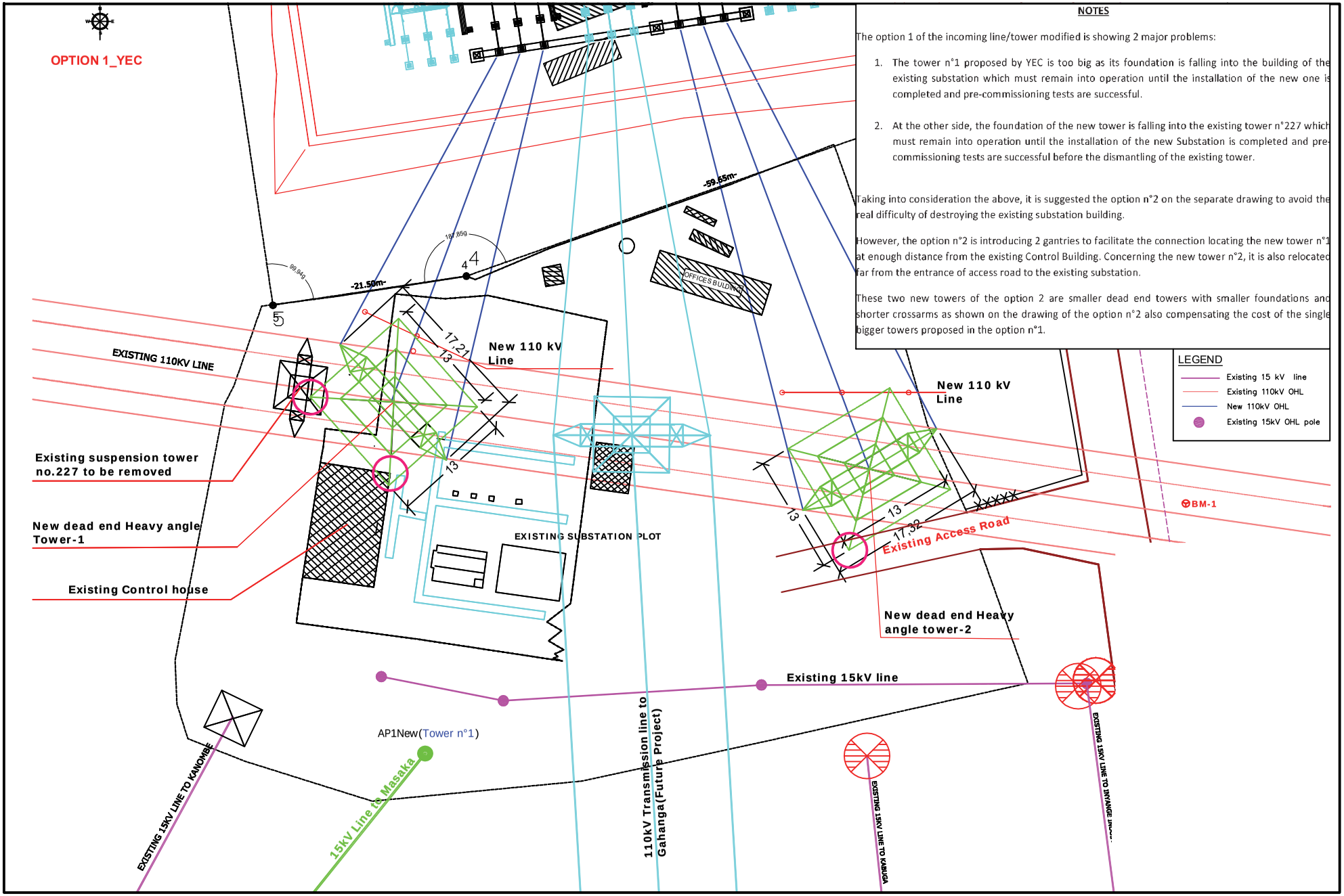
PROFILE VIEW OF OUTGOING LINES FROM NEW SUBSTATION
Scale L=1 : 2000 & H=1 : 500



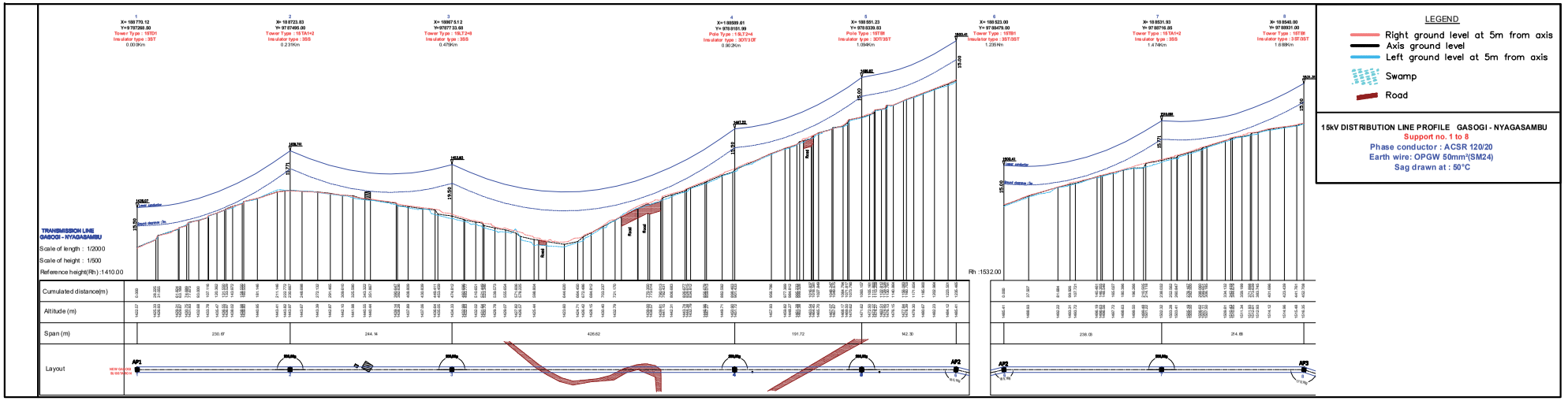
LEGEND

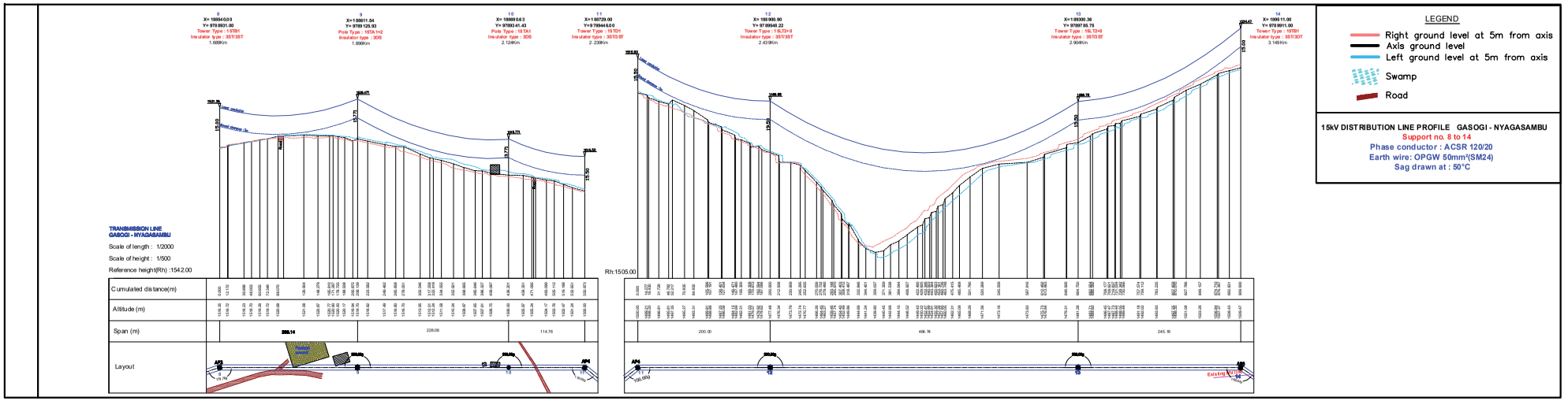
- Existing 15 kV line
- Existing 110kV OHL
- New 110kV OHL
- Existing 15kV OHL pole

Dwg. No. LP-01: 110 kV Transmission Line; Line Profile
(Existing Transmission Line – New Gasogi Substation)

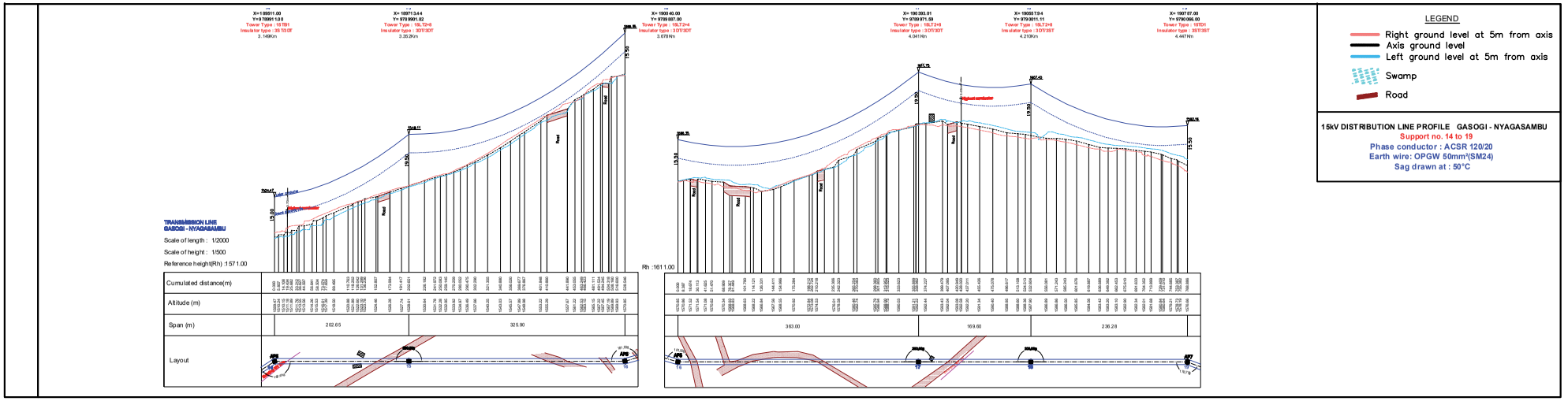


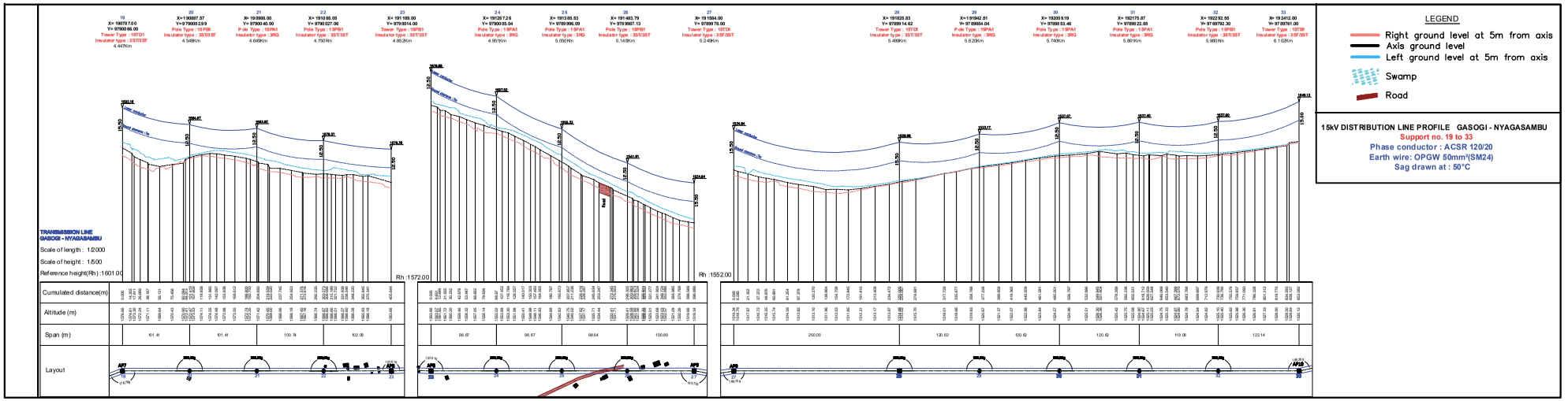
Dwg. No. LP-02: 110 kV Transmission Line; Line Profile
(Existing Transmission Line – New Gasogi Substation) (Close-up)



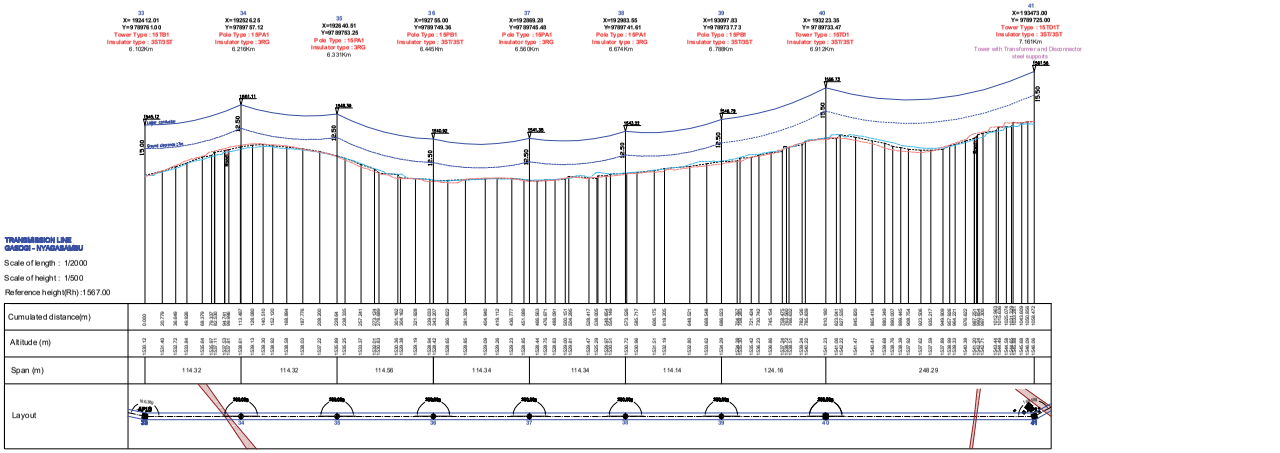


Dwg. No. LP-21: 15kVDistribution Line; Route-1, Line Profile (1/5)
(New Gasogi Substation – Nyagasambu)





Dwg. No. LP-22: 15kVDistribution Line; Route-1, Line Profile (2/5)
(New Gasogi Substation – Nyagasambu)



LEGEND

- Right ground level at 5m from axis
- Axis ground level
- Left ground level at 5m from axis
- Swamp
- Road

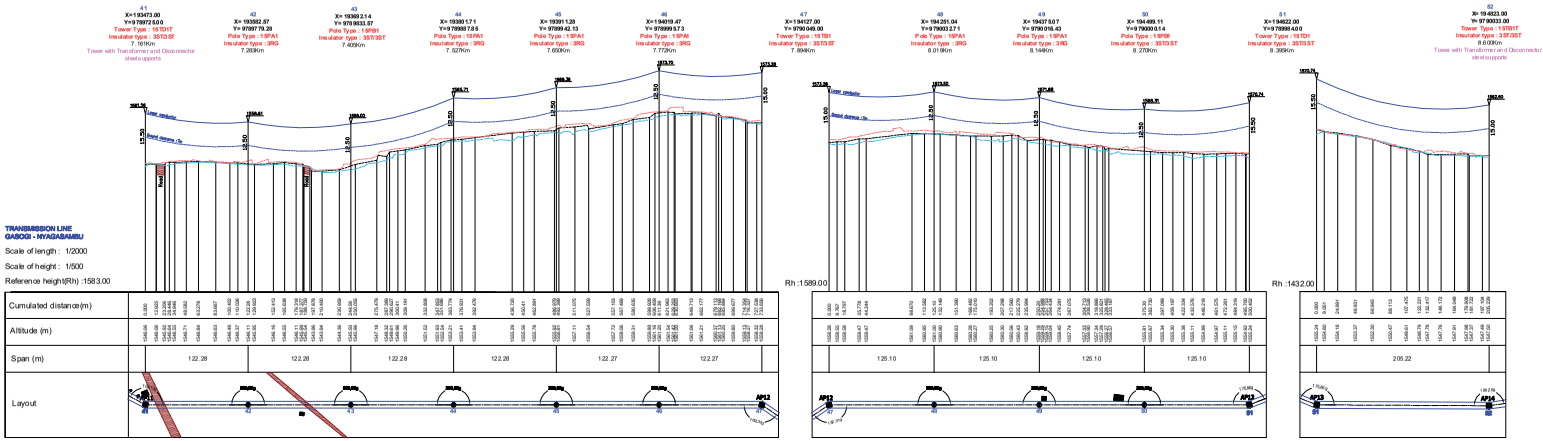
15kV DISTRIBUTION LINE PROFILE GASOGI - NYAGASAMBU

Support no. 33 to 41

Phase conductor : ACSR 120/20

Earth wire: OPGW 50mm²(SM24)

Sag drawn at : 50°C



LEGEND

- Right ground level at 5m from axis
- Axis ground level
- Left ground level at 5m from axis
- Swamp
- Road

15kV DISTRIBUTION LINE PROFILE GASOGI - NYAGASAMBU

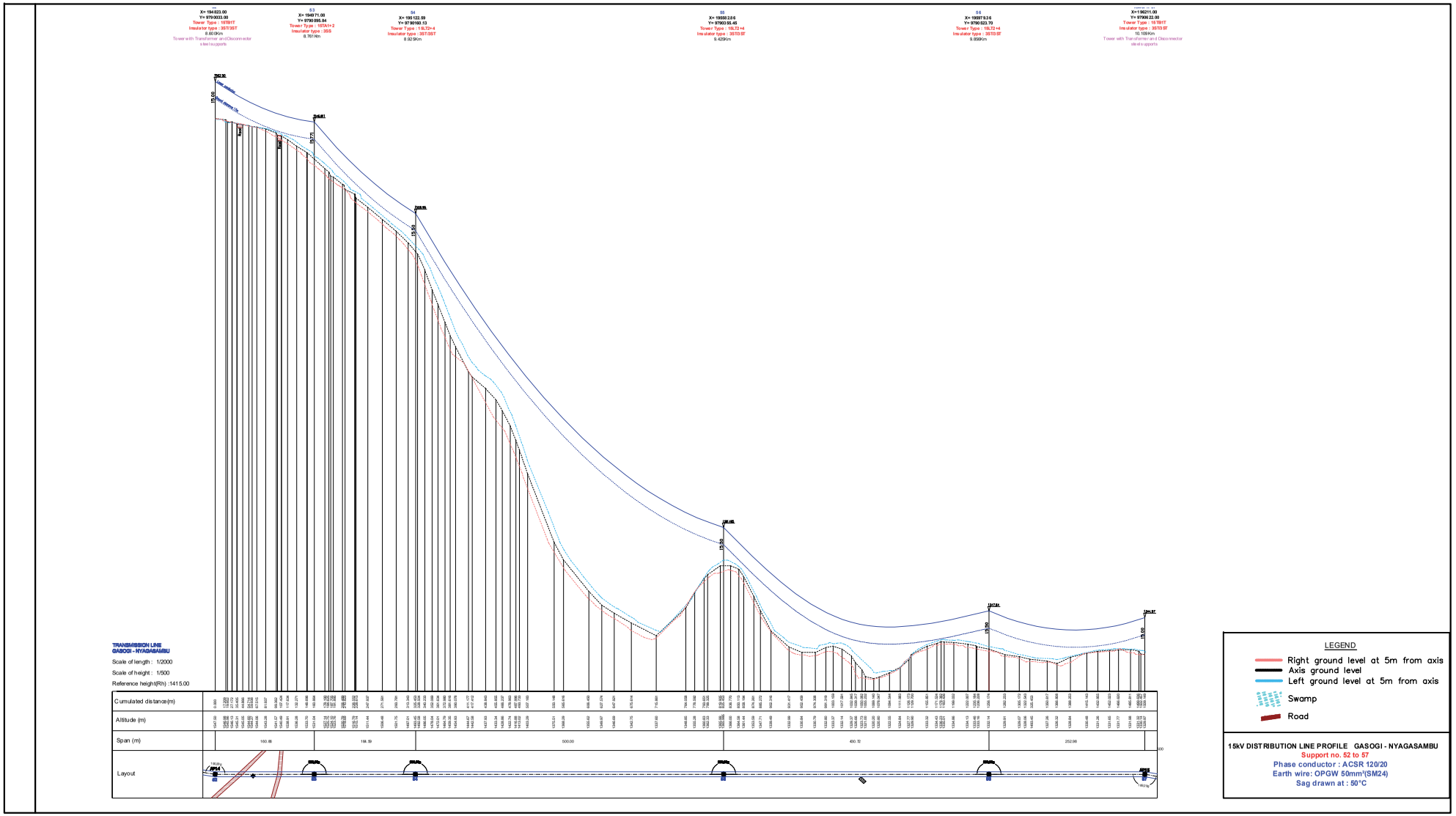
Support no. 41 to 52

Phase conductor : ACSR 120/20

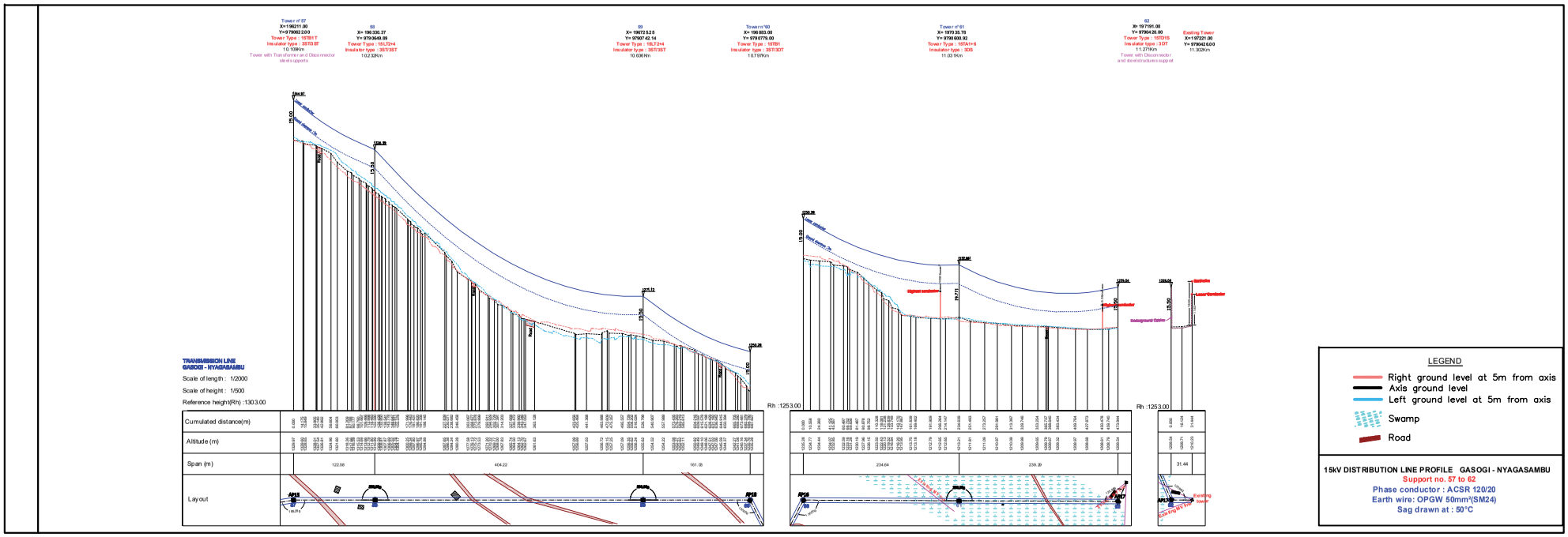
Earth wire: OPGW 50mm²(SM24)

Sag drawn at : 50°C

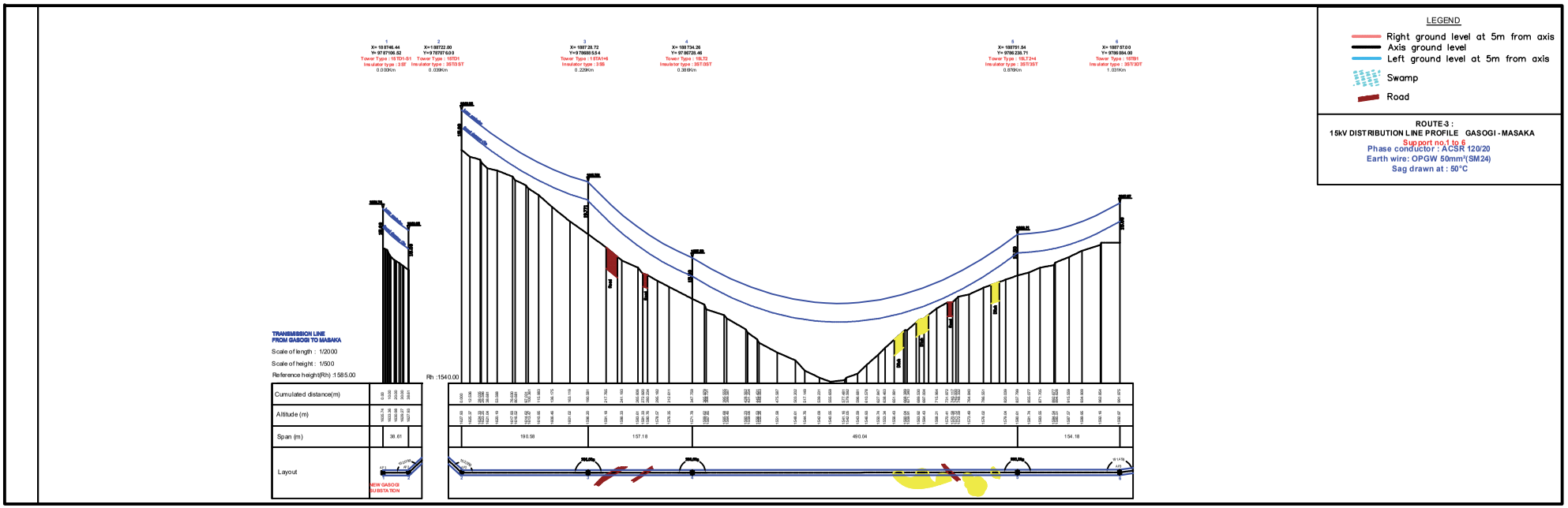
Dwg. No. LP-23: 15kVDistribution Line; Route-1, Line Profile (3/5)
(New Gasogi Substation - Nyagasambu)

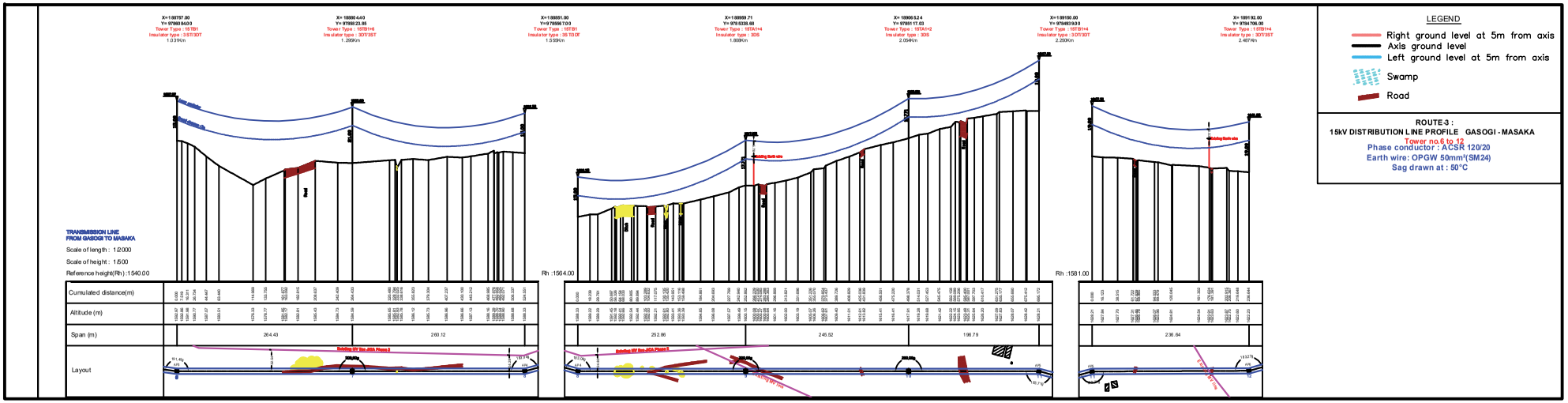


Dwg. No. LP-24: 15kVDistribution Line; Route-1, Line Profile (4/5)
(New Gasogi Substation – Nyagasambu)

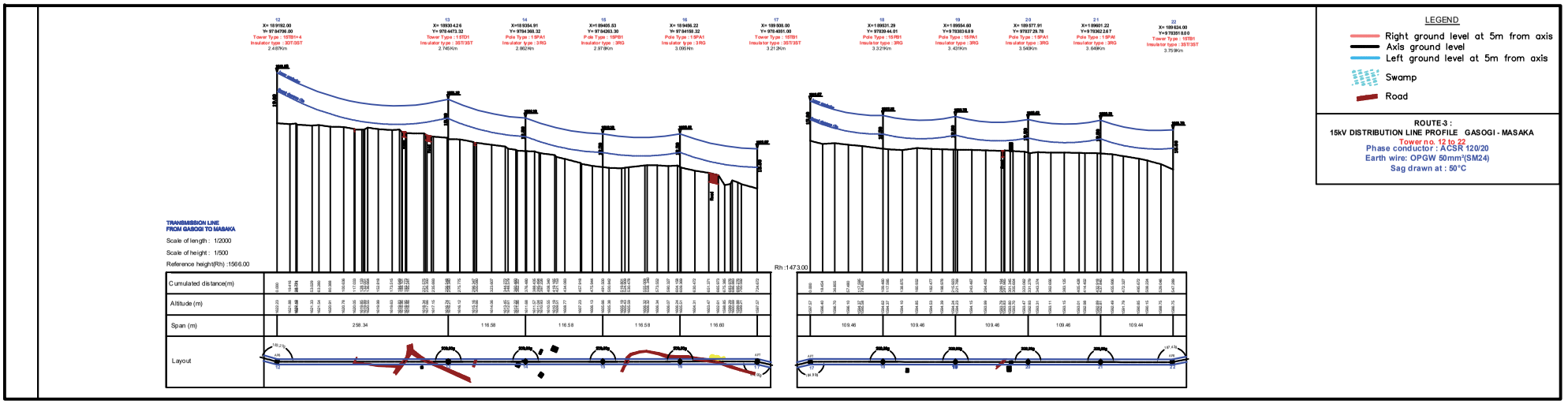


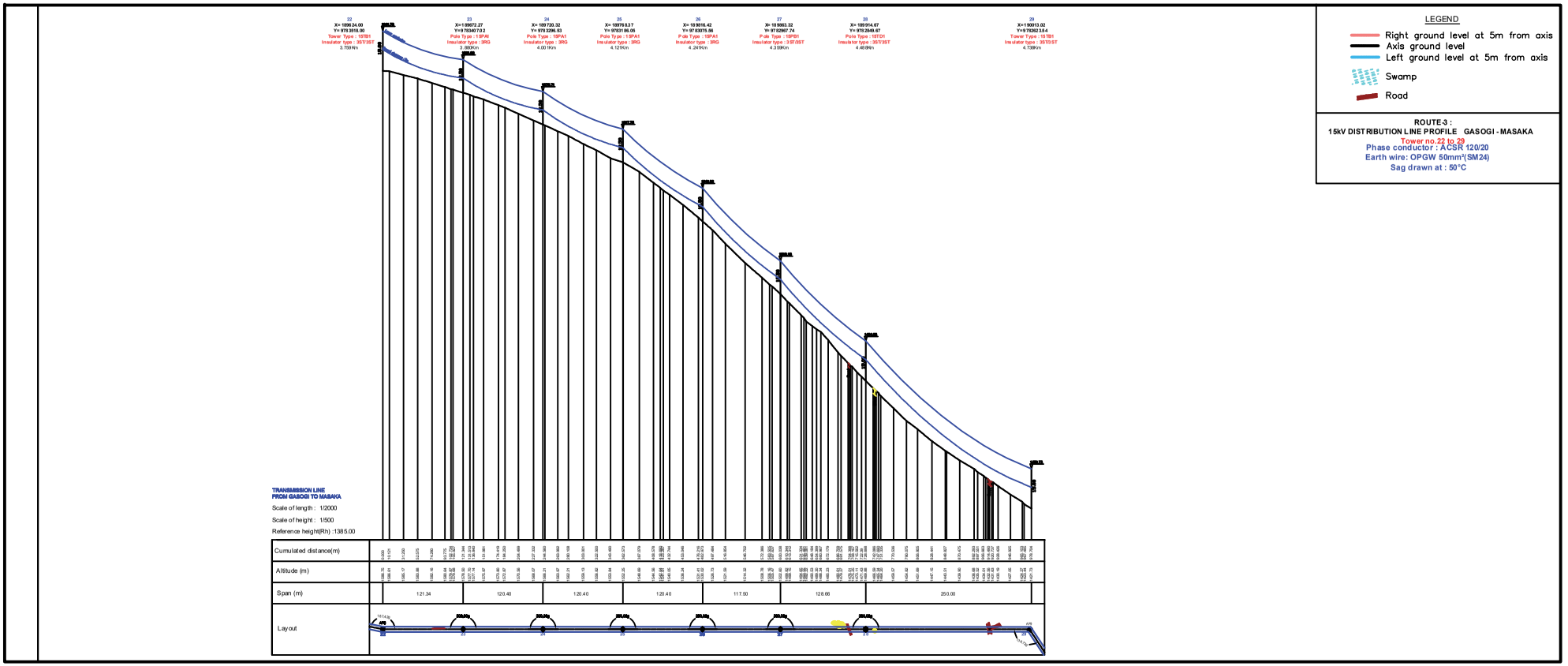
Dwg. No. LP-25: 15kVDistribution Line; Route-1, Line Profile (5/5)
(New Gasogi Substation – Nyagasambu)



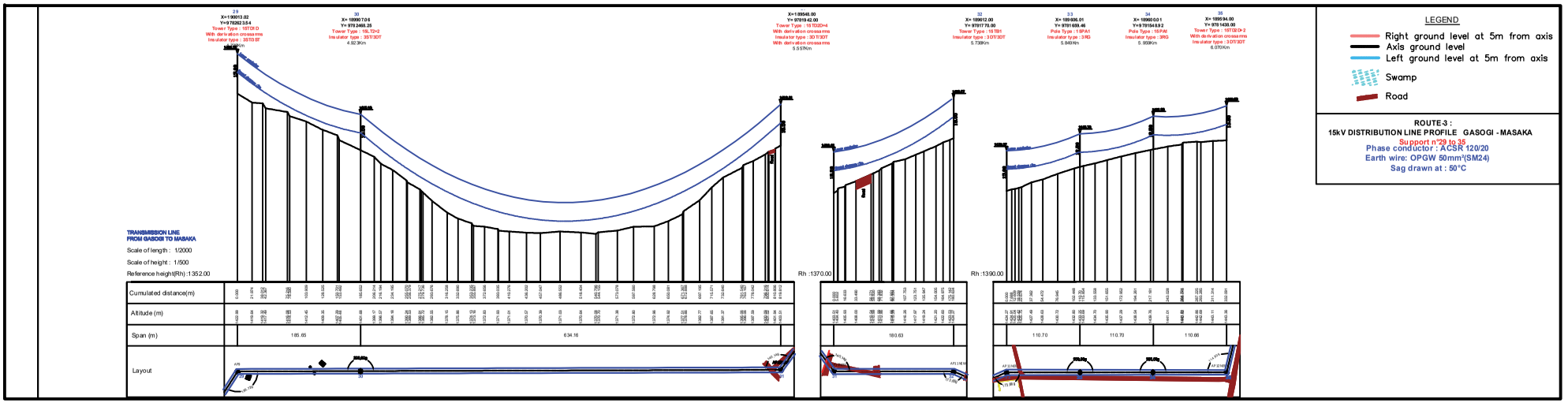


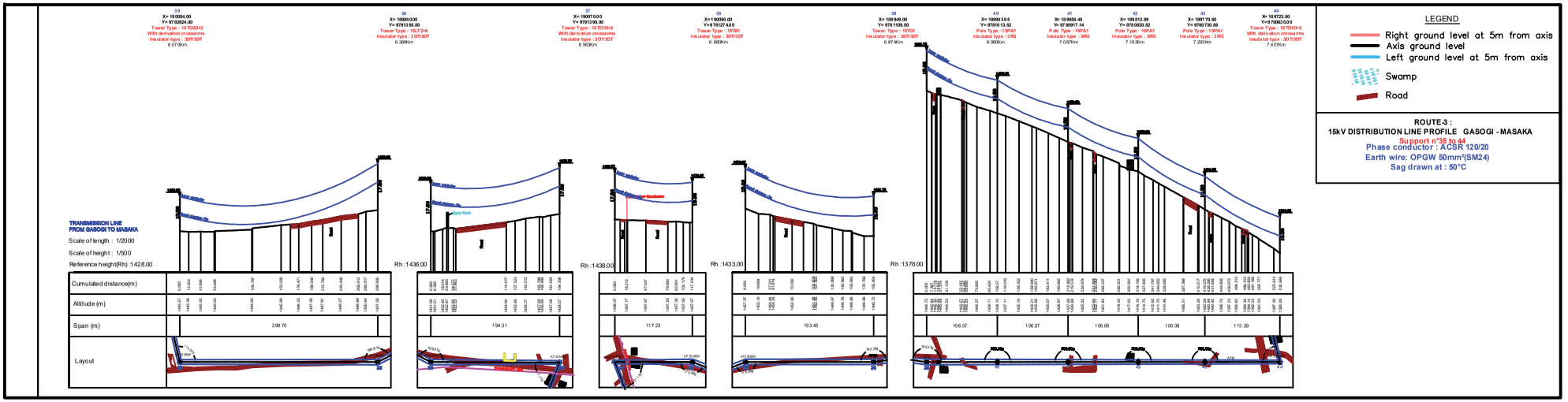
Dwg. No. LP-31: 15kVDistribution Line; Route-1, Line Profile (1/4)
(New Gasogi Substation – Masaka Hospital)



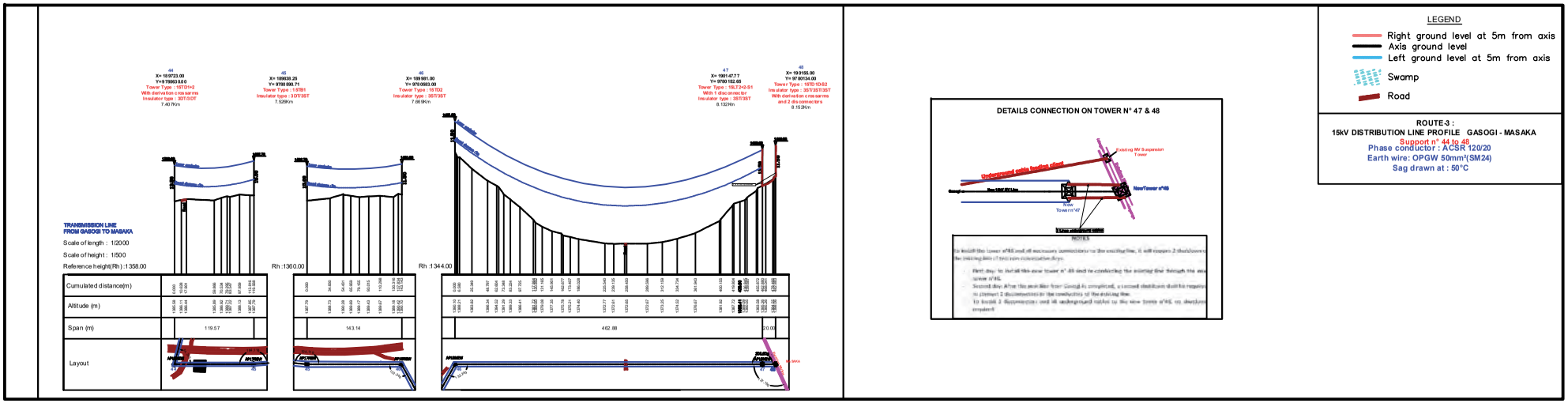


Dwg. No. LP-32: 15kVDistribution Line; Route-1, Line Profile (2/4)
(New Gasogi Substation - Masaka Hospital)

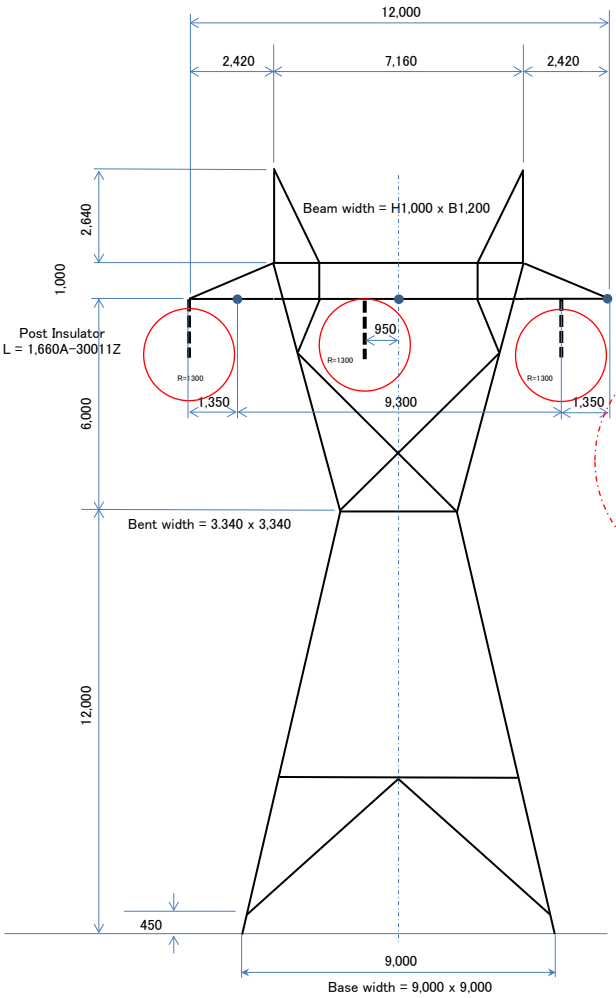


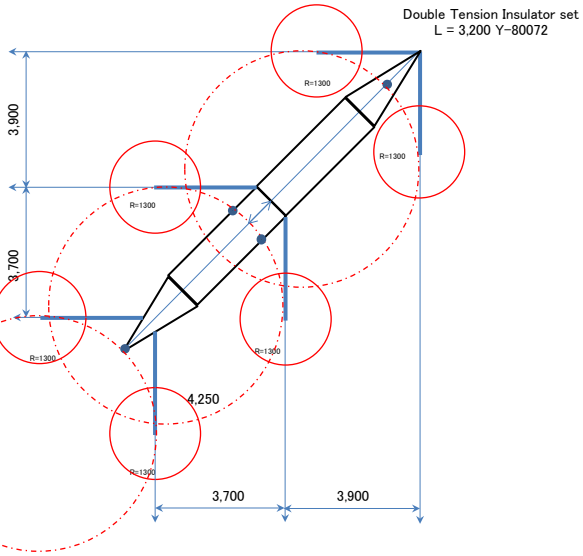


Dwg. No. LP-33: 15kVDistribution Line; Route-1, Line Profile (3/4)
(New Gasogi Substation – Masaka Hospital)



Dwg. No. LP-34: 15kVDistribution Line; Route-1, Line Profile (4/4)
(New Gasogi Substation – Masaka Hospital)





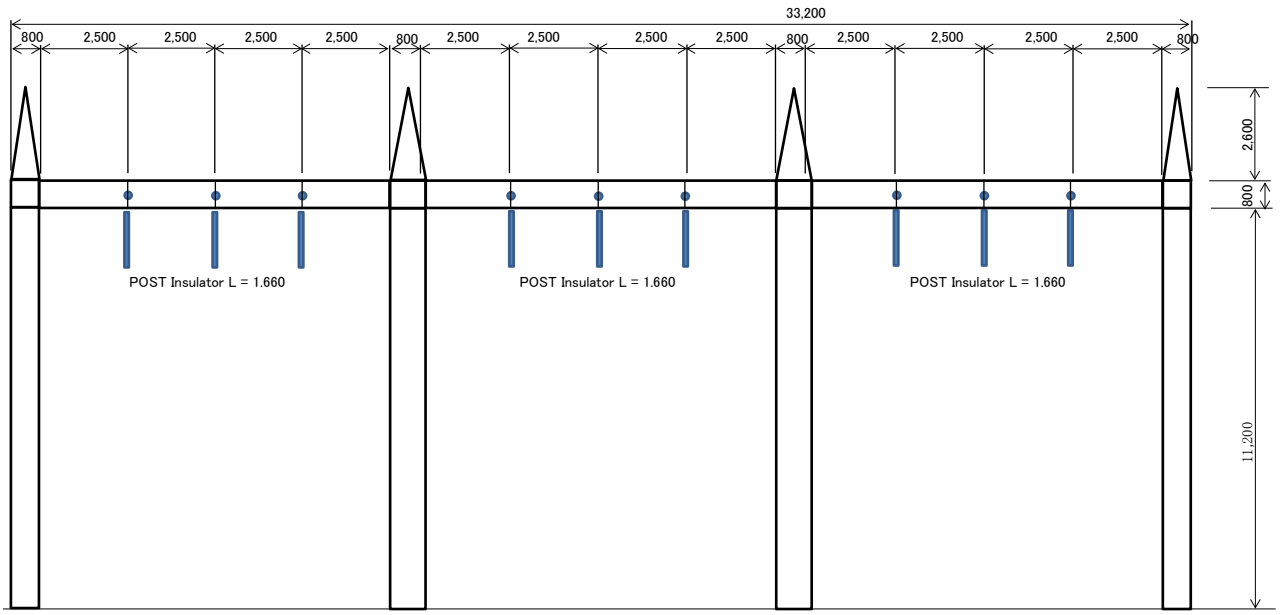
Description		Unit	Design Value	
Voltage		kV	110	
Circuit		cct	1	
Tower Type		–	110-D1H	
			Line Side	Gantry Side
Wind Span		m	250	50
Line Angle		deg	0 – 45	0 – 45
Vertical Angle		Σ tan δ	±0.15	0.15
			Line Side	Gantry Side
CONDUCTOR	Code	–	ACSR 240/40	
	Numbers	–	1	
	Diameter	mm	21.8	
	Unit Mass	kg/m	0.976	
	Unit Tension	N/wire	26,478	9,807
GROUND WIRE	Code	–	OPGW-100	
	Numbers	–	1	
	Diameter	mm	14.0	
	Unit Mass	kg/m	0.467	
	Unit Tension	N/wire	20,594	6,865
Insulator			Line Side	Gantry Side
	Kind	–	250mm Suspension	
	Numbers	–	9 x 2 TEN	9 x 2 TEN
	Weight	kg/set	180	180
	Length	mm	3,200	
	Jumper Depth	mm	1,600	
	Wind	N/set	386	386
	Support Insulat	mm	1,660	
	Weight	kg	55	
	Wind	N/set	170	
Wind Pressure	Tower	Pa	1,599	
	Conductor	Pa	552	
	Ground Wire	Pa	552	

※ Body Extension +3, +6, +9

※ Safety facter = 1.0 for Body, 1.2 for Arm

Dwg. No. TL-41: 110 kV Tower Skelton, Type: 110-E1

GANTRY at GASOGI S/S 110 kV

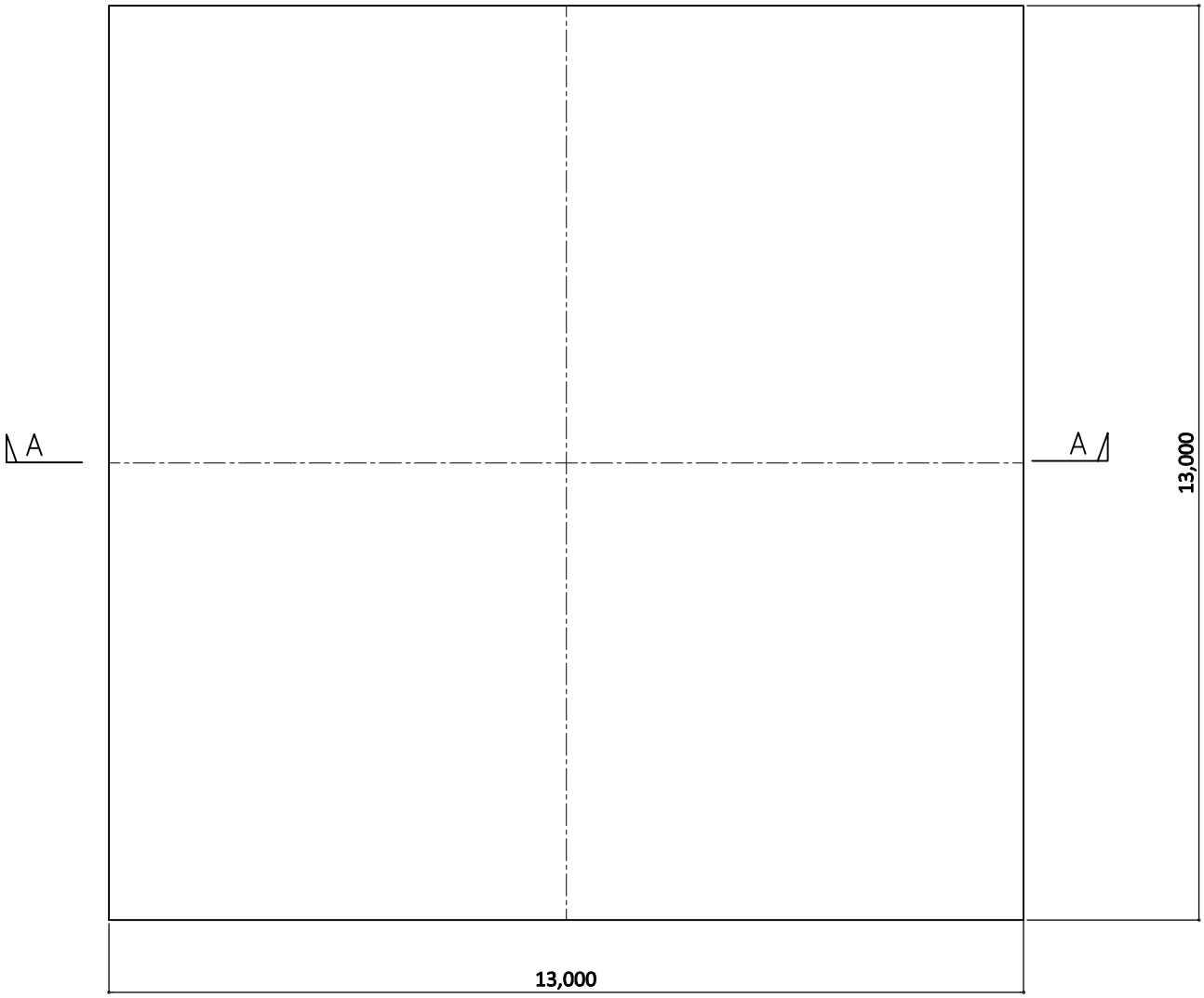


Description		Unit	Design Value	
Voltage		kV	110	
Circuit		cct	1	
Tower Type		-	GANTRY at GASOGI S/S	
			鉄塔側	変電側
Wind Span		m	50	30
Line Angle		deg	±25	-20 ～ +45
Vertical Angle		Σ tan δ	-0.15	0
			鉄塔側	変電側
CONDUCTOR	Code	-	ACSR 240/40	
	Numbers/phase	-	1	
	Diameter	mm	21.8	
	Unit Mass	kg/m	0.976	
	Unit Tension	N/wire	9,807	
GROUND WIRE	Code	-	OPGW-100	GSW-55
	Numbers/phase	-	1	2
	Diameter	mm	14.0	9.6
	Unit Mass	kg/m	0.467	0.446
	Unit Tension	N/wire	6,865	2,942
Insulator			本線側	
	Kind	-	250mm Suspension	
	Numbers	-	9 x 1 TEN	
	Weight	kg/set	90	
	Length	mm	3,200	
	Jumper Depth	mm	1,600	
	Wind	N/set	244	
	Support Insulator	mm	1,660	
	Weight	kg	55	
	Wind	N/set	170	
Wind Pressure	Tower	Pa	1,214	
	Conductor	Pa	552	
	Ground Wire	Pa	552	

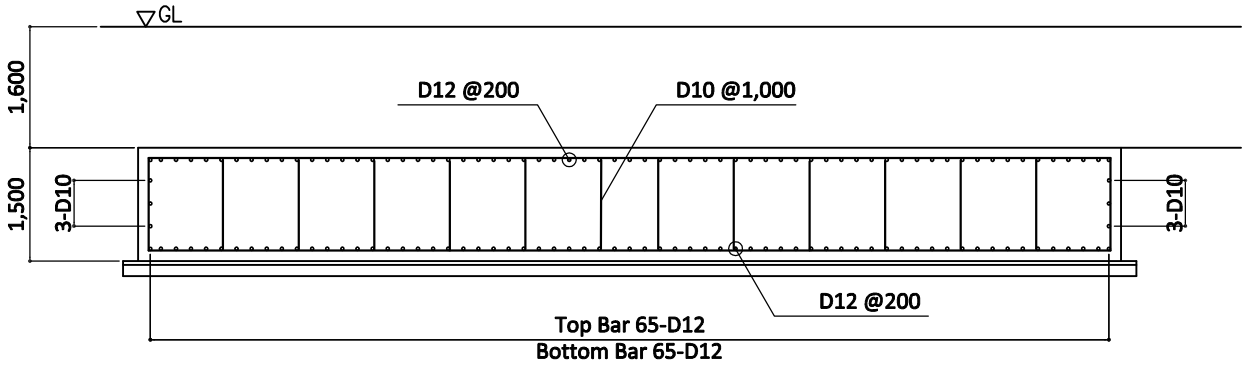
※ Body Extension Nil

※ Safety facter = 1.0

Dwg. No. TL-42: 110 kV Gantry Tower Skelton in New Gasogi Substation

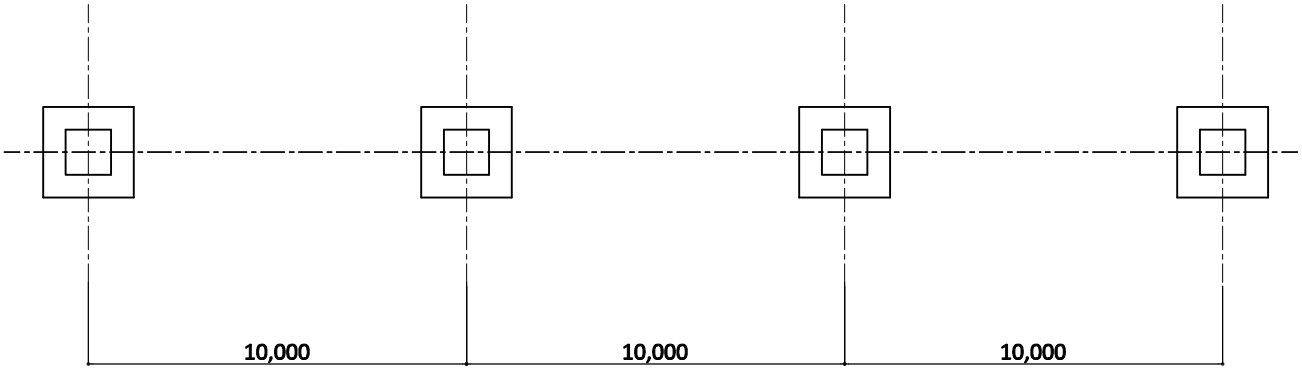


FOUNDATION PLAN

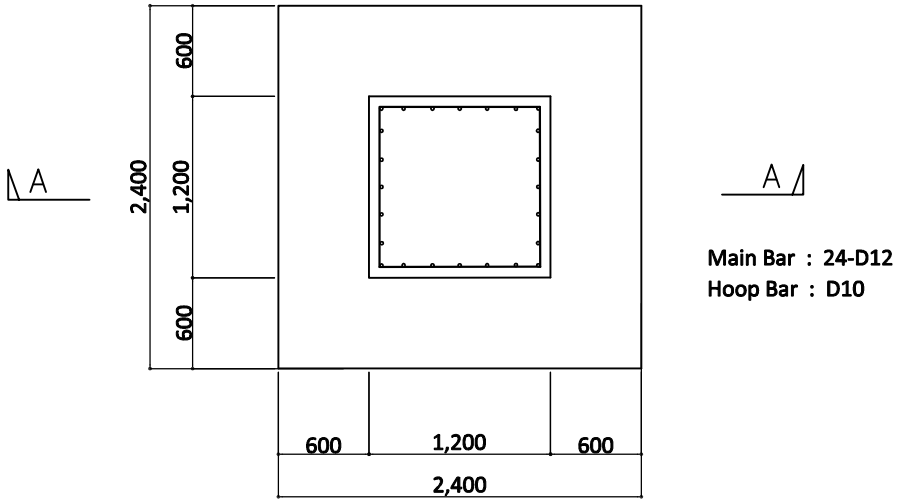


SECTION A - A

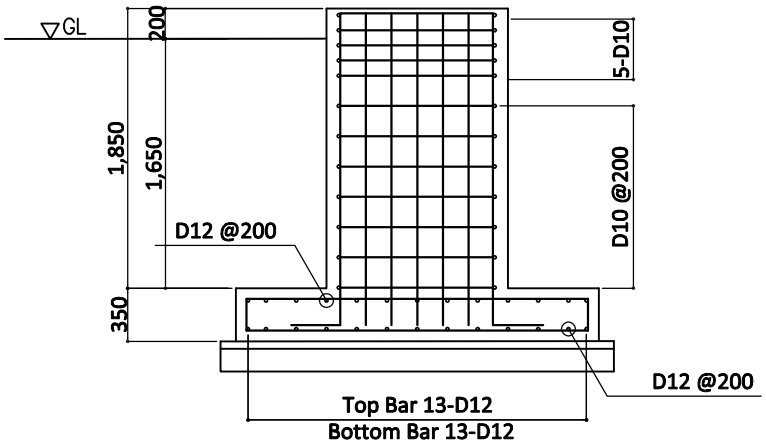
Dwg. No. TL-51: 110 kV Tower Foundation, Type: 110-E1



KEY - PLAN

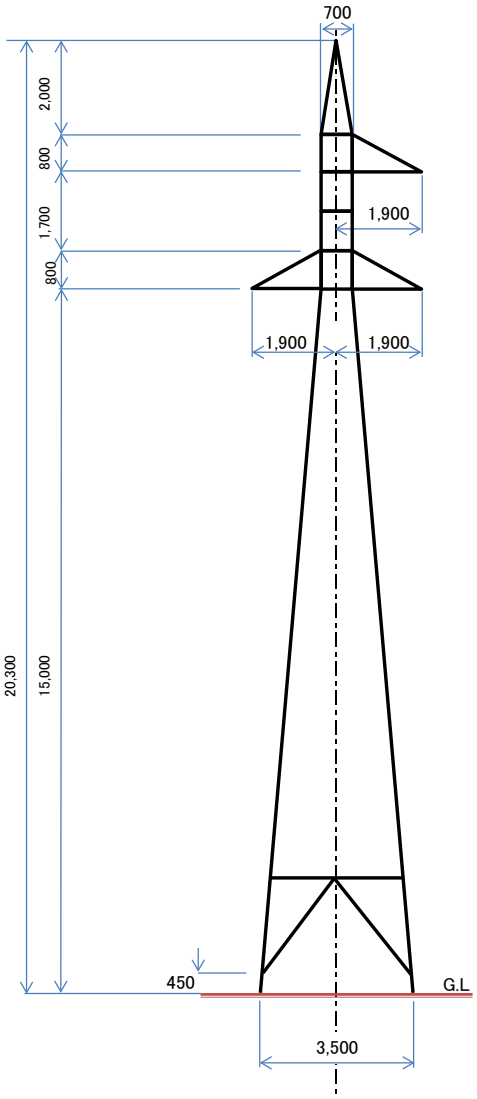


FOUNDATION PLAN



SECTION A - A

Dwg. No. TL-52: 110 kV Gantry Tower Foundation in New Gasogi Substation



15 kV TA1	Suspension

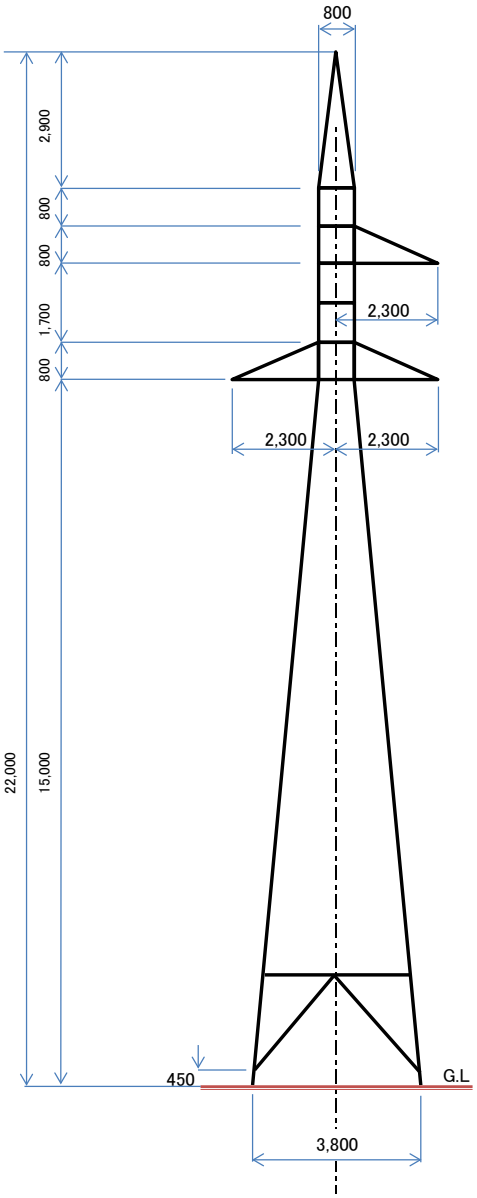
R/00

Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-TA1
Wind Span		m	250
Line Angle		deg	0 ～ 3
Vertical Angle		Σ tan δ	0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	15,690
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	11,770
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 2 Double SUS
	Weight	kg/set	120
	Length	mm	1,449
	Jumper Depth	mm	–
	Wind	N/set	346
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

※ Body Extension +2, +4, +6

※ Safety factor = 1.0 for Body, 1.2 for Arm

Dwg. No. DL-61: 15 kV Tower Skelton, Type: 15-TA1



15 kV TB1	Light angle Tension

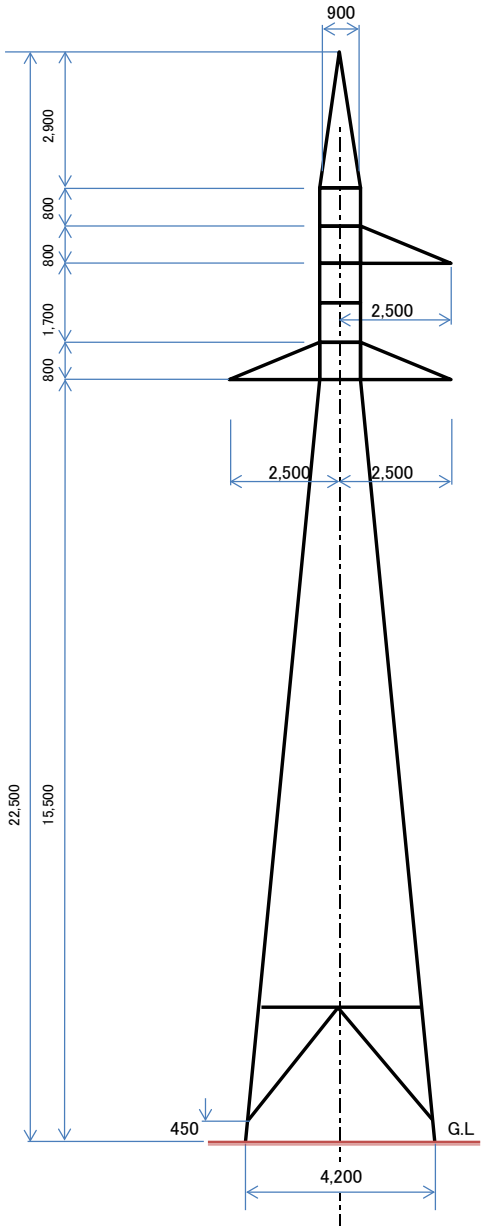
R/00

Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-TA1
Wind Span		m	250
Line Angle		deg	0 ～ 30
Vertical Angle		Σ tan δ	±0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	15,690
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	11,770
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 2 Double TEN
	Weight	kg/set	210
	Length	mm	1,654
	Jumper Depth	mm	–
	Wind	N/set	458
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

※ Body Extension −1.5 −2.5

※ Safety factor= 1.0 for Body, 1.2 for Arm

Dwg. No. DL-62: 15 kV Tower Skelton, Type: 15-TB1



15 kV TD1	Middle angle Tension

R/00

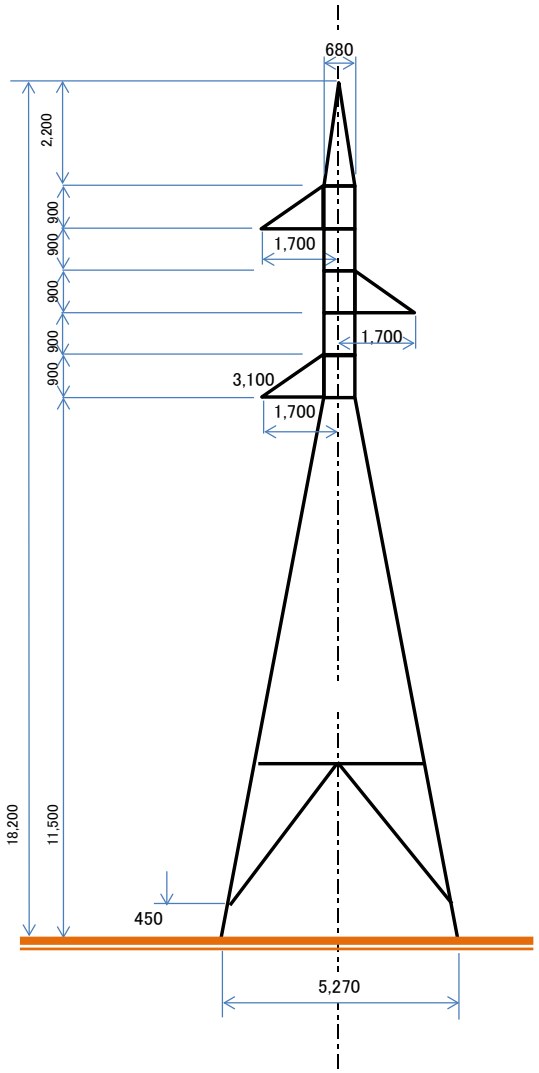
Description		Unit	Design Value	
Voltage		kV	15	
Circuit		cct	1	
Tower Type		–	15TD1	
			ANGLE	DEADEND
Wind Span		m	250	125
Line Angle		deg	0 – 50	0
Vertical Angle		Σ tan δ	±0.15	±0.075
CONDUCTOR	Code	–	ACSR 120/20	
	Numbers	–	1	
	Diameter	mm	15.5	
	Unit Mass	kg/m	0.491	
	Unit Tension	N/wire	15,690	
GROUND WIRE	Code	–	OPGW-50 or GSW-55	
	Numbers	–	1	
	Diameter	mm	9.7	
	Unit Mass	kg/m	0.337	
	Unit Tension	N/wire	11,770	
Insulator	Kind	–	250mm Suspension	
	Numbers	–	4 x 2 DOUBLE TENSION	
	Weight	kg/set	210	
	Length	mm	1,654	
	Wind	N/set	458	
Post	Length	mm	1,660	
	Weight	kg	55	
	Wind	N/set	170	
Wind Pressure	Tower	Pa	1,599	
	Conductor	Pa	552	
	Ground Wire	Pa	552	

※ Body Extension −1.5 −2.5

※ Safety factor= 1.0 for Body, 1.2 for Arm

Dwg. No. DL-63: 15 kV Tower Skelton, Type: 15-TD1

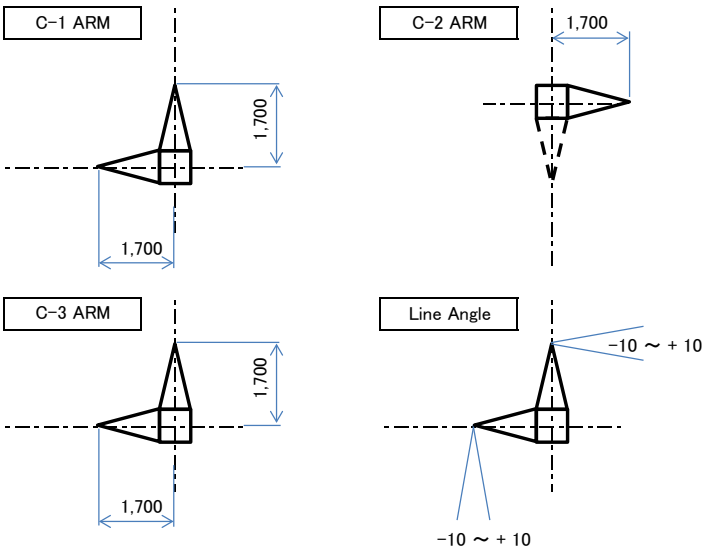
15 kV TD1D	Heavy angle Tension



Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-TD1D
Wind Span		m	100 + 60
Line Angle		deg	−10 ～ + 10
Vertical Angle		Σ tan δ	±0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	15,690
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	11,770
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 2 Double TEN
	Weight	kg/set	210
	Length	m	1,599
	Jumper Depth	m	1,600
	Wind	N/set	458
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

※ Body Extension +4, +8

※ Safety factor= 1.0 for Body, 1.2 for Arm



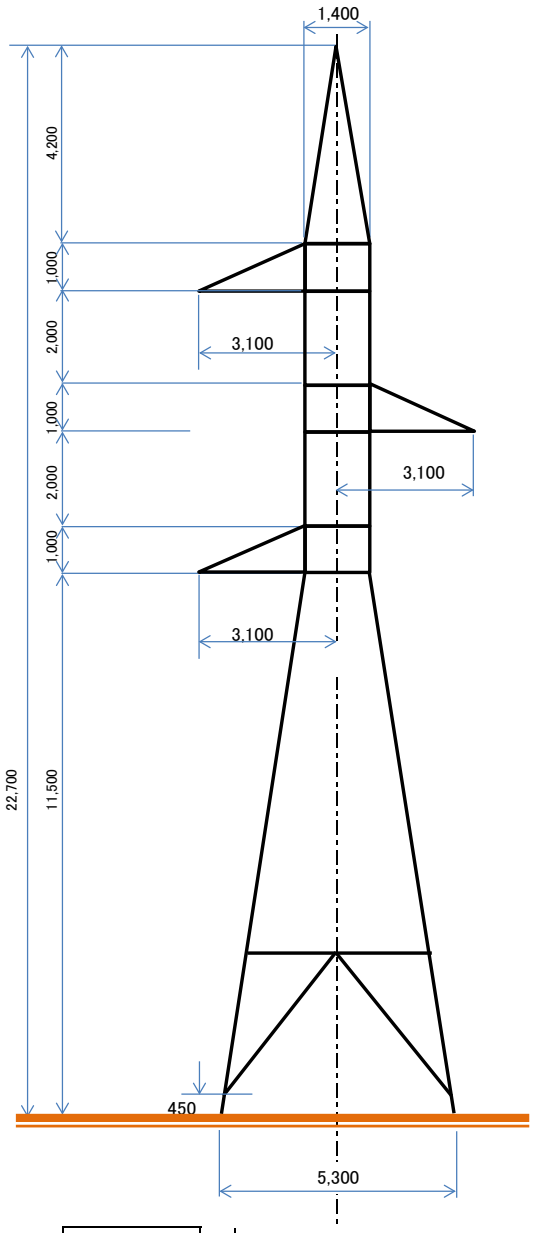
Dwg. No. DL-64: 15 kV Tower Skelton, Type: 15-TD1D

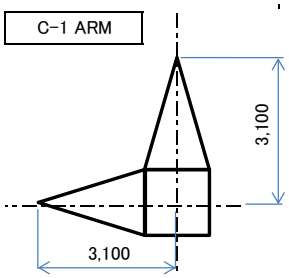
15 kV TD2D	Heavy angle Tension

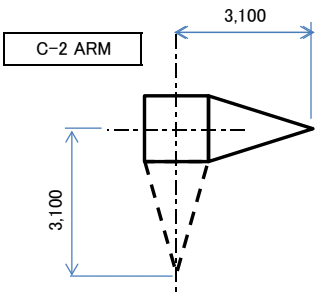
Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-TD2D
Wind Span		m	350 + 300
Line Angle		deg	−20 ～ + 20
Vertical Angle		Σ tan δ	±0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	15,690
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	11,770
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 2 Double TEN
	Weight	kg/set	210
	Length	m	1,599
	Jumper Depth	m	1,600
	Wind	N/set	458
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

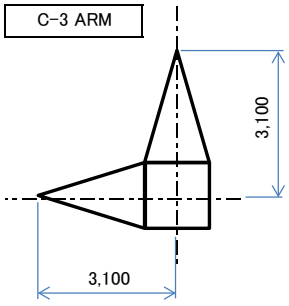
※ Body Extension +4, +8

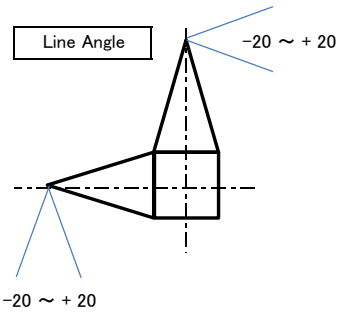
※ Safety factor= 1.0 for Body, 1.2 for Arm



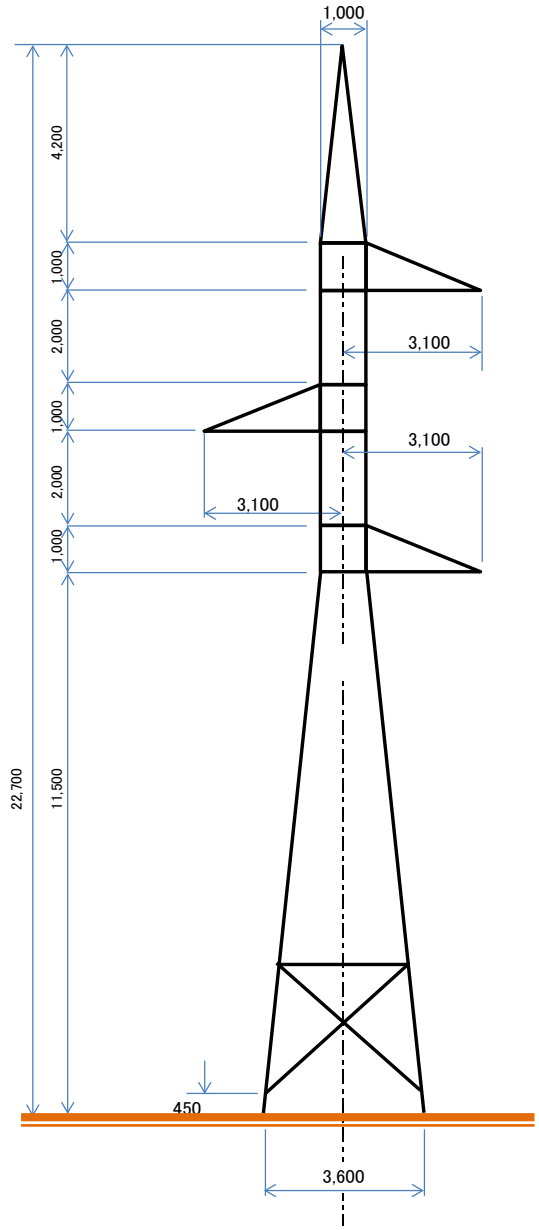








Dwg. No. DL-65: 15 kV Tower Skelton, Type: 15-TD2D



15 kV TL1	Long span Tension

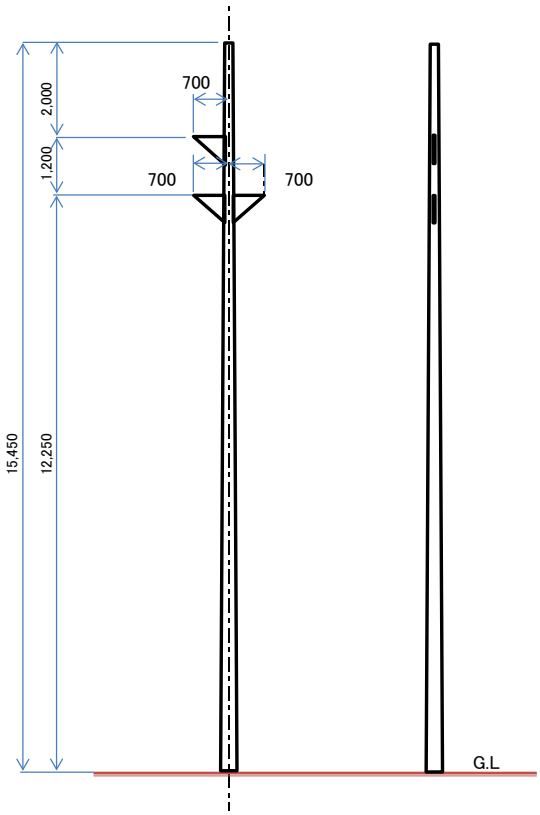
R/00

Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15–TL1
Wind Span		m	500
Line Angle		deg	0 – 3
Vertical Angle		Σ tan δ	±0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	15,690
		N/wire	20% of Maximum Tension
GROUND WIRE	Code	–	OPGW–50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	11,770
		N/wire	20% of Maximum Tension
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 2 Double TEN
	Weight	kg/set	210
	Length	m	1,599
	Jumper Depth	m	1,600
	Wind	N/set	458
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

※ Body Extension +4, +8

※ Safety factor= 1.0 for Body, 1.2 for Arm

Dwg. No. DL–66: 15 kV Tower Skelton, Type: 15–TL1



15 kV PA1	Suspension

R/00

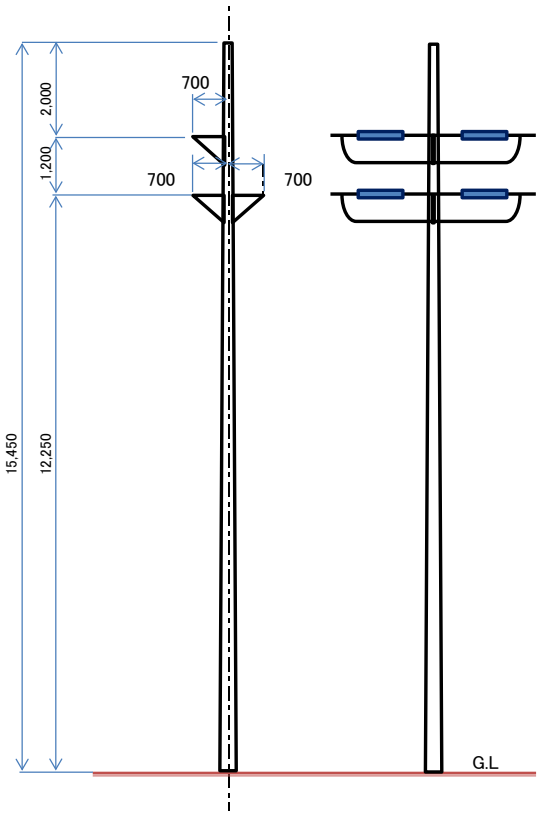
Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-PB1
Wind Span		m	130
Line Angle		deg	0 ～ 5
Vertical Angle		Σ tan δ	0
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	5,884
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.7
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	3,923
Insulator	Kind	–	Post Insulator
	Numbers	–	Contractor to Propose
	Weight	kg/set	
	Length	mm	
	Jumper Depth	mm	
	Wind	N/set	
Wind Pressure	Tower	Pa	552
	Conductor	Pa	552
	Ground Wire	Pa	552

※ No Body Extension

※ Safety factor= 1.0 for Body, 1.2 for Arm

※ Necessary separate distance : 0.2 m

Dwg. No. DL-67: 15 kV Pole Skelton, Type: 15-PA1



15 kV PB1	Tension

R/00

Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-PB1
Wind Span		m	130
Line Angle		deg	0 ～ 24.5
Vertical Angle		Σ tan δ	0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	5,884
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.7
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	3,923
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 1 Double TEN
	Weight	kg/set	210
	Length	mm	1,654
	Jumper Depth	mm	Contractor to inform
	Wind	N/set	458
Wind Pressure	Tower	Pa	552
	Conductor	Pa	552
	Ground Wire	Pa	552

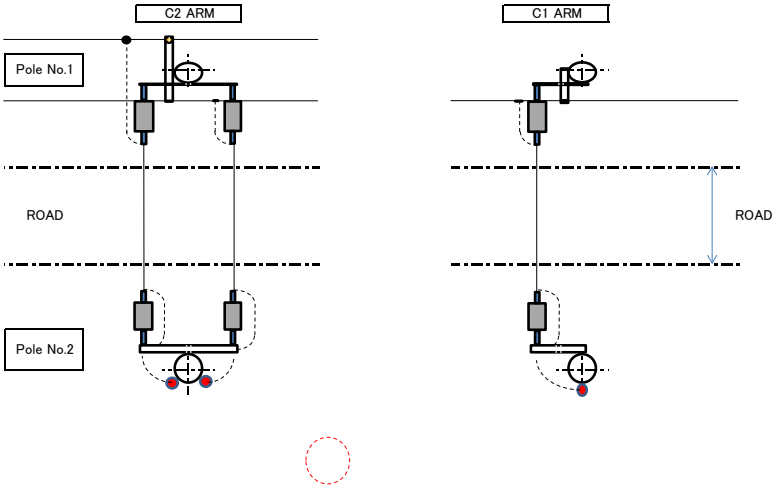
※ No Body Extension

※ Safety factor= 1.0 for Body, 1.2 for Arm

※ Necessary separate distance : 0.2 m

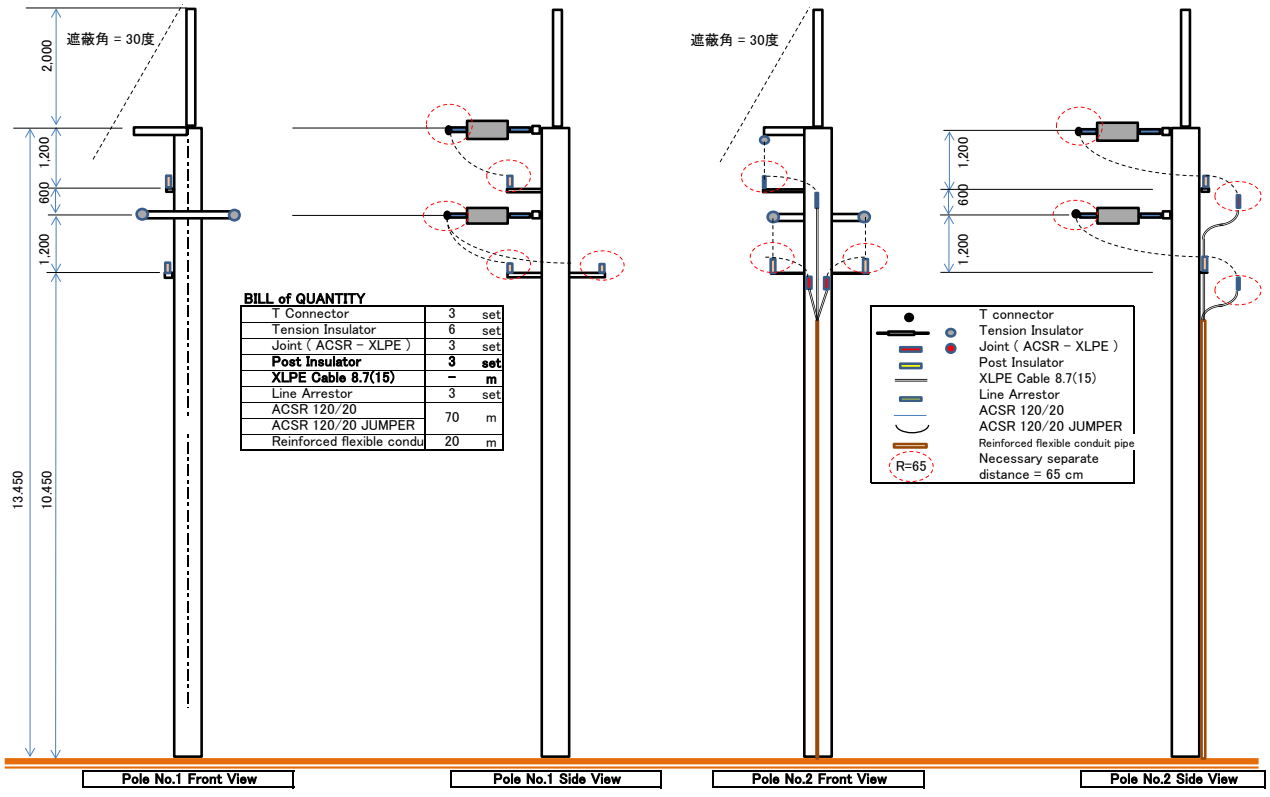
Dwg. No. DL-68: 15 kV Pole Skelton, Type: 15-PB1

15 kV PD1	Heavy angle Tension



Description		Unit	Design Value
Voltage		kV	15
Circuit		cct	1
Tower Type		–	15-PD1
Wind Span		m	200
Line Angle		deg	0 – 90
Vertical Angle		Σ tan δ	±0.15
CONDUCTOR	Code	–	ACSR 120/20
	Numbers	–	1
	Diameter	mm	15.5
	Unit Mass	kg/m	0.491
	Unit Tension	N/wire	5,884
GROUND WIRE	Code	–	OPGW-50
	Numbers	–	1
	Diameter	mm	9.70
	Unit Mass	kg/m	0.337
	Unit Tension	N/wire	3,923
Insulator	Kind	–	250mm Suspension
	Numbers	–	4 x 1 Single TEN
	Weight	kg/set	210
	Length	m	1,599
	Jumper Depth	m	1,600
	Wind	N/set	458
Wind Pressure	Tower	Pa	1,599
	Conductor	Pa	552
	Ground Wire	Pa	552

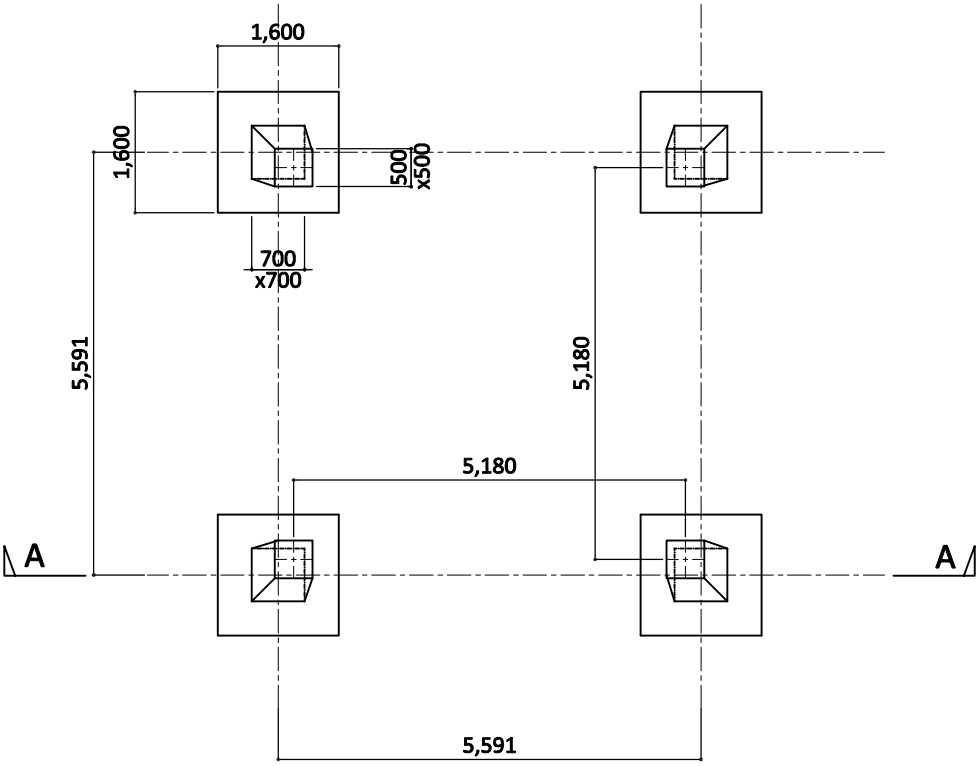
※ No Body Extension



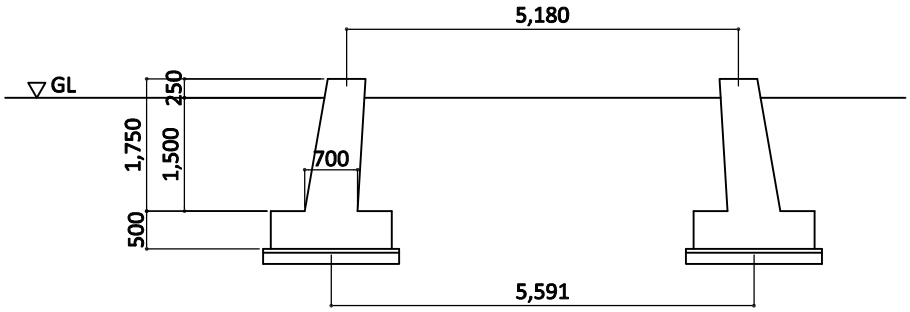
BILL of QUANTITY

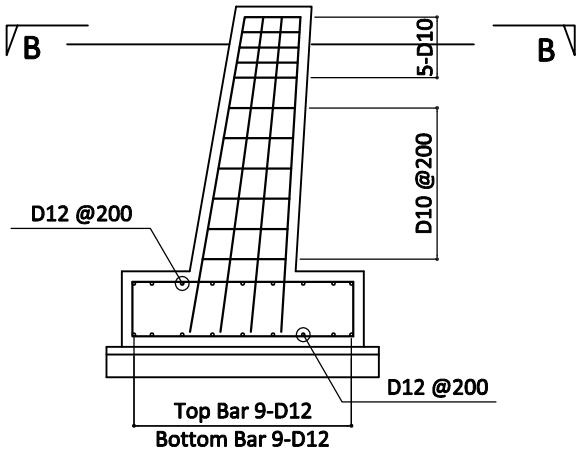
T Connector	3	set
Tension Insulator	6	set
Joint (ACSR – XLPE)	3	set
Post Insulator	**3**	**set**
XLPE Cable 8.7(15)	**–**	**m**
Line Arrestor	3	set
ACSR 120/20	70	m
ACSR 120/20 JUMPER		
Reinforced flexible condu	20	m

Dwg. No. DL-69: 15 kV Pole Skelton, Type: 15-PD1



PLAN

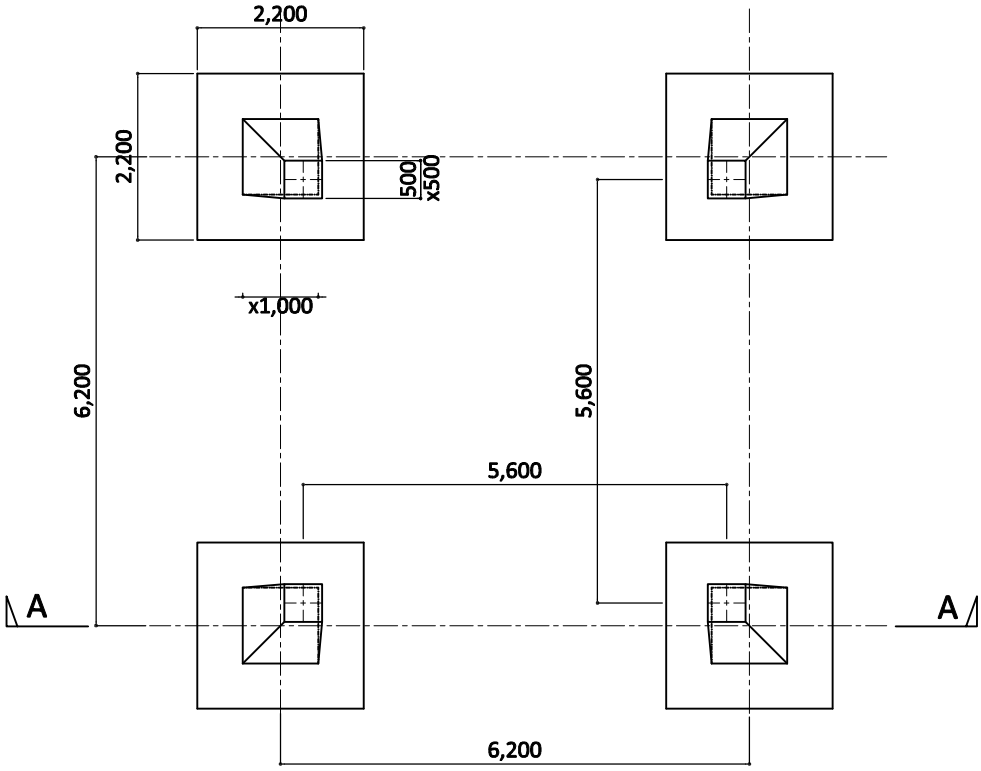




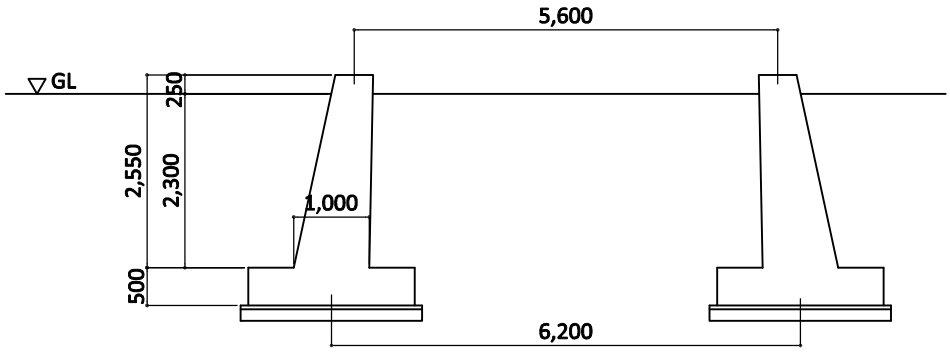
Main Bar : 12-D12
Hoop Bar : D10

PLAN B - B

Dwg. No. DL-71: 15 kV Tower Foundation, Type: 15-TA1



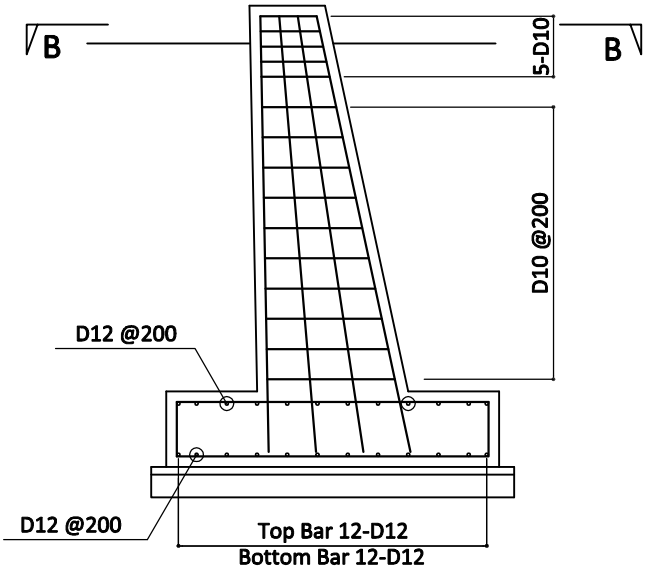
PLAN



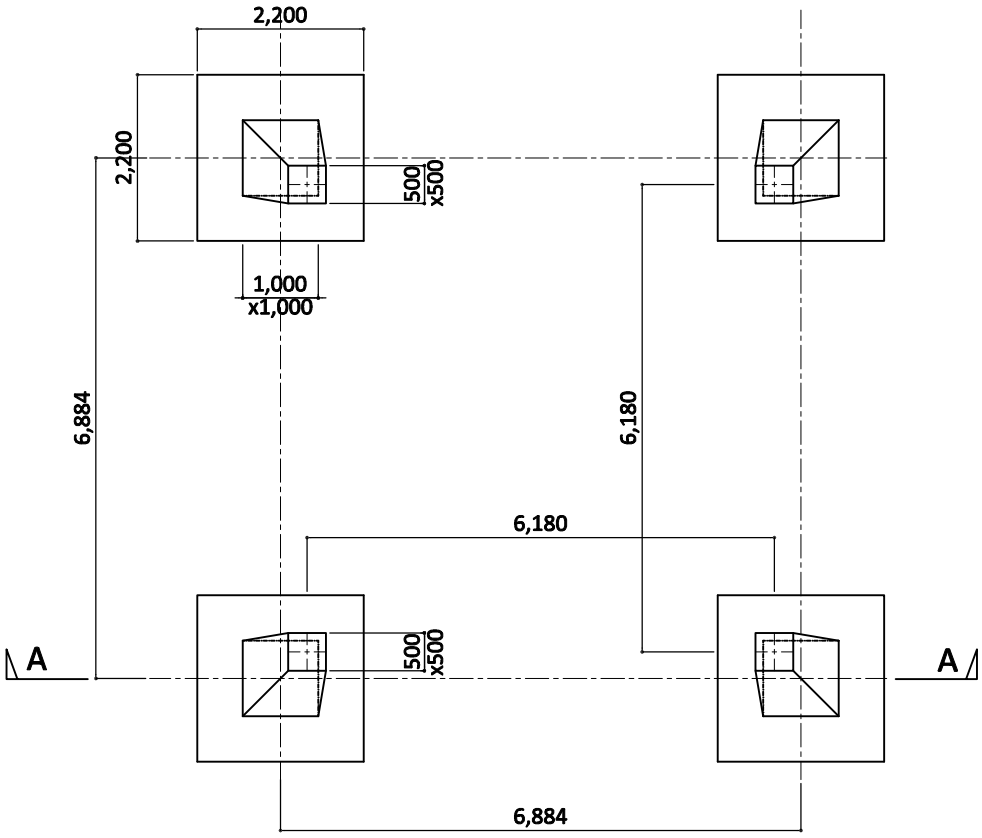
SECTION A - A

Main Bar : 12-D12
Hoop Bar : D10

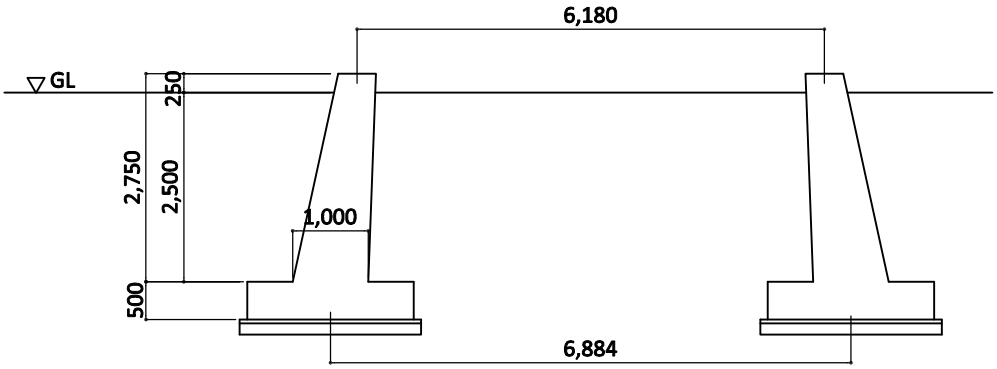
PLAN B - B



Dwg. No. DL-72: 15 kV Tower Foundation, Type: 15-TB1



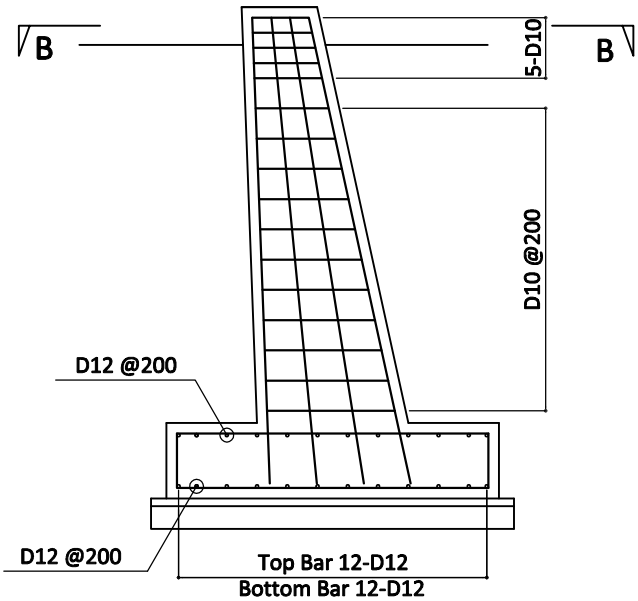
PLAN



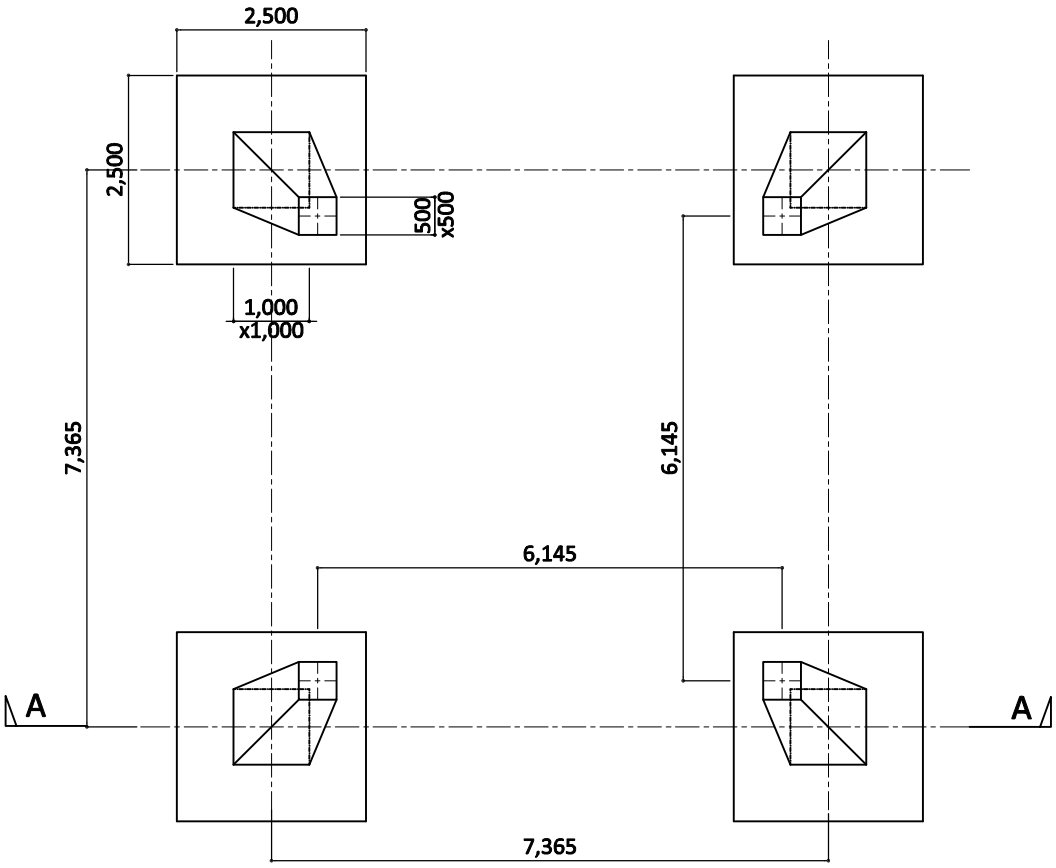
SECTION A - A

Main Bar : 12-D12
Hoop Bar : D10

PLAN B - B



Dwg. No. DL-73: 15 kV Tower Foundation, Type: 15-TD1



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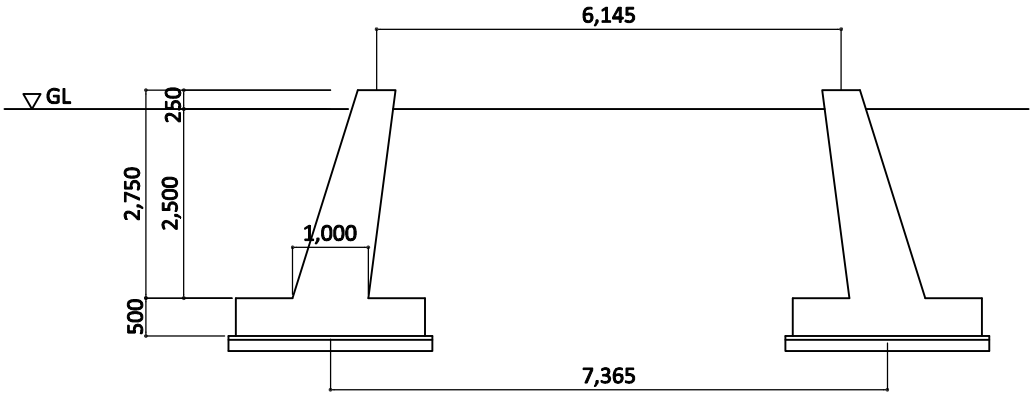
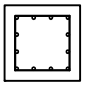
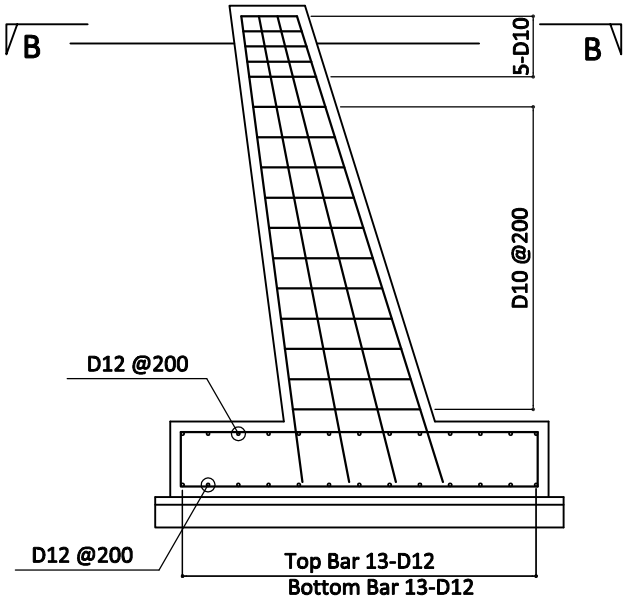


SECTION A - A

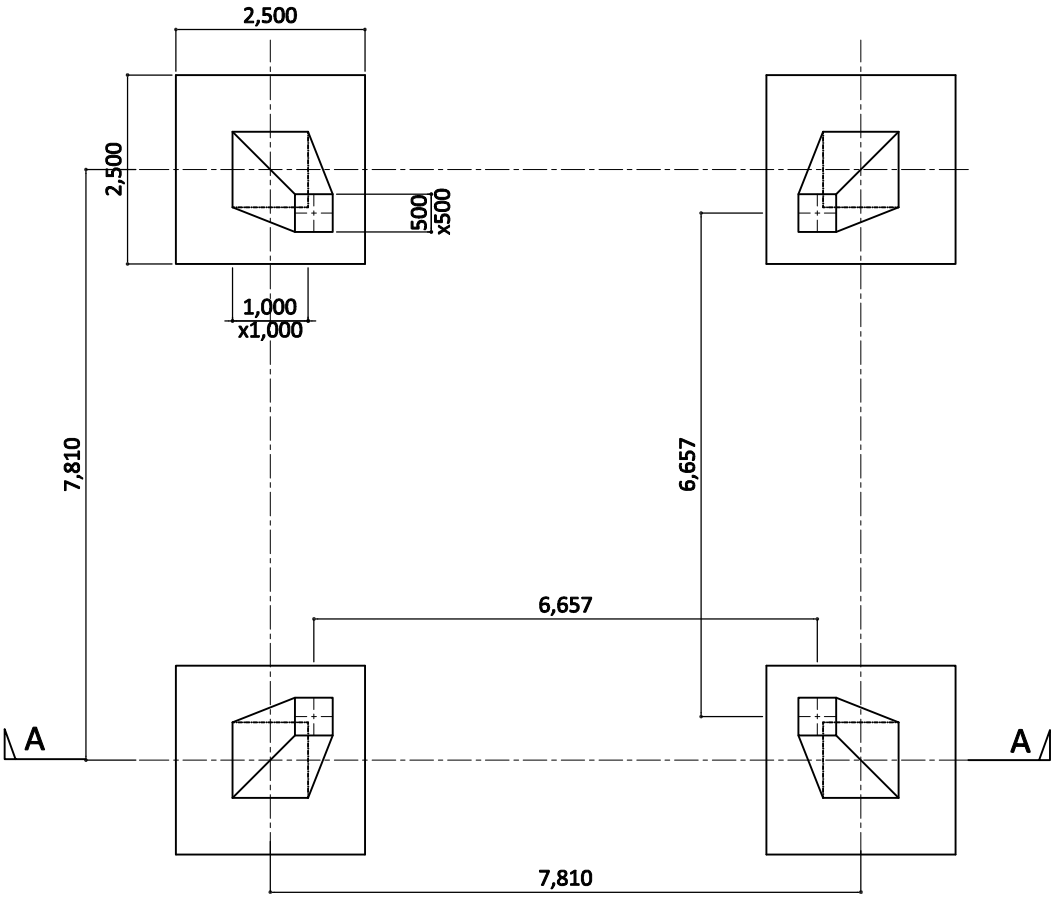


Main Bar : 12-D12
Hoop Bar : D10

PLAN B - B



Dwg. No. DL-74: 15 kV Tower Foundation, Type: 15-TD1D



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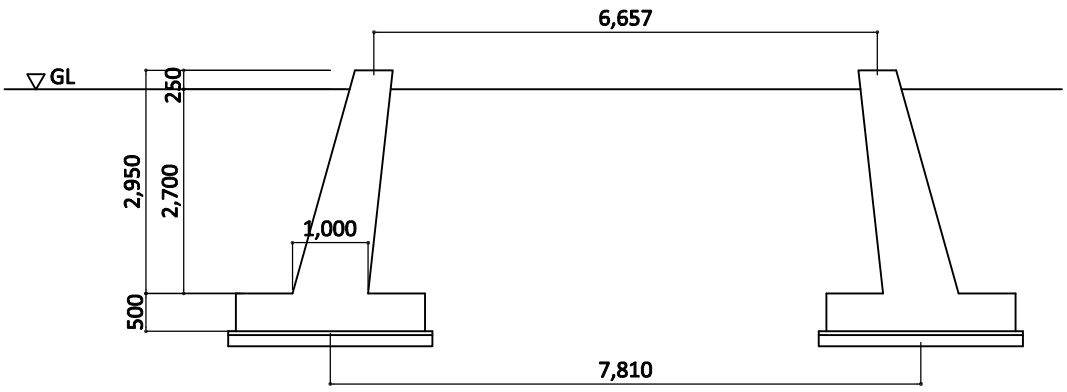
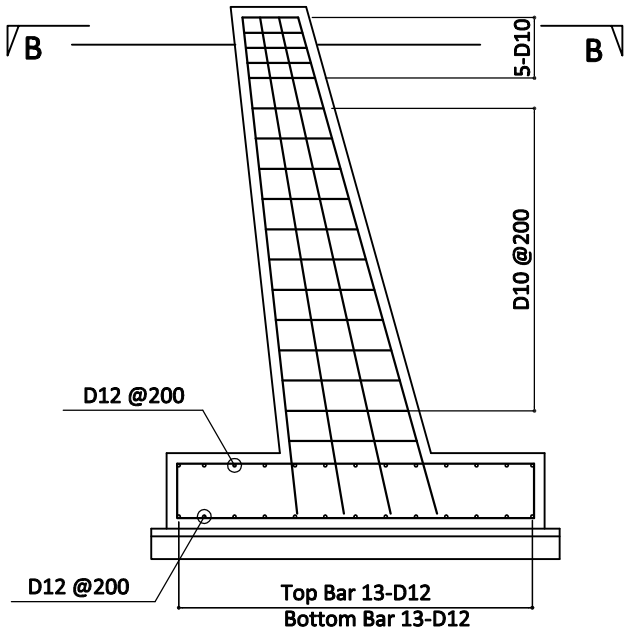


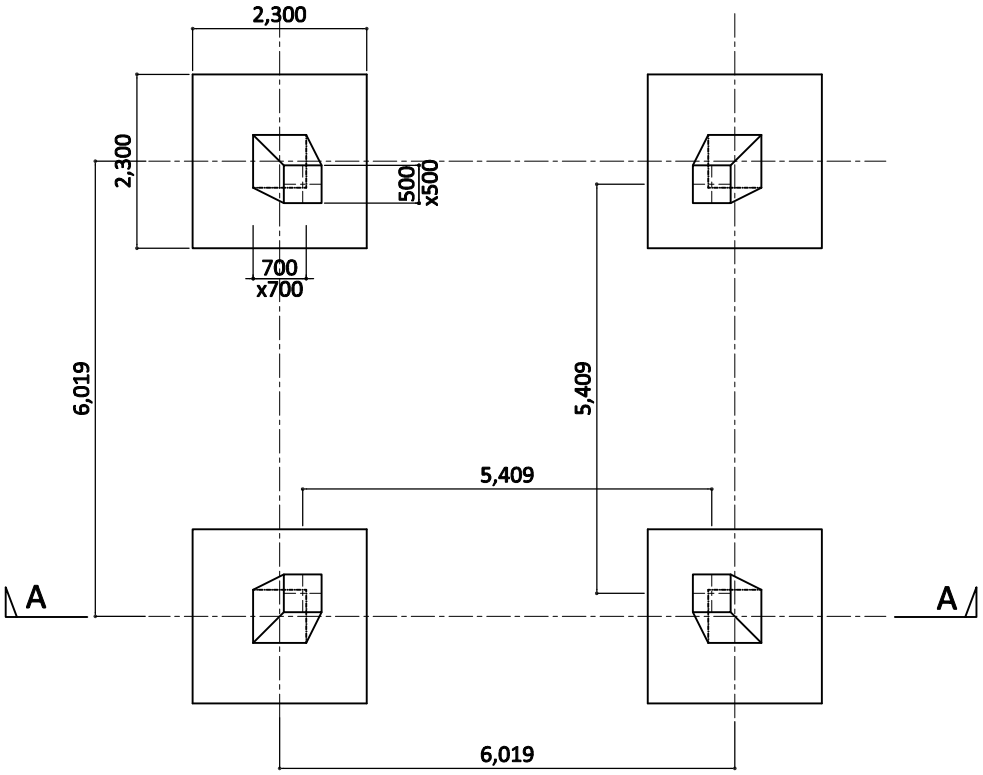
SECTION A - A



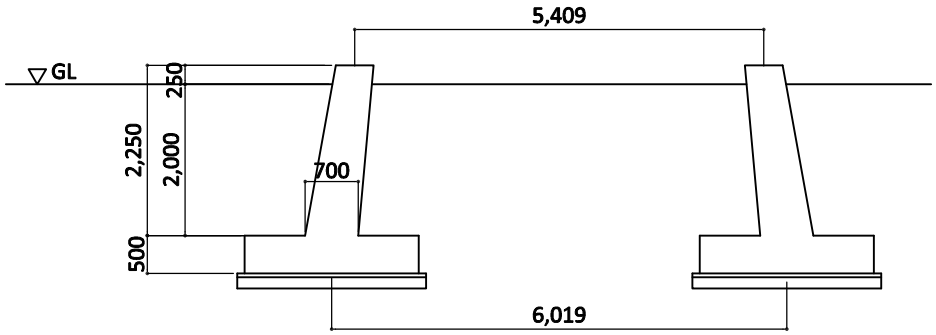
Main Bar : 12-D12
Hoop Bar : D10

PLAN B - B

Dwg. No. DL-75: 15 kV Tower Foundation, Type: 15-TD2D



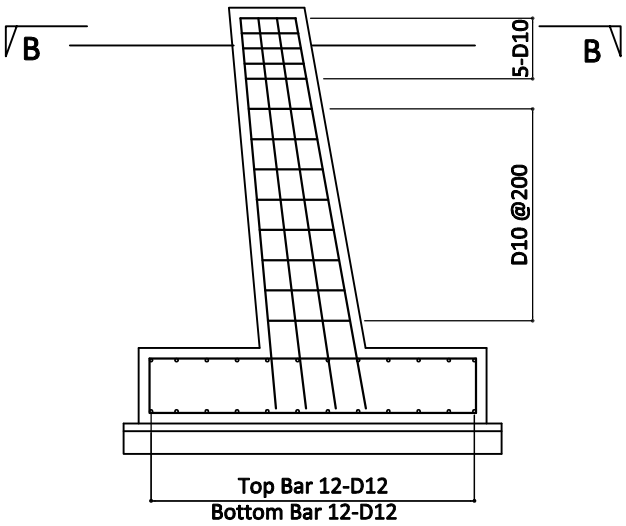
PLAN



SECTION A - A

Main Bar : 12-D12
Hoop Bar : D10

PLAN B - B



Dwg. No. DL-76: 15 kV Tower Foundation, Type: 15-TL1

7. Basic Data for Power System Analysis

Contents

1. Report on Power Flow Calculation

1）2020

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Grid Balance

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	11	76	88

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	32	0	0	18	0	47	97

Method of Solution:	Newton-Raphson Method
Maximum No. of Iteration:	9999
Precision of Solution:	0.0001000
System Frequency:	50.00 Hz
Unit System:	Metric
Project Filename:	Rwanda-Imp SSs Ph 3
Output Filename:	C:\Users\3062\□□□(ETAP)\Rwanda ETAP Project File\LF-2020 w Gas.lfr

LOAD_FLOW_REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
10-Kba/Msh/Rwi-B	110.000	97.033	-5.8	0	0	0	0	B-10-Kba-Msh-2	-18.600	-6.608	106.8	94.2	
								B-10-Kba-Rwi-2	7.618	2.462	43.3	95.2	
								Kba-10-B-1	10.982	4.146	63.5	93.6	
B-1-Jb1-Jb3-1	15.000	101.083	-5.0	0	0	0	0	B-1-Jb1-Jb3-2	-7.115	-5.197	335.5	80.8	
								Jb1-1-B-2	7.115	5.197	335.5	80.8	
B-1-Jb1-Jb3-2	15.000	101.108	-5.0	0	0	0	0	B-1-Jb1-Jb3-1	7.116	5.198	335.5	80.8	
								Jb3-1-B-1	-7.116	-5.198	335.5	80.8	
B-10-Bre-Gso-1	110.000	101.599	-3.3	0	0	0	0	C-BN	46.298	14.296	250.3	95.5	
								Bre-10-B-1	-46.298	-14.296	250.3	95.5	
B-10-Bre-Jb1-1	110.000	101.599	-3.3	0	0	0	0	B-10-Bre-Jb1-2	26.193	21.097	173.7	77.9	
								Bre-10-B-1	-26.193	-21.097	173.7	77.9	
B-10-Bre-Jb1-2	110.000	100.612	-3.6	0	0	0	0	B-10-Bre-Jb1-1	-26.034	-20.997	174.5	77.8	
								Jb1-10-B-1	26.034	20.997	174.5	77.8	
B-10-Bre-Nde-2	110.000	101.040	-3.6	0	0	0	0	C-BN	-2.563	0.030	13.3	100.0	
								Nde-10-B-1	2.563	-0.030	13.3	100.0	
B-10-Bre-Sha-1DT-F	110.000	101.599	-3.3	0	0	0	0	B-10-Bre-Sha-2DT-F	-80.589	-36.724	457.5	91.0	
								Bre-10-B-1	80.589	36.724	457.5	91.0	
B-10-Bre-Sha-2DT-F	110.000	102.121	-3.0	0	0	0	0	B-10-Bre-Sha-1DT-F	80.784	36.398	455.4	91.2	
								Sha-10-B-1	-80.784	-36.398	455.4	91.2	
B-10-Gbi-Msh-1G	110.000	99.777	-4.1	0	0	0	0	B-10-Gbi-Msh-1M	14.172	5.712	80.4	92.7	
								Gbi-10-B-1	-14.172	-5.712	80.4	92.7	
B-10-Gbi-Msh-1M	110.000	98.566	-5.0	0	0	0	0	B-10-Gbi-Msh-1G	-14.101	-7.508	85.1	88.3	
								Msh-10-B-1	14.101	7.508	85.1	88.3	
B-10-Gha-MKi-1	110.000	99.894	-3.7	0	0	0	0	B-10-Gha-MKi-2	-5.806	-2.100	32.4	94.0	
								Gha-10-B-1	5.806	2.100	32.4	94.0	
B-10-Gha-MKi-2	110.000	100.009	-3.6	0	0	0	0	B-10-Gha-MKi-1	5.810	1.873	32.0	95.2	
								MKi-10-B-1	-5.810	-1.873	32.0	95.2	
B-10-Gko-Jb1-1	110.000	99.874	-3.8	0	0	0	0	B-10-Gko-Jb1-2	-18.004	-15.657	125.4	75.5	
								Gko-10-B-1	18.004	15.657	125.4	75.5	
B-10-Gko-Jb1-2	110.000	100.612	-3.6	0	0	0	0	B-10-Gko-Jb1-1	18.066	15.577	124.4	75.7	
								Jb1-10-B-1	-18.066	-15.577	124.4	75.7	
B-10-Gko-MKi-1	110.000	99.874	-3.8	0	0	0	0	B-10-Gko-MKi-2	-20.444	-0.142	107.4	100.0	
								Gko-10-B-1	20.444	0.142	107.4	100.0	
B-10-Gko-MKi-2	110.000	100.009	-3.6	0	0	0	0	B-10-Gko-MKi-1	20.471	0.065	107.4	100.0	
								MKi-10-B-1	-20.471	-0.065	107.4	100.0	
B-10-Gso-Msh-1	110.000	100.338	-4.0	0	0	0	0	B-10-Gso-Msh-2	29.862	9.768	164.4	95.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								New-Gso-10-B-5	-29.862	-9.768	164.4	95.0	
B-10-Gso-Msh-2	110.000	98.566	-5.0	0	0	0	0	B-10-Gso-Msh-1	-29.499	-9.685	165.3	95.0	
								Msh-10-B-1	29.499	9.685	165.3	95.0	
B-10-Gso-Nde-1	110.000	100.338	-4.0	0	0	0	0	C-GN	-40.801	-14.298	226.2	94.4	
								New-Gso-10-B-5	40.801	14.298	226.2	94.4	
B-10-Gso-Nde-2	110.000	101.040	-3.6	0	0	0	0	C-GN	-2.563	0.030	13.3	100.0	
								Nde-10-B-1	2.563	-0.030	13.3	100.0	
B-10-Jb-Rul-1	110.000	100.612	-3.6	0	0	0	0	B-10-Jb-Rul-2	1.146	1.922	11.7	51.2	
								Jb1-10-B-1	-1.146	-1.922	11.7	51.2	
B-10-Jb-Rul-2	110.000	100.296	-3.6	0	0	0	0	B-10-Jb-Rul-1	-1.142	-2.738	15.5	38.5	
								Rul-10-B-1	1.142	2.738	15.5	38.5	
B-10-Jb1-Jb2-1	110.000	100.612	-3.6	0	0	0	0	B-10-Jb1-Jb2-2	-18.508	-10.451	110.9	87.1	
								Jb1-10-B-1	18.508	10.451	110.9	87.1	
B-10-Jb1-Jb2-2	110.000	100.682	-3.5	0	0	0	0	B-10-Jb1-Jb2-1	18.515	10.430	110.8	87.1	
								Jb2-10-B-1	-18.515	-10.430	110.8	87.1	
B-10-Jb1-Mki-1	110.000	100.612	-3.6	0	0	0	0	B-10-Jb1-Mki-2	3.084	7.979	44.6	36.0	
								Jb1-10-B-1	-3.084	-7.979	44.6	36.0	
B-10-Jb1-Mki-2	110.000	100.009	-3.6	0	0	0	0	B-10-Jb1-Mki-1	-3.068	-8.453	47.2	34.1	
								MKi-10-B-1	3.068	8.453	47.2	34.1	
B-10-Kba-Msh-2	110.000	98.566	-5.0	0	0	0	0	10-Kba/Msh/Rwi-B	18.799	6.216	105.4	94.9	
								Msh-10-B-1	-18.799	-6.216	105.4	94.9	
B-10-Kba-Rwi-2	110.000	96.842	-5.9	0	0	0	0	10-Kba/Msh/Rwi-B	-7.608	-2.673	43.7	94.3	
								Rwi-10-B-1	7.608	2.673	43.7	94.3	
B-10-Mki-Grid-1	110.000	100.009	-3.6	40.000	0.000	0	0	MKi-10-B-1	40.000	0.000	209.9	100.0	
B-10-Rul-Gbi-1G	110.000	99.777	-4.1	0	0	0	0	B-10-Rul-Gbi-1R	-18.706	-7.299	105.6	93.2	
								Gbi-10-B-1	18.706	7.299	105.6	93.2	
B-10-Rul-Gbi-1R	110.000	100.296	-3.6	0	0	0	0	B-10-Rul-Gbi-1G	18.762	1.905	98.7	99.5	
								Rul-10-B-1	-18.762	-1.905	98.7	99.5	
B-10-Rul-Grid-1	110.000	100.296	-3.6	20.000	0.000	0	0	Rul-10-B-1	20.000	0.000	104.7	100.0	
* B-20-Sha-Grid-1	220.000	100.000	0.0	92.533	46.008	0	0	Sha-20-B-1	92.533	46.008	271.2	89.5	
Bre-1-B-1	15.000	100.859	-8.3	0	0	17.960	5.903	Bre-10-B-1	-17.960	-5.903	721.5	95.0	
Bre-10-B-1	110.000	101.599	-3.3	0	0	0	0	Bre-1-B-1	18.043	7.739	101.4	91.9	-3.000
								B-10-Bre-Jb1-1	26.193	21.097	173.7	77.9	
								B-10-Bre-Sha-1DT-F	-80.589	-36.724	457.5	91.0	
								B-10-Bre-Gso-1	46.298	14.296	250.3	95.5	
								G-Kse-1-B3	-9.945	-6.408	61.1	84.1	
C-BN	110.000	101.043	-3.6	0	0	0	0	B-10-Bre-Gso-1	-46.121	-14.096	250.5	95.6	
								B-10-Bre-Nde-2	2.563	-0.196	13.4	-99.7	
								C-GN	43.558	14.292	238.1	95.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
C-GN	110.000	101.043	-3.6	0	0	0	0	B-10-Gso-Nde-1	40.995	14.487	225.9	94.3	
								B-10-Gso-Nde-2	2.563	-0.196	13.4	-99.7	
								C-BN	-43.558	-14.292	238.1	95.0	
C-Kab-3-B	30.000	100.201	-8.3	0	0	0	0	Kba-3-B-1	0.000	0.000	0.0	0.0	
C-Msh-1-B	15.000	99.614	-10.6	0	0	0	0	Msh-1-B-1	0.000	0.000	0.0	0.0	
C-Rwi-B-1	15.000	100.118	-8.1	0	0	0	0	Rwi-1-B-1	0.000	0.000	0.0	0.0	
G-Jb2-10-B	110.000	100.682	-3.5	0	0	0	0	Jb2-10-B-1	18.515	10.430	110.8	87.1	
								Jb2-10-B-2	-18.515	-10.430	110.8	87.1	
G-Jb3-1-B	15.000	101.108	-5.0	0	0	0	0	Jb3-1-B-1	7.116	5.198	335.5	80.8	
								Jb3-1-B-2	-7.116	-5.198	335.5	80.8	
G-Kse-1-B2	110.000	101.040	-3.6	0	0	0	0	Nde-10-B-1	9.945	6.397	61.4	84.1	
								Kse-10-B3	-9.945	-6.397	61.4	84.1	
G-Kse-1-B3	110.000	101.599	-3.3	0	0	0	0	Bre-10-B-1	9.945	6.408	61.1	84.1	
								Kse-10-B2	-9.945	-6.408	61.1	84.1	
Gbi-3-B-1	30.000	100.217	-5.2	0	0	4.526	1.488	Gbi-10-B-1	-2.227	-0.732	45.0	95.0	
								Gbi-10-B-1	-2.299	-0.756	46.5	95.0	
Gbi-10-B-1	110.000	99.777	-4.1	0	0	0	0	Gbi-3-B-1	2.231	0.781	12.4	94.4	-1.250
								Gbi-3-B-1	2.303	0.806	12.8	94.4	-1.250
								B-10-Rul-Gbi-1G	-18.706	-7.299	105.6	93.2	
								B-10-Gbi-Msh-1G	14.172	5.712	80.4	92.7	
Gha-1-B-1	15.000	100.015	-5.4	0	0	5.796	1.905	Gha-10-B-1	-5.796	-1.905	234.8	95.0	
Gha-10-B-1	110.000	99.894	-3.7	0	0	0	0	Gha-1-B-1	5.806	2.100	32.4	94.0	-1.300
								B-10-Gha-MKi-1	-5.806	-2.100	32.4	94.0	
Gko-1-B-2	15.000	103.183	-8.0	0	0	38.288	12.585	Gko-10-B-1	-12.822	-4.217	503.5	95.0	
								Gko-10-B-1	-12.922	-4.242	507.3	95.0	
								Gko-10-B-1	-12.544	-4.125	492.6	95.0	
Gko-10-B-1	110.000	99.874	-3.8	0	0	0	0	Gko-1-B-2	12.876	5.294	73.2	92.5	-6.155
								Gko-1-B-2	12.976	5.326	73.7	92.5	-6.150
								Gko-1-B-2	12.596	5.179	71.6	92.5	-6.155
								B-10-Gko-Jb1-1	-18.004	-15.657	125.4	75.5	
								B-10-Gko-MKi-1	-20.444	-0.142	107.4	100.0	
Jb1-1-B-2	15.000	101.083	-5.0	0	0	11.814	3.883	Jb1-10-B-1	-2.350	0.657	92.9	-96.3	
								Jb1-10-B-1	-2.350	0.657	92.9	-96.3	
								B-1-Jb1-Jb3-1	-7.115	-5.197	335.5	80.8	
Jb1-1-B-4	15.000	100.346	-7.6	0	0	17.507	5.754	Jb1-10-B-1	-17.507	-5.754	706.8	95.0	
Jb1-10-B-1	110.000	100.612	-3.6	0	0	0	0	Jb1-1-B-2	2.354	-0.595	12.7	-97.0	
								Jb1-1-B-2	2.354	-0.595	12.7	-97.0	
								Jb1-1-B-4	17.538	7.159	98.8	92.6	-2.460
								B-10-Jb1-Jb2-1	-18.508	-10.451	110.9	87.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								B-10-Jb-Rul-1	1.146	1.922	11.7	51.2	
								B-10-Bre-Jb1-2	-26.034	-20.997	174.5	77.8	
								B-10-Gko-Jb1-2	18.066	15.577	124.4	75.7	
								B-10-Jb1-Mki-1	3.084	7.979	44.6	36.0	
* Jb2-.6-B-1	6.600	105.000	0.0	18.600	12.049	0	0	Jb2-10-B-2	9.300	6.025	923.2	83.9	
								Jb2-10-B-2	9.300	6.025	923.2	83.9	
Jb2-10-B-1	110.000	100.682	-3.5	0	0	0	0	B-10-Jb1-Jb2-2	18.515	10.430	110.8	87.1	
								G-Jb2-10-B	-18.515	-10.430	110.8	87.1	
Jb2-10-B-2	110.000	100.682	-3.5	0	0	0	0	Jb2-.6-B-1	-9.257	-5.215	55.4	87.1	
								Jb2-.6-B-1	-9.257	-5.215	55.4	87.1	
								G-Jb2-10-B	18.515	10.430	110.8	87.1	
Jb3-1-B-1	15.000	101.108	-5.0	0	0	0	0	B-1-Jb1-Jb3-2	7.116	5.198	335.5	80.8	
								G-Jb3-1-B	-7.116	-5.198	335.5	80.8	
Jb3-1-B-2	15.000	101.108	-5.0	0	0	0	0	N-Jb3-.04-1	-1.186	-0.866	55.9	80.8	
								N-Jb3-.04-2	-1.186	-0.866	55.9	80.8	
								N-Jb3-.04-3	-1.186	-0.866	55.9	80.8	
								G-Jb3-1-B	7.116	5.198	335.5	80.8	
								Jb3-1-B-2d	-3.558	-2.599	167.7	80.8	
Jb3-1-B-2d	15.000	101.108	-5.0	0	0	0	0	N-Jb3-.04-4	-1.186	-0.866	55.9	80.8	
								N-Jb3-.04-5	-1.186	-0.866	55.9	80.8	
								N-Jb3-.04-6	-1.186	-0.866	55.9	80.8	
								Jb3-1-B-2	3.558	2.599	167.7	80.8	
Kba-3-B-1	30.000	100.201	-8.3	0	0	10.940	3.596	Kba-10-B-1	-5.470	-1.798	110.6	95.0	
								Kba-10-B-1	-5.470	-1.798	110.6	95.0	
								C-Kab-3-B	0.000	0.000	0.0	0.0	
Kba-10-B-1	110.000	97.033	-5.8	0	0	0	0	Kba-3-B-1	5.491	2.073	31.7	93.6	-5.000
								Kba-3-B-1	5.491	2.073	31.7	93.6	-5.000
								10-Kba/Msh/Rwi-B	-10.982	-4.146	63.5	93.6	
Kse-1-B-6	11.000	97.103	0.5	10.000	7.500	0	0	Kse-10-B3	10.000	7.500	675.7	80.0	
Kse-1-B-8	11.000	97.588	0.8	10.000	7.500	0	0	Kse-10-B2	10.000	7.500	672.3	80.0	
Kse-10-B2	110.000	101.599	-3.3	0	0	0	0	Kse-1-B-8	-9.945	-6.408	61.1	84.1	10.000
								G-Kse-1-B3	9.945	6.408	61.1	84.1	
Kse-10-B3	110.000	101.040	-3.6	0	0	0	0	Kse-1-B-6	-9.945	-6.397	61.4	84.1	10.000
								G-Kse-1-B2	9.945	6.397	61.4	84.1	
MKi-1-B-1	15.000	99.136	-4.8	0	0	4.237	1.393	MKi-10-B-1	-4.237	-1.393	173.2	95.0	
MKi-3-B-1	30.000	99.994	-7.2	0	0	12.499	4.108	MKi-10-B-1	-12.499	-4.108	253.2	95.0	
MKi-10-B-1	110.000	100.009	-3.6	0	0	0	0	MKi-1-B-1	4.242	1.499	23.6	94.3	
								MKi-3-B-1	12.544	5.016	70.9	92.9	-2.600
								B-10-Mki-Grid-1	-40.000	0.000	209.9	100.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								B-10-Gko-MKi-2	20.471	0.065	107.4	100.0	
								B-10-Jb1-Mki-2	-3.068	-8.453	47.2	34.1	
								B-10-Gha-MKi-2	5.810	1.873	32.0	95.2	
Msh-1-B-1	15.000	99.614	-10.6	0	0	24.737	8.131	Msh-10-B-1	-24.737	-8.131	1006.1	95.0	
								C-Msh-1-B	0.000	0.000	0.0	0.0	
Msh-10-B-1	110.000	98.566	-5.0	0	0	0	0	Msh-1-B-1	24.801	10.977	144.4	91.4	-5.000
								B-10-Gso-Msh-2	-29.499	-9.685	165.3	95.0	
								B-10-Kba-Msh-2	18.799	6.216	105.4	94.9	
								B-10-Gbi-Msh-1M	-14.101	-7.508	85.1	88.3	
N-Jb3-.04-1	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2182.1	78.4	
N-Jb3-.04-2	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2182.1	78.4	
N-Jb3-.04-3	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2182.1	78.4	
N-Jb3-.04-4	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2182.1	78.4	
N-Jb3-.04-5	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2182.1	78.4	
N-Jb3-.04-6	0.400	101.239	-2.8	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2182.1	78.4	
Nde-1-B-1	15.000	96.399	-8.2	0	0	15.001	4.930	Nde-10-B-1	-15.001	-4.930	630.5	95.0	
Nde-10-B-1	110.000	101.040	-3.6	0	0	0	0	Nde-1-B-1	15.071	6.337	84.9	92.2	1.230
								B-10-Bre-Nde-2	-2.563	0.030	13.3	100.0	
								B-10-Gso-Nde-2	-2.563	0.030	13.3	100.0	
								G-Kse-1-B2	-9.945	-6.397	61.4	84.1	
New-Gso-1-B-5	15.000	98.371	-8.3	0	0	10.892	3.580	New-Gso-10-B-5	-10.892	-3.580	448.6	95.0	
New-Gso-10-B-5	110.000	100.338	-4.0	0	0	0	0	New-Gso-1-B-5	10.939	4.530	61.9	92.4	-1.231
								B-10-Gso-Msh-1	29.862	9.768	164.4	95.0	
								B-10-Gso-Nde-1	-40.801	-14.298	226.2	94.4	
Rul-3-B-3	30.000	100.413	-4.6	0	0	2.376	0.781	Rul-10-B-1	-2.376	-0.781	47.9	95.0	
Rul-10-B-1	110.000	100.296	-3.6	0	0	0	0	Rul-3-B-3	2.380	0.833	13.2	94.4	-0.923
								B-10-Rul-Grid-1	-20.000	0.000	104.7	100.0	
								B-10-Rul-Gbi-1R	18.762	1.905	98.7	99.5	
								B-10-Jb-Rul-2	-1.142	-2.738	15.5	38.5	
Rwi-1-B-1	15.000	100.118	-8.1	0	0	3.908	1.285	Rwi-10-B-1	-3.908	-1.285	158.2	95.0	
								C-Rwi-B-1	0.000	0.000	0.0	0.0	
Rwi-10-B-1	110.000	96.842	-5.9	0	0	3.686	1.212	Rwi-1-B-1	3.922	1.461	22.7	93.7	-4.920
								B-10-Kba-Rwi-2	-7.608	-2.673	43.7	94.3	
Sha-3-B-1	30.000	101.132	-2.6	0	0	11.621	3.820	Sha-20-B-1	-11.621	-3.820	232.8	95.0	
Sha-10-B-1	110.000	102.121	-3.0	0	0	0	0	Sha-20-B-1	-40.392	-18.199	227.7	91.2	
								Sha-20-B-1	-40.392	-18.199	227.7	91.2	
								B-10-Bre-Sha-2DT-F	80.784	36.398	455.4	91.2	
Sha-20-B-1	220.000	100.000	0.0	0	0	0	0	Sha-10-B-1	40.450	20.794	119.4	88.9	-4.615
								Sha-10-B-1	40.450	20.794	119.4	88.9	-4.615

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Sha-3-B-1	11.634	4.420	32.7	93.5	-2.813
								B-20-Sha-Grid-1	-92.533	-46.008	271.2	89.5	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

# Indicates a bus with a load mismatch of more than 0.1 MVA

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	92.533	46.008	103.340	89.54 Lagging
Source (Non-Swing Buses):	105.800	32.749	110.753	95.53 Lagging
Total Demand:	198.333	78.757	213.398	92.94 Lagging
Total Motor Load:	30.882	10.150	32.507	95.00 Lagging
Total Static Load:	164.906	54.202	173.585	95.00 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	2.546	14.405		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

1. Report on Power Flow Calculation

2）2023

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Grid Balance

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	3	11	77	91

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	32	0	0	18	0	47	97

Method of Solution:	Newton-Raphson Method
Maximum No. of Iteration:	9999
Precision of Solution:	0.0001000
System Frequency:	50.00 Hz
Unit System:	Metric
Project Filename:	Rwanda-Imp SSs Ph 3
Output Filename:	C:\Users\3062\□□□(ETAP)\Rwanda ETAP Project File\SC-2023 w Gas.lfr

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
10-Kba/Msh/Rwi-B	110.000	95.650	-9.8	0	0	0	0	B-10-Kba-Msh-2	-19.136	-1.225	105.2	99.8	
								B-10-Kba-Rwi-2	5.082	1.746	29.5	94.6	
								Kba-10-B-1	14.054	-0.521	77.2	-99.9	
B-1-Jb1-Jb3-1	15.000	100.294	-8.6	0	0	0	0	B-1-Jb1-Jb3-2	-7.114	-5.189	337.9	80.8	
								Jb1-1-B-2	7.114	5.189	337.9	80.8	
B-1-Jb1-Jb3-2	15.000	100.320	-8.6	0	0	0	0	B-1-Jb1-Jb3-1	7.115	5.191	337.9	80.8	
								Jb3-1-B-1	-7.115	-5.191	337.9	80.8	
B-10-Bre-Gso-1	110.000	101.149	-5.2	0	0	0	0	C-BN	77.160	15.295	408.2	98.1	
								Bre-10-B-1	-77.160	-15.295	408.2	98.1	
B-10-Bre-Jb1-1	110.000	101.149	-5.2	0	0	0	0	B-10-Bre-Jb1-2	38.664	-10.356	207.7	-96.6	
								Bre-10-B-1	-38.664	10.356	207.7	-96.6	
B-10-Bre-Jb1-2	110.000	100.904	-6.0	0	0	0	0	B-10-Bre-Jb1-1	-38.438	10.594	207.4	-96.4	
								Jb1-10-B-1	38.438	-10.594	207.4	-96.4	
B-10-Bre-Nde-2	110.000	100.193	-5.9	0	0	0	0	C-BN	-76.612	-14.502	408.5	98.3	
								Nde-10-B-1	76.612	14.502	408.5	98.3	
B-10-Bre-Sha-1D	110.000	101.149	-5.2	0	0	0	0	B-10-Bre-Sha-2D	-64.628	-3.874	336.0	99.8	
								Bre-10-B-1	64.628	3.874	336.0	99.8	
B-10-Bre-Sha-1DT-F	110.000	101.149	-5.2	0	0	0	0	B-10-Bre-Sha-2DT-F	-64.628	-3.874	336.0	99.8	
								Bre-10-B-1	64.628	3.874	336.0	99.8	
B-10-Bre-Sha-2D	110.000	101.345	-4.9	0	0	0	0	B-10-Bre-Sha-1D	64.734	3.252	335.7	99.9	
								Sha-10-B-1	-64.734	-3.252	335.7	99.9	
B-10-Bre-Sha-2DT-F	110.000	101.345	-4.9	0	0	0	0	B-10-Bre-Sha-1DT-F	64.734	3.252	335.7	99.9	
								Sha-10-B-1	-64.734	-3.252	335.7	99.9	
B-10-Gha-MKi-1	110.000	100.804	-6.4	0	0	0	0	B-10-Gha-MKi-2	-5.906	-2.136	32.7	94.0	
								Gha-10-B-1	5.906	2.136	32.7	94.0	
B-10-Gha-MKi-2	110.000	100.920	-6.3	0	0	0	0	B-10-Gha-MKi-1	5.910	1.905	32.3	95.2	
								MKi-10-B-1	-5.910	-1.905	32.3	95.2	
B-10-Gko-Jb1-1	110.000	100.452	-6.5	0	0	0	0	B-10-Gko-Jb1-2	-27.395	-4.459	145.0	98.7	
								Gko-10-B-1	27.395	4.459	145.0	98.7	
B-10-Gko-Jb1-2	110.000	100.904	-6.0	0	0	0	0	B-10-Gko-Jb1-1	27.479	4.445	144.8	98.7	
								Jb1-10-B-1	-27.479	-4.445	144.8	98.7	
B-10-Gko-MKi-1	110.000	100.452	-6.5	0	0	0	0	B-10-Gko-MKi-2	-20.149	-16.560	136.3	77.3	
								Gko-10-B-1	20.149	16.560	136.3	77.3	
B-10-Gko-MKi-2	110.000	100.920	-6.3	0	0	0	0	B-10-Gko-MKi-1	20.193	16.533	135.7	77.4	
								MKi-10-B-1	-20.193	-16.533	135.7	77.4	
B-10-Gso-Msh-1	110.000	99.108	-6.7	0	0	0	0	B-10-Gso-Msh-2	52.061	7.020	278.2	99.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								New-Gso-10-B-5	-52.061	-7.020	278.2	99.1	
B-10-Gso-Msh-2	110.000	96.725	-8.7	0	0	0	0	B-10-Gso-Msh-1	-51.025	-5.660	278.6	99.4	
								Msh-10-B-1	51.025	5.660	278.6	99.4	
B-10-Gso-Nde-1	110.000	99.108	-6.7	0	0	0	0	C-GN	-66.287	-12.489	357.2	98.3	
								New-Gso-10-B-5	66.287	12.489	357.2	98.3	
B-10-Gso-Nde-2	110.000	100.193	-5.9	0	0	0	0	C-GN	66.832	13.221	356.9	98.1	
								Nde-10-B-1	-66.832	-13.221	356.9	98.1	
B-10-Jb-Rul-1	110.000	100.904	-6.0	0	0	0	0	B-10-Jb-Rul-2	-11.002	-3.133	59.5	96.2	
								Jb1-10-B-1	11.002	3.133	59.5	96.2	
B-10-Jb-Rul-2	110.000	101.791	-5.4	0	0	0	0	B-10-Jb-Rul-1	11.070	2.433	58.4	97.7	
								Rul-10-B-1	-11.070	-2.433	58.4	97.7	
B-10-Jb1-Jb2-1	110.000	100.904	-6.0	0	0	0	0	B-10-Jb1-Jb2-2	-18.487	-14.398	121.9	78.9	
								Jb1-10-B-1	18.487	14.398	121.9	78.9	
B-10-Jb1-Jb2-2	110.000	100.990	-5.9	0	0	0	0	B-10-Jb1-Jb2-1	18.494	14.381	121.8	78.9	
								Jb2-10-B-1	-18.494	-14.381	121.8	78.9	
B-10-Jb1-Mki-1	110.000	100.904	-6.0	0	0	0	0	B-10-Jb1-Mki-2	8.206	-3.085	45.6	-93.6	
								Jb1-10-B-1	-8.206	3.085	45.6	-93.6	
B-10-Jb1-Mki-2	110.000	100.920	-6.3	0	0	0	0	B-10-Jb1-Mki-1	-8.191	2.602	44.7	-95.3	
								MKi-10-B-1	8.191	-2.602	44.7	-95.3	
B-10-Kba-Msh-2	110.000	96.725	-8.7	0	0	0	0	10-Kba/Msh/Rwi-B	19.332	0.851	105.0	99.9	
								Msh-10-B-1	-19.332	-0.851	105.0	99.9	
B-10-Kba-Rwi-2	110.000	95.516	-9.9	0	0	0	0	10-Kba/Msh/Rwi-B	-5.077	-1.961	29.9	93.3	
								Rwi-10-B-1	5.077	1.961	29.9	93.3	
B-10-Mki-Grid-1	110.000	100.920	-6.3	40.000	30.000	0	0	MKi-10-B-1	40.000	30.000	260.0	80.0	
B-10-Rul-Gbi-1G	110.000	101.737	-5.5	0	0	0	0	B-10-Rul-Gbi-1R	-5.871	-2.243	32.4	93.4	
								Gbi-10-B-1	5.871	2.243	32.4	93.4	
B-10-Rul-Gbi-1R	110.000	101.791	-5.4	0	0	0	0	B-10-Rul-Gbi-1G	5.876	-3.519	35.3	-85.8	
								Rul-10-B-1	-5.876	3.519	35.3	-85.8	
B-10-Rul-Grid-1	110.000	101.791	-5.4	20.000	0.000	0	0	Rul-10-B-1	20.000	0.000	103.1	100.0	
* B-20-Sha-Grid-1	220.000	100.000	0.0	143.223	23.031	0	0	Sha-20-B-1	143.223	23.031	380.7	98.7	
Bre-1-B-1	15.000	100.782	-8.6	0	0	23.306	7.660	Bre-10-B-1	-11.653	-3.830	468.5	95.0	
								Bre-10-B-1	-11.653	-3.830	468.5	95.0	
Bre-10-B-1	110.000	101.149	-5.2	0	0	0	0	Bre-1-B-1	11.688	4.604	65.2	93.0	-2.000
								Bre-1-B-1	11.688	4.604	65.2	93.0	-2.000
								B-10-Bre-Jb1-1	38.664	-10.356	207.7	-96.6	
								B-10-Bre-Sha-1DT-F	-64.628	-3.874	336.0	99.8	
								B-10-Bre-Sha-1D	-64.628	-3.874	336.0	99.8	
								B-10-Bre-Gso-1	77.160	15.295	408.2	98.1	
								G-Kse-1-B3	-9.945	-6.399	61.4	84.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
C-BN	110.000	100.343	-5.8	0	0	0	0	B-10-Bre-Gso-1	-76.692	-14.546	408.3	98.2	
								B-10-Bre-Nde-2	76.692	14.546	408.3	98.2	
C-GN	110.000	100.060	-6.1	0	0	0	0	B-10-Gso-Nde-1	66.771	13.225	357.1	98.1	
								B-10-Gso-Nde-2	-66.771	-13.225	357.1	98.1	
C-Kab-3-B	30.000	99.575	-13.2	0	0	0.000	-5.949	Kba-3-B-1	0.000	5.949	115.0	0.0	
C-Msh-1-B	15.000	99.077	-16.3	0	0	0.000	-9.816	Msh-1-B-1	0.000	9.816	381.3	0.0	
C-Rwi-B-1	15.000	99.486	-12.8	0	0	0	0	Rwi-1-B-1	0.000	0.000	0.0	0.0	
G-Jb2-10-B	110.000	100.990	-5.9	0	0	0	0	Jb2-10-B-1	18.494	14.381	121.8	78.9	
								Jb2-10-B-2	-18.494	-14.381	121.8	78.9	
G-Jb3-1-B	15.000	100.320	-8.6	0	0	0	0	Jb3-1-B-1	7.115	5.191	337.9	80.8	
								Jb3-1-B-2	-7.115	-5.191	337.9	80.8	
G-Kse-1-B2	110.000	100.193	-5.9	0	0	0	0	Nde-10-B-1	9.944	6.380	61.9	84.2	
								Kse-10-B3	-9.944	-6.380	61.9	84.2	
G-Kse-1-B3	110.000	101.149	-5.2	0	0	0	0	Bre-10-B-1	9.945	6.399	61.4	84.1	
								Kse-10-B2	-9.945	-6.399	61.4	84.1	
Gbi-3-B-1	30.000	100.877	-8.3	0	0	5.846	1.922	Gbi-10-B-1	-5.846	-1.922	117.4	95.0	
Gbi-10-B-1	110.000	101.737	-5.5	0	0	0	0	Gbi-3-B-1	5.871	2.243	32.4	93.4	-1.250
								B-10-Rul-Gbi-1G	-5.871	-2.243	32.4	93.4	
Gha-1-B-1	15.000	100.927	-8.1	0	0	5.896	1.938	Gha-10-B-1	-5.896	-1.938	236.7	95.0	
Gha-10-B-1	110.000	100.804	-6.4	0	0	0	0	Gha-1-B-1	5.906	2.136	32.7	94.0	-1.300
								B-10-Gha-MKi-1	-5.906	-2.136	32.7	94.0	
Gko-1-B-2	15.000	100.162	-12.1	0	0	20.326	6.681	Gko-1-B-4	-20.326	-6.681	822.2	95.0	
Gko-1-B-4	15.000	100.162	-12.1	0	0	27.098	8.907	Gko-10-B-1	-47.423	-15.587	1918.3	95.0	
								Gko-1-B-2	20.326	6.681	822.2	95.0	
Gko-10-B-1	110.000	100.452	-6.5	0	0	0	0	Gko-1-B-4	47.544	21.019	271.6	91.5	-3.693
								B-10-Gko-Jb1-1	-27.395	-4.459	145.0	98.7	
								B-10-Gko-MKi-1	-20.149	-16.560	136.3	77.3	
Jb1-1-B-2	15.000	100.294	-8.6	0	0	15.633	3.174	Jb1-10-B-1	-4.259	1.008	168.0	-97.3	
								Jb1-10-B-1	-4.259	1.008	168.0	-97.3	
								B-1-Jb1-Jb3-1	-7.114	-5.189	337.9	80.8	
Jb1-1-B-4	15.000	100.789	-11.4	0	0	23.638	4.800	Jb1-10-B-1	-23.638	-4.800	921.1	98.0	
Jb1-10-B-1	110.000	100.904	-6.0	0	0	0	0	Jb1-1-B-2	4.275	-0.804	22.6	-98.3	1.230
								Jb1-1-B-2	4.275	-0.804	22.6	-98.3	1.230
								Jb1-1-B-4	23.691	7.186	128.8	95.7	-2.460
								B-10-Jb1-Jb2-1	-18.487	-14.398	121.9	78.9	
								B-10-Jb-Rul-1	-11.002	-3.133	59.5	96.2	
								B-10-Bre-Jb1-2	-38.438	10.594	207.4	-96.4	
								B-10-Gko-Jb1-2	27.479	4.445	144.8	98.7	
								B-10-Jb1-Mki-1	8.206	-3.085	45.6	-93.6	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Jb2-.6-B-1	6.600	105.537	-2.4	18.600	16.386	0	0	Jb2-10-B-2	9.300	8.193	1027.3	75.0	
								Jb2-10-B-2	9.300	8.193	1027.3	75.0	
Jb2-10-B-1	110.000	100.990	-5.9	0	0	0	0	B-10-Jb1-Jb2-2	18.494	14.381	121.8	78.9	
								G-Jb2-10-B	-18.494	-14.381	121.8	78.9	
Jb2-10-B-2	110.000	100.990	-5.9	0	0	0	0	Jb2-.6-B-1	-9.247	-7.190	60.9	78.9	1.250
								Jb2-.6-B-1	-9.247	-7.190	60.9	78.9	1.250
								G-Jb2-10-B	18.494	14.381	121.8	78.9	
Jb3-1-B-1	15.000	100.320	-8.6	0	0	0	0	B-1-Jb1-Jb3-2	7.115	5.191	337.9	80.8	
								G-Jb3-1-B	-7.115	-5.191	337.9	80.8	
Jb3-1-B-2	15.000	100.320	-8.6	0	0	0	0	N-Jb3-.04-1	-1.186	-0.865	56.3	80.8	
								N-Jb3-.04-2	-1.186	-0.865	56.3	80.8	
								N-Jb3-.04-3	-1.186	-0.865	56.3	80.8	
								G-Jb3-1-B	7.115	5.191	337.9	80.8	
								Jb3-1-B-2d	-3.558	-2.596	169.0	80.8	
Jb3-1-B-2d	15.000	100.320	-8.6	0	0	0	0	N-Jb3-.04-4	-1.186	-0.865	56.3	80.8	
								N-Jb3-.04-5	-1.186	-0.865	56.3	80.8	
								N-Jb3-.04-6	-1.186	-0.865	56.3	80.8	
								Jb3-1-B-2	3.558	2.596	169.0	80.8	
Kba-3-B-1	30.000	99.575	-13.2	0	0	13.990	4.598	Kba-10-B-1	-6.995	0.675	135.8	-99.5	
								Kba-10-B-1	-6.995	0.675	135.8	-99.5	
								C-Kab-3-B	0.000	-5.949	115.0	0.0	
Kba-10-B-1	110.000	95.650	-9.8	0	0	0	0	Kba-3-B-1	7.027	-0.261	38.6	-99.9	-4.000
								Kba-3-B-1	7.027	-0.261	38.6	-99.9	-4.000
								10-Kba/Msh/Rwi-B	-14.054	0.521	77.2	-99.9	
Kse-1-B-6	11.000	96.369	-1.8	10.000	7.500	0	0	Kse-10-B3	10.000	7.500	680.8	80.0	
Kse-1-B-8	11.000	97.198	-1.1	10.000	7.500	0	0	Kse-10-B2	10.000	7.500	675.0	80.0	
Kse-10-B2	110.000	101.149	-5.2	0	0	0	0	Kse-1-B-8	-9.945	-6.399	61.4	84.1	10.000
								G-Kse-1-B3	9.945	6.399	61.4	84.1	
Kse-10-B3	110.000	100.193	-5.9	0	0	0	0	Kse-1-B-6	-9.944	-6.380	61.9	84.2	10.000
								G-Kse-1-B2	9.944	6.380	61.9	84.2	
MKi-1-B-1	15.000	101.088	-7.9	0	0	5.700	1.873	MKi-10-B-1	-5.700	-1.873	228.4	95.0	
MKi-3-B-1	30.000	100.037	-11.0	0	0	16.303	5.358	MKi-10-B-1	-16.303	-5.358	330.1	95.0	
MKi-10-B-1	110.000	100.920	-6.3	0	0	0	0	MKi-1-B-1	5.709	2.058	31.6	94.1	-1.300
								MKi-3-B-1	16.380	6.901	92.4	92.2	-2.600
								B-10-Mki-Grid-1	-40.000	-30.000	260.0	80.0	
								B-10-Gko-MKi-2	20.193	16.533	135.7	77.4	
								B-10-Jb1-Mki-2	-8.191	2.602	44.7	-95.3	
								B-10-Gha-MKi-2	5.910	1.905	32.3	95.2	
Msh-1-B-1	15.000	99.077	-16.3	0	0	31.599	10.386	Msh-10-B-1	-31.599	-0.570	1227.8	100.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								C-Msh-1-B	0.000	-9.816	381.3	0.0	
Msh-10-B-1	110.000	96.725	-8.7	0	0	0	0	Msh-1-B-1	31.693	4.809	173.9	98.9	-3.750
								B-10-Gso-Msh-2	-51.025	-5.660	278.6	99.4	
								B-10-Kba-Msh-2	19.332	0.851	105.0	99.9	
N-Jb3-.04-1	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2197.9	78.4	
N-Jb3-.04-2	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2197.9	78.4	
N-Jb3-.04-3	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2197.9	78.4	
N-Jb3-.04-4	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2197.9	78.4	
N-Jb3-.04-5	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2197.9	78.4	
N-Jb3-.04-6	0.400	100.511	-6.4	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2197.9	78.4	
Nde-1-B-1	15.000	96.820	-9.0	0	0	19.664	6.463	Nde-10-B-1	-9.832	-3.232	411.4	95.0	
								Nde-10-B-1	-9.832	-3.232	411.4	95.0	
Nde-10-B-1	110.000	100.193	-5.9	0	0	0	0	Nde-1-B-1	9.862	3.831	55.4	93.2	1.230
								Nde-1-B-1	9.862	3.831	55.4	93.2	1.230
								B-10-Bre-Nde-2	-76.612	-14.502	408.5	98.3	
								B-10-Gso-Nde-2	66.832	13.221	356.9	98.1	
								G-Kse-1-B2	-9.944	-6.380	61.9	84.2	
New-Gso-1-B-5	15.000	98.310	-9.6	0	0	14.186	4.663	New-Gso-10-B-5	-7.093	-2.331	292.3	95.0	
								New-Gso-10-B-5	-7.093	-2.331	292.3	95.0	
New-Gso-10-B-5	110.000	99.108	-6.7	0	0	0	0	New-Gso-1-B-5	7.113	2.735	40.4	93.3	-1.231
								New-Gso-1-B-5	7.113	2.735	40.4	93.3	-1.231
								B-10-Gso-Msh-1	52.061	7.020	278.2	99.1	
								B-10-Gso-Nde-1	-66.287	-12.489	357.2	98.3	
Rul-3-B-3	30.000	100.740	-6.8	0	0	3.048	1.002	Rul-10-B-1	-3.048	-1.002	61.3	95.0	
Rul-10-B-1	110.000	101.791	-5.4	0	0	0	0	Rul-3-B-3	3.054	1.086	16.7	94.2	
								B-10-Rul-Grid-1	-20.000	0.000	103.1	100.0	
								B-10-Rul-Gbi-1R	5.876	-3.519	35.3	-85.8	
								B-10-Jb-Rul-2	11.070	2.433	58.4	97.7	
Rwi-1-B-1	15.000	99.486	-12.8	0	0	5.054	1.661	Rwi-10-B-1	-5.054	-1.661	205.8	95.0	
								C-Rwi-B-1	0.000	0.000	0.0	0.0	
Rwi-10-B-1	110.000	95.516	-9.9	0	0	0	0	Rwi-1-B-1	5.077	1.961	29.9	93.3	-6.150
								B-10-Kba-Rwi-2	-5.077	-1.961	29.9	93.3	
Sha-3-B-1	30.000	100.822	-3.0	0	0	13.487	4.433	Sha-20-B-1	-13.487	-4.433	271.0	95.0	
Sha-10-B-1	110.000	101.345	-4.9	0	0	0	0	Sha-20-B-1	-64.734	-3.252	335.7	99.9	
								Sha-20-B-1	-64.734	-3.252	335.7	99.9	
								B-10-Bre-Sha-2DT-F	64.734	3.252	335.7	99.9	
								B-10-Bre-Sha-2D	64.734	3.252	335.7	99.9	
Sha-20-B-1	220.000	100.000	0.0	0	0	0	0	Sha-10-B-1	64.859	8.892	171.8	99.1	-2.308
								Sha-10-B-1	64.859	8.892	171.8	99.1	-2.308

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Sha-3-B-1	13.505	5.247	38.0	93.2	-2.813
								B-20-Sha-Grid-1	-143.223	-23.031	380.7	98.7	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

# Indicates a bus with a load mismatch of more than 0.1 MVA

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	143.223	23.031	145.062	98.73 Lagging
Source (Non-Swing Buses):	105.800	67.086	125.276	84.45 Lagging
Total Demand:	249.023	90.117	264.827	94.03 Lagging
Total Motor Load:	39.271	12.175	41.116	95.51 Lagging
Total Static Load:	205.501	47.579	210.937	97.42 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	4.250	30.363		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

1. Report on Power Flow Calculation

3）2030

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Grid Balance

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	11	79	91

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	43	0	0	19	0	49	111

Method of Solution:	Newton-Raphson Method
Maximum No. of Iteration:	9999
Precision of Solution:	0.0001000
System Frequency:	50.00 Hz
Unit System:	Metric
Project Filename:	Rwanda-Imp SSs Ph 3
Output Filename:	C:\Users\3062\□□□(ETAP)\Rwanda ETAP Project File\LF-2030 w Gas.lfr

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
10-Kba/Msh/Rwi-B	110.000	95.718	-12.9	0	0	0	0	B-10-Kba-Msh-2	-39.319	-3.142	216.3	99.7	
								B-10-Kba-Rwi-2	14.273	-0.708	78.4	-99.9	
								Kba-10-B-1	25.046	3.850	139.0	98.8	
B-1-Jb1-Jb3-1	15.000	100.700	-12.4	0	0	0	0	B-1-Jb1-Jb3-2	-7.114	-5.193	336.7	80.8	
								Jb1-1-B-2	7.114	5.193	336.7	80.8	
B-1-Jb1-Jb3-2	15.000	100.725	-12.4	0	0	0	0	B-1-Jb1-Jb3-1	7.116	5.195	336.7	80.8	
								Jb3-1-B-1	-7.116	-5.195	336.7	80.8	
B-10-Bre-Gso-1	110.000	102.181	-5.3	0	0	0	0	C-BN	164.945	44.602	877.7	96.5	
								Bre-10-B-1	-164.945	-44.602	877.7	96.5	
B-10-Bre-Jb1-1	110.000	102.181	-5.3	0	0	0	0	B-10-Bre-Jb1-2	137.149	28.284	719.3	97.9	
								Bre-10-B-1	-137.149	-28.284	719.3	97.9	
B-10-Bre-Jb1-2	110.000	100.238	-7.4	0	0	0	0	B-10-Bre-Jb1-1	-135.453	-23.144	719.5	98.6	
								Jb1-10-B-1	135.453	23.144	719.5	98.6	
B-10-Bre-Nde-2	110.000	100.968	-6.6	0	0	0	0	C-BN	-163.900	-40.899	878.1	97.0	
								Nde-10-B-1	163.900	40.899	878.1	97.0	
B-10-Bre-Sha-1D	110.000	102.181	-5.3	0	0	0	0	B-10-Bre-Sha-2D	-167.846	-42.135	888.9	97.0	
								Bre-10-B-1	167.846	42.135	888.9	97.0	
B-10-Bre-Sha-1DT-F	110.000	102.181	-5.3	0	0	0	0	B-10-Bre-Sha-2DT-F	-167.846	-42.135	888.9	97.0	
								Bre-10-B-1	167.846	42.135	888.9	97.0	
B-10-Bre-Sha-2D	110.000	102.974	-4.6	0	0	0	0	B-10-Bre-Sha-1D	168.585	43.662	887.6	96.8	
								Sha-10-B-1	-168.585	-43.662	887.6	96.8	
B-10-Bre-Sha-2DT-F	110.000	102.974	-4.6	0	0	0	0	B-10-Bre-Sha-1DT-F	168.585	43.662	887.6	96.8	
								Sha-10-B-1	-168.585	-43.662	887.6	96.8	
B-10-Gha-MKi-1	110.000	99.329	-8.3	0	0	0	0	B-10-Gha-MKi-2	0.068	-0.683	3.6	-9.9	
								Gha-10-B-1	-0.068	0.683	3.6	-9.9	
B-10-Gha-MKi-2	110.000	99.345	-8.3	0	0	0	0	B-10-Gha-MKi-1	-0.068	0.447	2.4	-15.0	
								MKi-10-B-1	0.068	-0.447	2.4	-15.0	
B-10-Gko-Jb1-1	110.000	98.799	-8.5	0	0	0	0	B-10-Gko-Jb1-2	-64.243	-20.252	357.8	95.4	
								Gko-10-B-1	64.243	20.252	357.8	95.4	
B-10-Gko-Jb1-2	110.000	100.238	-7.4	0	0	0	0	B-10-Gko-Jb1-1	64.752	21.590	357.4	94.9	
								Jb1-10-B-1	-64.752	-21.590	357.4	94.9	
B-10-Gko-MKi-1	110.000	98.799	-8.5	0	0	0	0	B-10-Gko-MKi-2	-25.356	-18.248	166.0	81.2	
								Gko-10-B-1	25.356	18.248	166.0	81.2	
B-10-Gko-MKi-2	110.000	99.345	-8.3	0	0	0	0	B-10-Gko-MKi-1	25.421	18.293	165.5	81.2	
								MKi-10-B-1	-25.421	-18.293	165.5	81.2	
B-10-Gso-Gha-1	110.000	99.800	-7.9	0	0	0	0	B-10-Gso-Gha-2	11.125	3.176	60.8	96.2	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								New-Gso-10-B-5	-11.125	-3.176	60.8	96.2	
B-10-Gso-Gha-2	110.000	99.329	-8.3	0	0	0	0	B-10-Gso-Gha-1	-11.095	-3.618	61.7	95.1	
								Gha-10-B-1	11.095	3.618	61.7	95.1	
B-10-Gso-Msh-1	110.000	99.800	-7.9	0	0	0	0	B-10-Gso-Msh-2	99.049	13.602	525.8	99.1	
								New-Gso-10-B-5	-99.049	-13.602	525.8	99.1	
B-10-Gso-Msh-2	110.000	98.055	-10.8	0	0	0	0	B-10-Gso-Msh-1	-97.894	-9.118	526.3	99.6	
								Msh-10-B-1	97.894	9.118	526.3	99.6	
B-10-Gso-Nde-1	110.000	99.800	-7.9	0	0	0	0	C-GN	-136.480	-28.120	732.8	97.9	
								New-Gso-10-B-5	136.480	28.120	732.8	97.9	
B-10-Gso-Nde-2	110.000	100.968	-6.6	0	0	0	0	C-GN	137.374	31.295	732.4	97.5	
								Nde-10-B-1	-137.374	-31.295	732.4	97.5	
B-10-Jb-Rul-1	110.000	100.238	-7.4	0	0	0	0	B-10-Jb-Rul-2	0.245	-13.456	70.5	-1.8	
								Jb1-10-B-1	-0.245	13.456	70.5	-1.8	
B-10-Jb-Rul-2	110.000	101.656	-7.8	0	0	0	0	B-10-Jb-Rul-1	-0.154	12.811	66.1	-1.2	
								Rul-10-B-1	0.154	-12.811	66.1	-1.2	
B-10-Jb1-Jb2-1	110.000	100.238	-7.4	0	0	0	0	B-10-Jb1-Jb2-2	-18.471	-14.098	121.7	79.5	
								Jb1-10-B-1	18.471	14.098	121.7	79.5	
B-10-Jb1-Jb2-2	110.000	100.324	-7.3	0	0	0	0	B-10-Jb1-Jb2-1	18.479	14.081	121.5	79.5	
								Jb2-10-B-1	-18.479	-14.081	121.5	79.5	
B-10-Jb1-Mki-1	110.000	100.238	-7.4	0	0	0	0	B-10-Jb1-Mki-2	26.224	5.268	140.1	98.0	
								Jb1-10-B-1	-26.224	-5.268	140.1	98.0	
B-10-Jb1-Mki-2	110.000	99.345	-8.3	0	0	0	0	B-10-Jb1-Mki-1	-26.076	-5.317	140.6	98.0	
								MKi-10-B-1	26.076	5.317	140.6	98.0	
B-10-Kba-Msh-2	110.000	98.055	-10.8	0	0	0	0	10-Kba/Msh/Rwi-B	40.147	3.940	215.9	99.5	
								Msh-10-B-1	-40.147	-3.940	215.9	99.5	
B-10-Kba-Rwi-2	110.000	95.514	-13.2	0	0	0	0	10-Kba/Msh/Rwi-B	-14.239	0.546	78.3	-99.9	
								Rwi-10-B-1	14.239	-0.546	78.3	-99.9	
B-10-Mki-Grid-1	110.000	99.345	-8.3	40.000	30.000	0	0	MKi-10-B-1	40.000	30.000	264.2	80.0	
B-10-Rul-Gbi-1G	110.000	101.345	-8.1	0	0	0	0	B-10-Rul-Gbi-1R	-13.147	-5.131	73.1	93.2	
								Gbi-10-B-1	13.147	5.131	73.1	93.2	
B-10-Rul-Gbi-1R	110.000	101.656	-7.8	0	0	0	0	B-10-Rul-Gbi-1G	13.173	-0.530	68.1	-99.9	
								Rul-10-B-1	-13.173	0.530	68.1	-99.9	
B-10-Rul-Grid-1	110.000	101.656	-7.8	20.000	15.000	0	0	Rul-10-B-1	20.000	15.000	129.1	80.0	
* B-20-Sha-Grid-1	220.000	100.000	0.0	355.301	123.994	0	0	Sha-20-B-1	355.301	123.994	987.6	94.4	
Bre-1-B-1	15.000	101.214	-9.4	0	0	43.382	14.259	Bre-10-B-1	-14.461	-4.753	578.9	95.0	
								Bre-10-B-1	-14.461	-4.753	578.9	95.0	
								Bre-10-B-1	-14.461	-4.753	578.9	95.0	
Bre-10-B-1	110.000	102.181	-5.3	0	0	0	0	Bre-1-B-1	14.515	5.935	80.5	92.6	-2.000
								Bre-1-B-1	14.515	5.935	80.5	92.6	-2.000

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bre-1-B-1	14.515	5.935	80.5	92.6	-2.000
								B-10-Bre-Jb1-1	137.149	28.284	719.3	97.9	
								B-10-Bre-Sha-1DT-F	-167.846	-42.135	888.9	97.0	
								B-10-Bre-Sha-1D	-167.846	-42.135	888.9	97.0	
								B-10-Bre-Gso-1	164.945	44.602	877.7	96.5	
								G-Kse-1-B3	-9.946	-6.419	60.8	84.0	
C-BN	110.000	101.322	-6.3	0	0	0	0	B-10-Bre-Gso-1	-164.268	-41.693	877.9	96.9	
								B-10-Bre-Nde-2	164.268	41.693	877.9	96.9	
C-GN	110.000	100.683	-6.8	0	0	0	0	B-10-Gso-Nde-1	137.117	30.793	732.6	97.6	
								B-10-Gso-Nde-2	-137.117	-30.793	732.6	97.6	
C-Kab-3-B	30.000	100.480	-16.8	0	0	0.000	-6.058	Kba-3-B-1	0.000	6.058	116.0	0.0	
C-Msh-1-B	15.000	101.242	-17.5	0	0	0.000	-20.500	Msh-1-B-1	0.000	20.500	779.4	0.0	
C-Rwi-B-1	15.000	101.245	-18.8	0	0	0.000	-6.150	Rwi-1-B-1	0.000	6.150	233.8	0.0	
G-Jb2-10-B	110.000	100.324	-7.3	0	0	0	0	Jb2-10-B-1	18.479	14.081	121.5	79.5	
								Jb2-10-B-2	-18.479	-14.081	121.5	79.5	
G-Jb3-1-B	15.000	100.725	-12.4	0	0	0	0	Jb3-1-B-1	7.116	5.195	336.7	80.8	
								Jb3-1-B-2	-7.116	-5.195	336.7	80.8	
G-Kse-1-B2	110.000	100.968	-6.6	0	0	0	0	Nde-10-B-1	9.945	6.395	61.5	84.1	
								Kse-10-B3	-9.945	-6.395	61.5	84.1	
G-Kse-1-B3	110.000	102.181	-5.3	0	0	0	0	Bre-10-B-1	9.946	6.419	60.8	84.0	
								Kse-10-B2	-9.946	-6.419	60.8	84.0	
Gbi-3-B-1	30.000	100.148	-11.3	0	0	13.083	4.300	Gbi-10-B-1	-6.437	-2.116	130.2	95.0	
								Gbi-10-B-1	-6.646	-2.184	134.4	95.0	
Gbi-10-B-1	110.000	101.345	-8.1	0	0	0	0	Gbi-3-B-1	6.468	2.524	36.0	93.2	-1.250
								Gbi-3-B-1	6.679	2.606	37.1	93.2	-1.250
								B-10-Rul-Gbi-1G	-13.147	-5.131	73.1	93.2	
Gha-1-B-1	15.000	101.047	-11.4	0	0	10.993	3.613	Gha-10-B-1	-10.993	-3.613	440.8	95.0	
Gha-10-B-1	110.000	99.329	-8.3	0	0	0	0	Gha-1-B-1	11.027	4.301	62.5	93.2	-3.900
								B-10-Gha-MKi-1	0.068	-0.683	3.6	-9.9	
								B-10-Gso-Gha-2	-11.095	-3.618	61.7	95.1	
Gko-1-B-2	15.000	104.738	-12.8	0	0	40.406	13.281	Gko-10-B-1	-13.532	-4.452	523.5	95.0	
								Gko-10-B-1	-13.636	-4.474	527.4	95.0	
								Gko-10-B-1	-13.238	-4.355	512.1	95.0	
Gko-1-B-4	15.000	101.039	-14.3	0	0	48.893	16.070	Gko-10-B-1	-48.893	-16.070	1960.6	95.0	
Gko-10-B-1	110.000	98.799	-8.5	0	0	0	0	Gko-1-B-2	13.590	5.616	78.1	92.4	-8.616
								Gko-1-B-4	49.019	21.745	284.9	91.4	-6.155
								Gko-1-B-2	13.695	5.646	78.7	92.5	-8.610
								Gko-1-B-2	13.295	5.494	76.4	92.4	-8.616
								B-10-Gko-Jb1-1	-64.243	-20.252	357.8	95.4	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								B-10-Gko-MKi-1	-25.356	-18.248	166.0	81.2	
Jb1-1-B-2	15.000	100.700	-12.4	0	0	16.674	5.465	Jb1-10-B-1	-8.841	-2.122	347.5	97.2	
								Jb1-10-B-1	-8.841	-2.122	347.5	97.2	
								B-1-Jb1-Jb3-1	-7.114	-5.193	336.7	80.8	
								Jb1-1-B-4	8.121	3.972	345.6	89.8	
Jb1-1-B-4	15.000	100.700	-12.4	0	0	52.908	17.340	Jb1-10-B-1	-22.393	-6.684	893.2	95.8	
								Jb1-10-B-1	-22.393	-6.684	893.2	95.8	
								Jb1-1-B-2	-8.121	-3.972	345.6	89.8	
Jb1-10-B-1	110.000	100.238	-7.4	0	0	0	0	Jb1-1-B-2	8.908	2.992	49.2	94.8	-3.690
								Jb1-1-B-2	8.908	2.992	49.2	94.8	-3.690
								Jb1-1-B-4	22.443	8.928	126.5	92.9	-3.690
								Jb1-1-B-4	22.443	8.928	126.5	92.9	-3.690
								B-10-Jb1-Jb2-1	-18.471	-14.098	121.7	79.5	
								B-10-Jb-Rul-1	0.245	-13.456	70.5	-1.8	
								B-10-Bre-Jb1-2	-135.453	-23.144	719.5	98.6	
								B-10-Gko-Jb1-2	64.752	21.590	357.4	94.9	
								B-10-Jb1-Mki-1	26.224	5.268	140.1	98.0	
Jb2-.6-B-1	6.600	98.432	-3.3	18.600	16.386	0	0	Jb2-10-B-2	9.300	8.193	1101.5	75.0	
								Jb2-10-B-2	9.300	8.193	1101.5	75.0	
Jb2-10-B-1	110.000	100.324	-7.3	0	0	0	0	B-10-Jb1-Jb2-2	18.479	14.081	121.5	79.5	
								G-Jb2-10-B	-18.479	-14.081	121.5	79.5	
Jb2-10-B-2	110.000	100.324	-7.3	0	0	0	0	Jb2-.6-B-1	-9.239	-7.040	60.8	79.5	8.750
								Jb2-.6-B-1	-9.239	-7.040	60.8	79.5	8.750
								G-Jb2-10-B	18.479	14.081	121.5	79.5	
Jb3-1-B-1	15.000	100.725	-12.4	0	0	0	0	B-1-Jb1-Jb3-2	7.116	5.195	336.7	80.8	
								G-Jb3-1-B	-7.116	-5.195	336.7	80.8	
Jb3-1-B-2	15.000	100.725	-12.4	0	0	0	0	N-Jb3-.04-1	-1.186	-0.866	56.1	80.8	
								N-Jb3-.04-2	-1.186	-0.866	56.1	80.8	
								N-Jb3-.04-3	-1.186	-0.866	56.1	80.8	
								G-Jb3-1-B	7.116	5.195	336.7	80.8	
								Jb3-1-B-2d	-3.558	-2.597	168.3	80.8	
Jb3-1-B-2d	15.000	100.725	-12.4	0	0	0	0	N-Jb3-.04-4	-1.186	-0.866	56.1	80.8	
								N-Jb3-.04-5	-1.186	-0.866	56.1	80.8	
								N-Jb3-.04-6	-1.186	-0.866	56.1	80.8	
								Jb3-1-B-2	3.558	2.597	168.3	80.8	
Kba-3-B-1	30.000	100.480	-16.8	0	0	24.914	8.189	Kba-10-B-1	-8.305	-0.710	159.6	99.6	
								Kba-10-B-1	-8.305	-0.710	159.6	99.6	
								Kba-10-B-1	-8.305	-0.710	159.6	99.6	
								C-Kab-3-B	0.000	-6.058	116.0	0.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Kba-10-B-1	110.000	95.718	-12.9	0	0	0	0	Kba-3-B-1	8.349	1.283	46.3	98.8	-6.000
								Kba-3-B-1	8.349	1.283	46.3	98.8	-6.000
								Kba-3-B-1	8.349	1.283	46.3	98.8	-6.000
								10-Kba/Msh/Rwi-B	-25.046	-3.850	139.0	98.8	
Kse-1-B-6	11.000	97.041	-2.4	10.000	7.500	0	0	Kse-10-B3	10.000	7.500	676.1	80.0	
Kse-1-B-8	11.000	98.092	-1.3	10.000	7.500	0	0	Kse-10-B2	10.000	7.500	668.8	80.0	
Kse-10-B2	110.000	102.181	-5.3	0	0	0	0	Kse-1-B-8	-9.946	-6.419	60.8	84.0	10.000
								G-Kse-1-B3	9.946	6.419	60.8	84.0	
Kse-10-B3	110.000	100.968	-6.6	0	0	0	0	Kse-1-B-6	-9.945	-6.395	61.5	84.1	10.000
								G-Kse-1-B2	9.945	6.395	61.5	84.1	
MKi-1-B-1	15.000	101.176	-11.3	0	0	10.507	3.453	MKi-10-B-1	-10.507	-3.453	420.8	95.0	
MKi-3-B-1	30.000	100.106	-12.6	0	0	30.054	9.878	MKi-10-B-1	-15.027	-4.939	304.1	95.0	
								MKi-10-B-1	-15.027	-4.939	304.1	95.0	
MKi-10-B-1	110.000	99.345	-8.3	0	0	0	0	MKi-1-B-1	10.538	4.080	59.7	93.3	-3.900
								MKi-3-B-1	15.093	6.248	86.3	92.4	-3.900
								MKi-3-B-1	15.093	6.248	86.3	92.4	-3.900
								B-10-Mki-Grid-1	-40.000	-30.000	264.2	80.0	
								B-10-Gko-MKi-2	25.421	18.293	165.5	81.2	
								B-10-Jb1-Mki-2	-26.076	-5.317	140.6	98.0	
								B-10-Gha-MKi-2	-0.068	0.447	2.4	-15.0	
Msh-1-B-1	15.000	101.242	-17.5	0	0	57.598	18.931	Msh-10-B-1	-28.799	0.784	1095.3	-100.0	
								Msh-10-B-1	-28.799	0.784	1095.3	-100.0	
								C-Msh-1-B	0.000	-20.500	779.4	0.0	
Msh-10-B-1	110.000	98.055	-10.8	0	0	0	0	Msh-1-B-1	28.874	2.589	155.2	99.6	-3.750
								Msh-1-B-1	28.874	2.589	155.2	99.6	-3.750
								B-10-Gso-Msh-2	-97.894	-9.118	526.3	99.6	
								B-10-Kba-Msh-2	40.147	3.940	215.9	99.5	
N-Jb3-.04-1	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2189.7	78.4	
N-Jb3-.04-2	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2189.7	78.4	
N-Jb3-.04-3	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2	1.200	0.950	2189.7	78.4	
N-Jb3-.04-4	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2189.7	78.4	
N-Jb3-.04-5	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2189.7	78.4	
N-Jb3-.04-6	0.400	100.886	-10.2	1.200	0.950	0	0	Jb3-1-B-2d	1.200	0.950	2189.7	78.4	
Nde-1-B-1	15.000	96.785	-12.0	0	0	36.267	11.920	Nde-10-B-1	-18.133	-5.960	759.1	95.0	
								Nde-10-B-1	-18.133	-5.960	759.1	95.0	
Nde-10-B-1	110.000	100.968	-6.6	0	0	0	0	Nde-1-B-1	18.235	8.000	103.5	91.6	
								Nde-1-B-1	18.235	8.000	103.5	91.6	
								B-10-Bre-Nde-2	-163.900	-40.899	878.1	97.0	
								B-10-Gso-Nde-2	137.374	31.295	732.4	97.5	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								G-Kse-1-B2	-9.945	-6.395	61.5	84.1	
New-Gso-1-B-5	15.000	98.388	-13.0	0	0	26.169	8.601	New-Gso-10-B-5	-13.085	-4.301	538.8	95.0	
								New-Gso-10-B-5	-13.085	-4.301	538.8	95.0	
New-Gso-10-B-5	110.000	99.800	-7.9	0	0	0	0	New-Gso-1-B-5	13.153	5.671	75.3	91.8	-2.461
								New-Gso-1-B-5	13.153	5.671	75.3	91.8	-2.461
								B-10-Gso-Gha-1	11.125	3.176	60.8	96.2	
								B-10-Gso-Msh-1	99.049	13.602	525.8	99.1	
								B-10-Gso-Nde-1	-136.480	-28.120	732.8	97.9	
Rul-3-B-3	30.000	101.097	-10.9	0	0	6.948	2.284	Rul-10-B-1	-6.948	-2.284	139.2	95.0	
Rul-10-B-1	110.000	101.656	-7.8	0	0	0	0	Rul-3-B-3	6.981	2.719	38.7	93.2	-1.846
								B-10-Rul-Grid-1	-20.000	-15.000	129.1	80.0	
								B-10-Rul-Gbi-1R	13.173	-0.530	68.1	-99.9	
								B-10-Jb-Rul-2	-0.154	12.811	66.1	-1.2	
Rwi-1-B-1	15.000	101.245	-18.8	0	0	9.100	2.991	Rwi-10-B-1	-9.100	3.159	366.2	-94.5	
								C-Rwi-B-1	0.000	-6.150	233.8	0.0	
Rwi-10-B-1	110.000	95.514	-13.2	0	0	5.066	1.665	Rwi-1-B-1	9.173	-2.211	51.9	-97.2	-3.690
								B-10-Kba-Rwi-2	-14.239	0.546	78.3	-99.9	
Sha-3-B-1	30.000	101.174	-3.9	0	0	17.443	5.733	Sha-20-B-1	-17.443	-5.733	349.3	95.0	
Sha-10-B-1	110.000	102.974	-4.6	0	0	0	0	Sha-20-B-1	-63.240	-16.379	333.0	96.8	
								Sha-20-B-1	-63.240	-16.379	333.0	96.8	
								Sha-20-B-1	-105.344	-27.283	554.7	96.8	
								Sha-20-B-1	-105.344	-27.283	554.7	96.8	
								B-10-Bre-Sha-2DT-F	168.585	43.662	887.6	96.8	
								B-10-Bre-Sha-2D	168.585	43.662	887.6	96.8	
Sha-20-B-1	220.000	100.000	0.0	0	0	0	0	Sha-10-B-1	63.364	21.928	176.0	94.5	-5.385
								Sha-10-B-1	63.364	21.928	176.0	94.5	-5.385
								Sha-3-B-1	17.473	7.086	49.5	92.7	-3.750
								Sha-10-B-1	105.550	36.527	293.1	94.5	-5.385
								Sha-10-B-1	105.550	36.527	293.1	94.5	-5.385
								B-20-Sha-Grid-1	-355.301	-123.994	987.6	94.4	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

# Indicates a bus with a load mismatch of more than 0.1 MVA

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	355.301	123.994	376.315	94.42 Lagging
Source (Non-Swing Buses):	105.800	82.086	133.910	79.01 Lagging
Total Demand:	461.101	206.080	505.057	91.30 Lagging
Total Motor Load:	71.062	23.347	74.799	95.00 Lagging
Total Static Load:	379.345	91.921	390.323	97.19 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	10.694	90.812		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

2. Report on Three-phase Short-circuit Calculation

1）2020

3-Phase fault at bus: **Bre-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 22.130 kA Method C
Steady State = 7.693 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-1-B-1	Total	0.00	0.488	-8.460	17.3	8.474
Bre-10-B-1	Bre-1-B-1	93.60	0.411	-7.695	18.7	7.706
Bre-1-L-21	Bre-1-B-1	100.00	0.077	-0.765	10.0	0.769

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	8.474	13.151	10.056
0.02	8.474	12.036	8.548
0.03	8.474	11.132	7.219
0.04	8.474	10.439	6.096
0.05	8.474	9.995	5.300
0.06	8.474	9.596	4.502
0.07	8.474	9.297	3.824
0.08	8.474	9.076	3.249
0.09	8.474	8.912	2.760
0.10	8.474	8.823	2.455
0.15	8.474	8.547	1.111
0.20	8.474	8.489	0.503
0.25	8.474	8.477	0.228
0.30	8.474	8.475	0.103

3-Phase fault at bus: **Bre-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 38.083 kA Method C
Steady State = 15.901 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-10-B-1	Total	0.00	2.768	-16.171	5.8	16.406
Bre-1-B-1	Bre-10-B-1	8.55	0.009	-0.095	10.5	0.096
Kse-1-B-8	Kse-10-B2	28.98	0.013	-0.242	19.3	0.242
C-BN	B-10-Bre-Gso-1	5.22	0.378	-1.793	4.7	1.832
B-10-Bre-Sha-2DT-F	B-10-Bre-Sha-1DT-F	12.54	0.504	-7.834	15.5	7.851
B-10-Bre-Jb1-2	B-10-Bre-Jb1-1	36.87	1.864	-6.206	3.3	6.479
B-10-Bre-Gso-1	Bre-10-B-1	0.00	0.378	-1.793	4.7	1.832
B-10-Bre-Jb1-1	Bre-10-B-1	0.00	1.864	-6.206	3.3	6.479
B-10-Bre-Sha-1DT-F	Bre-10-B-1	0.00	0.504	-7.834	15.5	7.851
G-Kse-1-B3	Bre-10-B-1	0.00	0.013	-0.242	19.3	0.242
Kse-10-B2	G-Kse-1-B3	0.00	0.013	-0.242	19.3	0.242

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.385	22.328	15.168
0.02	16.379	20.207	11.834
0.03	16.372	18.424	8.451
0.04	16.363	17.441	6.036
0.05	16.353	17.301	5.649
0.06	16.350	16.895	4.258
0.07	16.347	16.659	3.210
0.08	16.344	16.522	2.420
0.09	16.341	16.442	1.824
0.10	16.337	16.442	1.856
0.15	16.331	16.340	0.525
0.20	16.324	16.325	0.148
0.25	16.316	16.316	0.042
0.30	16.307	16.307	0.012

3-Phase fault at bus: **Gko-1-B-2**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 51.791 kA Method C
Steady State = 18.278 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-1-B-2	Total	0.00	1.635	-20.368	12.5	20.434
Gko-10-B-1	Gko-1-B-2	82.11	0.477	-6.117	12.8	6.135
Gko-10-B-1	Gko-1-B-2	82.11	0.481	-6.162	12.8	6.181
Gko-10-B-1	Gko-1-B-2	82.11	0.467	-5.990	12.8	6.008
Gko-1-L-21	Gko-1-B-2	100.00	0.210	-2.099	10.0	2.109

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	20.434	30.446	22.570
0.02	20.434	27.086	17.779
0.03	20.434	24.739	13.946
0.04	20.434	23.177	10.939
0.05	20.434	22.217	8.722
0.06	20.434	21.555	6.863
0.07	20.434	21.135	5.401
0.08	20.434	20.871	4.250
0.09	20.434	20.706	3.345
0.10	20.434	20.612	2.702
0.15	20.434	20.450	0.826
0.20	20.434	20.435	0.253
0.25	20.434	20.434	0.077
0.30	20.434	20.434	0.024

3-Phase fault at bus: **Gko-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 31.099 kA Method C
Steady State = 13.636 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-10-B-1	Total	0.00	2.841	-13.801	4.9	14.090
Gko-1-B-2	Gko-10-B-1	8.64	0.008	-0.088	10.5	0.088
Gko-1-B-2	Gko-10-B-1	8.64	0.008	-0.088	10.5	0.089
Gko-1-B-2	Gko-10-B-1	8.64	0.008	-0.086	10.5	0.086
B-10-Gko-MKi-2	B-10-Gko-MKi-1	29.99	1.429	-7.894	5.5	8.022
B-10-Gko-Jb1-2	B-10-Gko-Jb1-1	36.63	1.387	-5.646	4.1	5.813
B-10-Gko-Jb1-1	Gko-10-B-1	0.00	1.387	-5.646	4.1	5.813
B-10-Gko-MKi-1	Gko-10-B-1	0.00	1.429	-7.894	5.5	8.022

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	14.086	17.812	10.902
0.02	14.086	15.458	6.367
0.03	14.085	14.537	3.599
0.04	14.083	14.229	2.034
0.05	14.081	14.140	1.286
0.06	14.081	14.101	0.743
0.07	14.081	14.087	0.430
0.08	14.081	14.083	0.248
0.09	14.080	14.081	0.144
0.10	14.080	14.080	0.098
0.15	14.079	14.079	0.007
0.20	14.078	14.078	0.000
0.25	14.076	14.076	0.000
0.30	14.074	14.074	0.000

3-Phase fault at bus: **Jb1-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 37.243 kA Method C
Steady State = 16.424 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-10-B-1	Total	0.00	3.472	-16.591	4.8	16.951
Jb1-1-B-2	Jb1-10-B-1	21.52	0.011	-0.129	11.8	0.130
Jb1-1-B-2	Jb1-10-B-1	21.52	0.011	-0.129	11.8	0.130
Jb1-1-B-4	Jb1-10-B-1	6.75	0.009	-0.096	10.6	0.096
B-10-Jb1-Mki-2	B-10-Jb1-Mki-1	37.31	0.546	-3.076	5.6	3.124
B-10-Gko-Jb1-1	B-10-Gko-Jb1-2	23.89	0.660	-3.733	5.7	3.791
B-10-Bre-Jb1-1	B-10-Bre-Jb1-2	35.60	1.309	-6.118	4.7	6.256
B-10-Jb-Rul-2	B-10-Jb-Rul-1	61.63	0.897	-2.770	3.1	2.911
B-10-Jb1-Jb2-2	B-10-Jb1-Jb2-1	0.42	0.029	-0.541	18.6	0.542
B-10-Bre-Jb1-2	Jb1-10-B-1	0.00	1.309	-6.118	4.7	6.256
B-10-Gko-Jb1-2	Jb1-10-B-1	0.00	0.660	-3.733	5.7	3.791
B-10-Jb-Rul-1	Jb1-10-B-1	0.00	0.897	-2.770	3.1	2.911
B-10-Jb1-Jb2-1	Jb1-10-B-1	0.00	0.029	-0.541	18.6	0.542
B-10-Jb1-Mki-1	Jb1-10-B-1	0.00	0.546	-3.076	5.6	3.124

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.923	21.287	12.913
0.02	16.915	18.486	7.458
0.03	16.904	17.409	4.160
0.04	16.892	17.051	2.320
0.05	16.879	16.948	1.536
0.06	16.875	16.898	0.887
0.07	16.871	16.878	0.512
0.08	16.866	16.869	0.295
0.09	16.862	16.863	0.171
0.10	16.857	16.858	0.142
0.15	16.848	16.848	0.011
0.20	16.839	16.839	0.001

(Cont.)

3-Phase fault at bus: **Jb1-10-B-1**

Nominal kV	=	110.000	
Voltage c Factor	=	1.10	(User-Defined)
Peak Value	=	37.243	kA Method C
Steady State	=	16.424	kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.25	16.828	16.828	0.000
0.30	16.816	16.816	0.000

3-Phase fault at bus: **Nde-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 23.311 kA Method C
Steady State = 8.163 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-1-B-1	Total	0.00	0.656	-9.078	13.8	9.102
Nde-10-B-1	Nde-1-B-1	90.75	0.565	-8.162	14.5	8.181
Nde-1-L-21	Nde-1-B-1	100.00	0.092	-0.917	10.0	0.921

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	9.102	13.754	10.311
0.02	9.102	12.353	8.351
0.03	9.102	11.318	6.727
0.04	9.102	10.593	5.418
0.05	9.102	10.144	4.478
0.06	9.102	9.798	3.626
0.07	9.102	9.564	2.936
0.08	9.102	9.407	2.377
0.09	9.102	9.303	1.924
0.10	9.102	9.247	1.631
0.15	9.102	9.121	0.581
0.20	9.102	9.105	0.207
0.25	9.102	9.102	0.074
0.30	9.102	9.102	0.026

3-Phase fault at bus: **Nde-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 25.242 kA Method C
Steady State = 11.560 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-10-B-1	Total	0.00	2.988	-11.567	3.9	11.946
Nde-1-B-1	Nde-10-B-1	9.27	0.011	-0.113	10.5	0.114
Kse-1-B-6	Kse-10-B3	30.43	0.014	-0.267	19.3	0.267
C-GN	B-10-Gso-Nde-2	3.68	1.482	-5.593	3.8	5.786
C-BN	B-10-Bre-Nde-2	3.68	1.482	-5.593	3.8	5.786
B-10-Bre-Nde-2	Nde-10-B-1	0.00	1.482	-5.593	3.8	5.786
B-10-Gso-Nde-2	Nde-10-B-1	0.00	1.482	-5.593	3.8	5.786
G-Kse-1-B2	Nde-10-B-1	0.00	0.014	-0.267	19.3	0.267
Kse-10-B3	G-Kse-1-B2	0.00	0.014	-0.267	19.3	0.267

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	11.934	14.514	8.260
0.02	11.931	12.850	4.772
0.03	11.927	12.193	2.536
0.04	11.921	11.997	1.348
0.05	11.916	11.956	0.977
0.06	11.914	11.927	0.553
0.07	11.912	11.916	0.312
0.08	11.910	11.912	0.177
0.09	11.908	11.909	0.100
0.10	11.906	11.907	0.091
0.15	11.903	11.903	0.007
0.20	11.899	11.899	0.000
0.25	11.894	11.894	0.000
0.30	11.889	11.889	0.000

3-Phase fault at bus: **New-Gso-1-B-5**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 17.001 kA Method C
Steady State = 6.158 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-1-B-5	Total	0.00	0.495	-6.641	13.4	6.660
New-Gso-10-B-5	New-Gso-1-B-5	91.30	0.447	-6.157	13.8	6.173
Gso-1-L-50	New-Gso-1-B-5	100.00	0.048	-0.484	10.0	0.487

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	6.660	10.015	7.479
0.02	6.660	8.950	5.980
0.03	6.660	8.189	4.765
0.04	6.660	7.666	3.796
0.05	6.660	7.333	3.070
0.06	6.660	7.097	2.454
0.07	6.660	6.942	1.961
0.08	6.660	6.842	1.567
0.09	6.660	6.776	1.252
0.10	6.660	6.738	1.027
0.15	6.660	6.668	0.339
0.20	6.660	6.661	0.112
0.25	6.660	6.660	0.037
0.30	6.660	6.660	0.012

3-Phase fault at bus: **New-Gso-10-B-5**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 19.003 kA Method C
Steady State = 9.145 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-10-B-5	Total	0.00	2.810	-9.029	3.2	9.456
New-Gso-1-B-5	New-Gso-10-B-5	6.71	0.006	-0.062	10.3	0.062
C-GN	B-10-Gso-Nde-1	29.05	2.360	-7.179	3.0	7.557
B-10-Gso-Msh-2	B-10-Gso-Msh-1	24.93	0.444	-1.789	4.0	1.843
B-10-Gso-Msh-1	New-Gso-10-B-5	0.00	0.444	-1.789	4.0	1.843
B-10-Gso-Nde-1	New-Gso-10-B-5	0.00	2.360	-7.179	3.0	7.557

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	9.453	10.901	5.430
0.02	9.452	9.779	2.505
0.03	9.451	9.513	1.084
0.04	9.450	9.462	0.469
0.05	9.448	9.452	0.260
0.06	9.448	9.449	0.118
0.07	9.448	9.448	0.054
0.08	9.448	9.448	0.025
0.09	9.447	9.447	0.011
0.10	9.447	9.447	0.008
0.15	9.446	9.446	0.000
0.20	9.445	9.445	0.000
0.25	9.444	9.444	0.000
0.30	9.442	9.442	0.000

2. Report on Three-phase Short-circuit Calculation

2）2025

3-Phase fault at bus: **Bre-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 41.956 kA Method C
Steady State = 14.822 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-1-B-1	Total	0.00	0.936	-16.040	17.1	16.067
Bre-10-B-1	Bre-1-B-1	90.34	0.408	-7.426	18.2	7.437
Bre-10-B-1	Bre-1-B-1	90.34	0.408	-7.426	18.2	7.437
Bre-1-L-45	Bre-1-B-1	100.00	0.119	-1.187	10.0	1.193

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.067	24.947	19.084
0.02	16.067	22.853	16.251
0.03	16.067	21.143	13.744
0.04	16.067	19.831	11.623
0.05	16.067	18.971	10.086
0.06	16.067	18.212	8.574
0.07	16.067	17.643	7.289
0.08	16.067	17.220	6.196
0.09	16.067	16.908	5.267
0.10	16.067	16.727	4.651
0.15	16.067	16.204	2.104
0.20	16.067	16.095	0.952
0.25	16.067	16.073	0.431
0.30	16.067	16.068	0.195

3-Phase fault at bus: **Bre-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 50.474 kA Method C
Steady State = 20.171 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-10-B-1	Total	0.00	3.009	-20.849	6.9	21.065
Bre-1-B-1	Bre-10-B-1	6.76	0.007	-0.076	10.4	0.076
Bre-1-B-1	Bre-10-B-1	6.76	0.007	-0.076	10.4	0.076
Kse-1-B-8	Kse-10-B2	28.98	0.013	-0.242	19.3	0.242
C-BN	B-10-Bre-Gso-1	1.55	0.073	-0.792	10.9	0.796
B-10-Bre-Sha-2D	B-10-Bre-Sha-1D	10.51	0.431	-6.566	15.2	6.580
B-10-Bre-Sha-2DT-F	B-10-Bre-Sha-1DT-F	10.51	0.431	-6.566	15.2	6.580
B-10-Bre-Jb1-2	B-10-Bre-Jb1-1	38.94	2.047	-6.531	3.2	6.844
B-10-Bre-Gso-1	Bre-10-B-1	0.00	0.073	-0.792	10.9	0.796
B-10-Bre-Jb1-1	Bre-10-B-1	0.00	2.047	-6.531	3.2	6.844
B-10-Bre-Sha-1D	Bre-10-B-1	0.00	0.431	-6.566	15.2	6.580
B-10-Bre-Sha-1DT-F	Bre-10-B-1	0.00	0.431	-6.566	15.2	6.580
G-Kse-1-B3	Bre-10-B-1	0.00	0.013	-0.242	19.3	0.242
Kse-10-B2	G-Kse-1-B3	0.00	0.013	-0.242	19.3	0.242

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	21.044	29.770	21.057
0.02	21.037	26.966	16.871
0.03	21.029	24.565	12.696
0.04	21.020	23.090	9.554
0.05	21.010	22.654	8.473
0.06	21.007	22.016	6.589
0.07	21.004	21.620	5.124
0.08	21.001	21.375	3.985
0.09	20.997	21.225	3.099
0.10	20.994	21.187	2.859
0.15	20.987	21.006	0.885
0.20	20.980	20.982	0.274

3-Phase fault at bus: **Gko-1-B-4**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 52.573 kA Method C
Steady State = 18.202 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-1-B-4	Total	0.00	1.184	-20.126	17.0	20.161
Gko-10-B-1	Gko-1-B-4	83.42	0.997	-18.265	18.3	18.293
Gko-1-L-21-woNd10	Gko-1-B-4	100.00	0.186	-1.861	10.0	1.870

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	20.161	31.224	23.842
0.02	20.161	28.517	20.168
0.03	20.161	26.348	16.963
0.04	20.161	24.698	14.266
0.05	20.161	23.623	12.312
0.06	20.161	22.690	10.409
0.07	20.161	21.998	8.800
0.08	20.161	21.490	7.439
0.09	20.161	21.119	6.289
0.10	20.161	20.913	5.559
0.15	20.161	20.310	2.454
0.20	20.161	20.190	1.084
0.25	20.161	20.167	0.478
0.30	20.161	20.162	0.211

3-Phase fault at bus: **Gko-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.877 kA Method C
Steady State = 14.379 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-10-B-1	Total	0.00	3.186	-14.700	4.6	15.041
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.060	10.3	0.060
Gko-1-B-4	Gko-10-B-1	7.86	0.022	-0.234	10.7	0.235
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.060	10.3	0.061
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.059	10.3	0.059
B-10-Gko-MKi-2	B-10-Gko-MKi-1	30.76	1.517	-8.086	5.3	8.227
B-10-Gko-Jb1-2	B-10-Gko-Jb1-1	40.40	1.630	-6.201	3.8	6.412
B-10-Gko-Jb1-1	Gko-10-B-1	0.00	1.630	-6.201	3.8	6.412
B-10-Gko-MKi-1	Gko-10-B-1	0.00	1.517	-8.086	5.3	8.227

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	15.038	18.839	11.348
0.02	15.038	16.413	6.576
0.03	15.037	15.475	3.657
0.04	15.036	15.172	2.033
0.05	15.034	15.090	1.304
0.06	15.034	15.052	0.746
0.07	15.034	15.040	0.427
0.08	15.034	15.036	0.244
0.09	15.033	15.034	0.140
0.10	15.033	15.034	0.098
0.15	15.033	15.033	0.007
0.20	15.032	15.032	0.000
0.25	15.030	15.030	0.000
0.30	15.029	15.029	0.000

3-Phase fault at bus: **Jb1-1-B-2**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 72.457 kA Method C
Steady State = 26.287 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-1-B-2	Total	0.00	2.111	-28.294	13.4	28.373
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-1-L-4	Jb1-1-B-2	100.00	0.049	-0.486	10.0	0.489
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-1-L-40	Jb1-1-B-4	100.00	0.146	-1.459	10.0	1.467
B-1-Jb1-Jb3-2	B-1-Jb1-Jb3-1	0.13	0.160	-1.915	12.0	1.922
B-1-Jb1-Jb3-1	Jb1-1-B-2	0.00	0.160	-1.915	12.0	1.922
Jb1-1-B-4	Jb1-1-B-2	0.00	1.102	-18.650	16.9	18.683

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	28.294	42.669	31.939
0.02	28.266	38.307	25.855
0.03	28.235	35.042	20.754
0.04	28.199	32.753	16.660
0.05	28.161	31.539	14.202
0.06	28.148	30.421	11.538
0.07	28.135	29.655	9.374
0.08	28.121	29.134	7.616
0.09	28.107	28.780	6.187
0.10	28.092	28.711	5.930
0.15	28.067	28.159	2.279
0.20	28.039	28.053	0.876
0.25	28.009	28.012	0.337
0.30	27.979	27.979	0.129

3-Phase fault at bus: **Jb1-1-B-4**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 72.457 kA Method C
Steady State = 26.287 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-1-B-4	Total	0.00	2.111	-28.294	13.4	28.373
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-1-L-40	Jb1-1-B-4	100.00	0.146	-1.459	10.0	1.467
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-1-L-4	Jb1-1-B-2	100.00	0.049	-0.486	10.0	0.489
B-1-Jb1-Jb3-2	B-1-Jb1-Jb3-1	0.13	0.160	-1.915	12.0	1.922
B-1-Jb1-Jb3-1	Jb1-1-B-2	0.00	0.160	-1.915	12.0	1.922
Jb1-1-B-2	Jb1-1-B-4	0.00	1.009	-9.644	9.6	9.696

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	28.294	42.669	31.939
0.02	28.266	38.307	25.855
0.03	28.235	35.042	20.754
0.04	28.199	32.753	16.660
0.05	28.161	31.539	14.202
0.06	28.148	30.421	11.538
0.07	28.135	29.655	9.374
0.08	28.121	29.134	7.616
0.09	28.107	28.780	6.187
0.10	28.092	28.711	5.930
0.15	28.067	28.159	2.279
0.20	28.039	28.053	0.876
0.25	28.009	28.012	0.337
0.30	27.979	27.979	0.129

3-Phase fault at bus: **Jb1-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 41.334 kA Method C
Steady State = 18.363 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-10-B-1	Total	0.00	4.216	-18.654	4.4	19.125
Jb1-1-B-2	Jb1-10-B-1	11.53	0.009	-0.069	8.0	0.070
Jb1-1-B-2	Jb1-10-B-1	11.53	0.009	-0.069	8.0	0.070
Jb1-1-B-4	Jb1-10-B-1	11.53	0.011	-0.164	14.4	0.164
Jb1-1-B-4	Jb1-10-B-1	11.53	0.011	-0.164	14.4	0.164
B-10-Jb1-Mki-2	B-10-Jb1-Mki-1	37.69	0.553	-3.107	5.6	3.155
B-10-Gko-Jb1-1	B-10-Gko-Jb1-2	24.39	0.674	-3.812	5.7	3.871
B-10-Bre-Jb1-1	B-10-Bre-Jb1-2	45.80	1.925	-7.816	4.1	8.050
B-10-Jb-Rul-2	B-10-Jb-Rul-1	65.14	0.994	-2.913	2.9	3.078
B-10-Jb1-Jb2-2	B-10-Jb1-Jb2-1	0.42	0.029	-0.541	18.6	0.542
B-10-Bre-Jb1-2	Jb1-10-B-1	0.00	1.925	-7.816	4.1	8.050
B-10-Gko-Jb1-2	Jb1-10-B-1	0.00	0.674	-3.812	5.7	3.871
B-10-Jb-Rul-1	Jb1-10-B-1	0.00	0.994	-2.913	2.9	3.078
B-10-Jb1-Jb2-1	Jb1-10-B-1	0.00	0.029	-0.541	18.6	0.542
B-10-Jb1-Mki-1	Jb1-10-B-1	0.00	0.553	-3.107	5.6	3.155

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	19.097	23.603	13.871
0.02	19.088	20.588	7.715
0.03	19.077	19.517	4.121
0.04	19.065	19.192	2.201
0.05	19.051	19.106	1.448
0.06	19.047	19.064	0.807
0.07	19.043	19.048	0.449
0.08	19.038	19.040	0.250
0.09	19.034	19.034	0.139
0.10	19.029	19.029	0.121
0.15	19.020	19.020	0.008

3-Phase fault at bus: **Nde-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 43.028 kA Method C
Steady State = 15.256 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-1-B-1	Total	0.00	1.202	-16.732	13.9	16.775
Nde-10-B-1	Nde-1-B-1	85.10	0.530	-7.654	14.4	7.672
Nde-10-B-1	Nde-1-B-1	85.10	0.530	-7.654	14.4	7.672
Nde-1-L-4	Nde-1-B-1	100.00	0.142	-1.424	10.0	1.431

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.775	25.422	19.102
0.02	16.775	22.902	15.592
0.03	16.775	21.004	12.641
0.04	16.775	19.657	10.248
0.05	16.775	18.812	8.513
0.06	16.775	18.152	6.936
0.07	16.775	17.701	5.650
0.08	16.775	17.395	4.603
0.09	16.775	17.189	3.750
0.10	16.775	17.072	3.169
0.15	16.775	16.815	1.158
0.20	16.775	16.780	0.423
0.25	16.775	16.776	0.155
0.30	16.775	16.775	0.057

3-Phase fault at bus: **Nde-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.345 kA Method C
Steady State = 13.427 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-10-B-1	Total	0.00	2.488	-13.907	5.6	14.128
Nde-1-B-1	Nde-10-B-1	7.35	0.009	-0.090	10.4	0.090
Nde-1-B-1	Nde-10-B-1	7.35	0.009	-0.090	10.4	0.090
Kse-1-B-6	Kse-10-B3	30.43	0.014	-0.267	19.3	0.267
C-GN	B-10-Gso-Nde-2	0.23	0.041	-0.362	8.9	0.365
C-BN	B-10-Bre-Nde-2	8.47	2.416	-13.098	5.4	13.319
B-10-Bre-Nde-2	Nde-10-B-1	0.00	2.416	-13.098	5.4	13.319
B-10-Gso-Nde-2	Nde-10-B-1	0.00	0.041	-0.362	8.9	0.365
G-Kse-1-B2	Nde-10-B-1	0.00	0.014	-0.267	19.3	0.267
Kse-10-B3	G-Kse-1-B2	0.00	0.014	-0.267	19.3	0.267

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	14.117	18.755	12.348
0.02	14.113	16.448	8.447
0.03	14.109	15.140	5.493
0.04	14.104	14.549	3.571
0.05	14.098	14.352	2.685
0.06	14.097	14.211	1.797
0.07	14.095	14.146	1.203
0.08	14.093	14.116	0.805
0.09	14.091	14.102	0.539
0.10	14.089	14.096	0.432
0.15	14.086	14.086	0.064
0.20	14.082	14.082	0.009
0.25	14.077	14.077	0.001
0.30	14.073	14.073	0.000

3-Phase fault at bus: **New-Gso-1-B-5**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 31.012 kA Method C
Steady State = 11.310 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-1-B-5	Total	0.00	0.909	-12.113	13.3	12.147
New-Gso-10-B-5	New-Gso-1-B-5	84.24	0.417	-5.681	13.6	5.696
New-Gso-10-B-5	New-Gso-1-B-5	84.24	0.417	-5.681	13.6	5.696
Gso-1-L-56	New-Gso-1-B-5	100.00	0.075	-0.752	10.0	0.755

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	12.147	18.283	13.664
0.02	12.147	16.374	10.980
0.03	12.147	14.987	8.778
0.04	12.147	14.029	7.018
0.05	12.147	13.422	5.710
0.06	12.147	12.982	4.581
0.07	12.147	12.691	3.675
0.08	12.147	12.500	2.949
0.09	12.147	12.375	2.366
0.10	12.147	12.302	1.947
0.15	12.147	12.165	0.655
0.20	12.147	12.149	0.221
0.25	12.147	12.147	0.074
0.30	12.147	12.147	0.025

3-Phase fault at bus: **New-Gso-10-B-5**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 22.018 kA Method C
Steady State = 9.336 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-10-B-5	Total	0.00	1.923	-9.677	5.0	9.866
New-Gso-1-B-5	New-Gso-10-B-5	5.29	0.005	-0.049	10.3	0.049
New-Gso-1-B-5	New-Gso-10-B-5	5.29	0.005	-0.049	10.3	0.049
C-GN	B-10-Gso-Nde-1	25.05	1.882	-9.310	4.9	9.498
B-10-Gso-Msh-2	B-10-Gso-Msh-1	3.67	0.031	-0.270	8.7	0.271
B-10-Gso-Msh-1	New-Gso-10-B-5	0.00	0.031	-0.270	8.7	0.271
B-10-Gso-Nde-1	New-Gso-10-B-5	0.00	1.882	-9.310	4.9	9.498

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	9.863	12.665	7.945
0.02	9.863	11.014	4.902
0.03	9.862	10.281	2.906
0.04	9.861	10.010	1.722
0.05	9.860	9.926	1.151
0.06	9.859	9.884	0.699
0.07	9.859	9.868	0.424
0.08	9.859	9.862	0.258
0.09	9.858	9.860	0.156
0.10	9.858	9.859	0.111
0.15	9.857	9.857	0.010
0.20	9.857	9.857	0.001
0.25	9.855	9.855	0.000
0.30	9.854	9.854	0.000

2. Report on Three-phase Short-circuit Calculation

3）2030

3-Phase fault at bus: **Bre-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 41.956 kA Method C
Steady State = 14.822 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-1-B-1	Total	0.00	0.936	-16.040	17.1	16.067
Bre-10-B-1	Bre-1-B-1	90.34	0.408	-7.426	18.2	7.437
Bre-10-B-1	Bre-1-B-1	90.34	0.408	-7.426	18.2	7.437
Bre-1-L-45	Bre-1-B-1	100.00	0.119	-1.187	10.0	1.193

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.067	24.947	19.084
0.02	16.067	22.853	16.251
0.03	16.067	21.143	13.744
0.04	16.067	19.831	11.623
0.05	16.067	18.971	10.086
0.06	16.067	18.212	8.574
0.07	16.067	17.643	7.289
0.08	16.067	17.220	6.196
0.09	16.067	16.908	5.267
0.10	16.067	16.727	4.651
0.15	16.067	16.204	2.104
0.20	16.067	16.095	0.952
0.25	16.067	16.073	0.431
0.30	16.067	16.068	0.195

3-Phase fault at bus: **Bre-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 50.474 kA Method C
Steady State = 20.171 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bre-10-B-1	Total	0.00	3.009	-20.849	6.9	21.065
Bre-1-B-1	Bre-10-B-1	6.76	0.007	-0.076	10.4	0.076
Bre-1-B-1	Bre-10-B-1	6.76	0.007	-0.076	10.4	0.076
Kse-1-B-8	Kse-10-B2	28.98	0.013	-0.242	19.3	0.242
C-BN	B-10-Bre-Gso-1	1.55	0.073	-0.792	10.9	0.796
B-10-Bre-Sha-2D	B-10-Bre-Sha-1D	10.51	0.431	-6.566	15.2	6.580
B-10-Bre-Sha-2DT-F	B-10-Bre-Sha-1DT-F	10.51	0.431	-6.566	15.2	6.580
B-10-Bre-Jb1-2	B-10-Bre-Jb1-1	38.94	2.047	-6.531	3.2	6.844
B-10-Bre-Gso-1	Bre-10-B-1	0.00	0.073	-0.792	10.9	0.796
B-10-Bre-Jb1-1	Bre-10-B-1	0.00	2.047	-6.531	3.2	6.844
B-10-Bre-Sha-1D	Bre-10-B-1	0.00	0.431	-6.566	15.2	6.580
B-10-Bre-Sha-1DT-F	Bre-10-B-1	0.00	0.431	-6.566	15.2	6.580
G-Kse-1-B3	Bre-10-B-1	0.00	0.013	-0.242	19.3	0.242
Kse-10-B2	G-Kse-1-B3	0.00	0.013	-0.242	19.3	0.242

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	21.044	29.770	21.057
0.02	21.037	26.966	16.871
0.03	21.029	24.565	12.696
0.04	21.020	23.090	9.554
0.05	21.010	22.654	8.473
0.06	21.007	22.016	6.589
0.07	21.004	21.620	5.124
0.08	21.001	21.375	3.985
0.09	20.997	21.225	3.099
0.10	20.994	21.187	2.859
0.15	20.987	21.006	0.885
0.20	20.980	20.982	0.274

(Cont.)

3-Phase fault at bus: **Bre-10-B-1**

Nominal kV	=	110.000	
Voltage c Factor	=	1.10	(User-Defined)
Peak Value	=	50.474	kA Method C
Steady State	=	20.171	kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.25	20.971	20.972	0.085
0.30	20.962	20.962	0.026

3-Phase fault at bus: **Gko-1-B-2**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 50.650 kA Method C
Steady State = 18.456 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-1-B-2	Total	0.00	1.584	-19.900	12.6	19.963
Gko-10-B-1	Gko-1-B-2	83.16	0.484	-6.195	12.8	6.214
Gko-10-B-1	Gko-1-B-2	83.16	0.487	-6.241	12.8	6.260
Gko-10-B-1	Gko-1-B-2	83.16	0.474	-6.067	12.8	6.086
Gko-1-L-21-woNd4	Gko-1-B-2	100.00	0.140	-1.396	10.0	1.403

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	19.963	29.791	22.113
0.02	19.963	26.543	17.493
0.03	19.963	24.251	13.770
0.04	19.963	22.716	10.839
0.05	19.963	21.774	8.695
0.06	19.963	21.112	6.870
0.07	19.963	20.688	5.428
0.08	19.963	20.418	4.289
0.09	19.963	20.248	3.389
0.10	19.963	20.152	2.757
0.15	19.963	19.981	0.861
0.20	19.963	19.965	0.269
0.25	19.963	19.963	0.084
0.30	19.963	19.963	0.026

3-Phase fault at bus: **Gko-1-B-4**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 52.573 kA Method C
Steady State = 18.202 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-1-B-4	Total	0.00	1.184	-20.126	17.0	20.161
Gko-10-B-1	Gko-1-B-4	83.42	0.997	-18.265	18.3	18.293
Gko-1-L-21-woNd10	Gko-1-B-4	100.00	0.186	-1.861	10.0	1.870

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	20.161	31.224	23.842
0.02	20.161	28.517	20.168
0.03	20.161	26.348	16.963
0.04	20.161	24.698	14.266
0.05	20.161	23.623	12.312
0.06	20.161	22.690	10.409
0.07	20.161	21.998	8.800
0.08	20.161	21.490	7.439
0.09	20.161	21.119	6.289
0.10	20.161	20.913	5.559
0.15	20.161	20.310	2.454
0.20	20.161	20.190	1.084
0.25	20.161	20.167	0.478
0.30	20.161	20.162	0.211

3-Phase fault at bus: **Gko-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.877 kA Method C
Steady State = 14.379 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Gko-10-B-1	Total	0.00	3.186	-14.700	4.6	15.041
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.060	10.3	0.060
Gko-1-B-4	Gko-10-B-1	7.86	0.022	-0.234	10.7	0.235
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.060	10.3	0.061
Gko-1-B-2	Gko-10-B-1	5.91	0.006	-0.059	10.3	0.059
B-10-Gko-MKi-2	B-10-Gko-MKi-1	30.76	1.517	-8.086	5.3	8.227
B-10-Gko-Jb1-2	B-10-Gko-Jb1-1	40.40	1.630	-6.201	3.8	6.412
B-10-Gko-Jb1-1	Gko-10-B-1	0.00	1.630	-6.201	3.8	6.412
B-10-Gko-MKi-1	Gko-10-B-1	0.00	1.517	-8.086	5.3	8.227

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	15.038	18.839	11.348
0.02	15.038	16.413	6.576
0.03	15.037	15.475	3.657
0.04	15.036	15.172	2.033
0.05	15.034	15.090	1.304
0.06	15.034	15.052	0.746
0.07	15.034	15.040	0.427
0.08	15.034	15.036	0.244
0.09	15.033	15.034	0.140
0.10	15.033	15.034	0.098
0.15	15.033	15.033	0.007
0.20	15.032	15.032	0.000
0.25	15.030	15.030	0.000
0.30	15.029	15.029	0.000

3-Phase fault at bus: **Jb1-1-B-2**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 72.457 kA Method C
Steady State = 26.287 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-1-B-2	Total	0.00	2.111	-28.294	13.4	28.373
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-1-L-4	Jb1-1-B-2	100.00	0.049	-0.486	10.0	0.489
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-1-L-40	Jb1-1-B-4	100.00	0.146	-1.459	10.0	1.467
B-1-Jb1-Jb3-2	B-1-Jb1-Jb3-1	0.13	0.160	-1.915	12.0	1.922
B-1-Jb1-Jb3-1	Jb1-1-B-2	0.00	0.160	-1.915	12.0	1.922
Jb1-1-B-4	Jb1-1-B-2	0.00	1.102	-18.650	16.9	18.683

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	28.294	42.669	31.939
0.02	28.266	38.307	25.855
0.03	28.235	35.042	20.754
0.04	28.199	32.753	16.660
0.05	28.161	31.539	14.202
0.06	28.148	30.421	11.538
0.07	28.135	29.655	9.374
0.08	28.121	29.134	7.616
0.09	28.107	28.780	6.187
0.10	28.092	28.711	5.930
0.15	28.067	28.159	2.279
0.20	28.039	28.053	0.876
0.25	28.009	28.012	0.337
0.30	27.979	27.979	0.129

3-Phase fault at bus: **Jb1-1-B-4**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 72.457 kA Method C
Steady State = 26.287 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-1-B-4	Total	0.00	2.111	-28.294	13.4	28.373
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-10-B-1	Jb1-1-B-4	82.36	0.478	-8.595	18.0	8.609
Jb1-1-L-40	Jb1-1-B-4	100.00	0.146	-1.459	10.0	1.467
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-10-B-1	Jb1-1-B-2	82.36	0.400	-3.621	9.0	3.643
Jb1-1-L-4	Jb1-1-B-2	100.00	0.049	-0.486	10.0	0.489
B-1-Jb1-Jb3-2	B-1-Jb1-Jb3-1	0.13	0.160	-1.915	12.0	1.922
B-1-Jb1-Jb3-1	Jb1-1-B-2	0.00	0.160	-1.915	12.0	1.922
Jb1-1-B-2	Jb1-1-B-4	0.00	1.009	-9.644	9.6	9.696

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	28.294	42.669	31.939
0.02	28.266	38.307	25.855
0.03	28.235	35.042	20.754
0.04	28.199	32.753	16.660
0.05	28.161	31.539	14.202
0.06	28.148	30.421	11.538
0.07	28.135	29.655	9.374
0.08	28.121	29.134	7.616
0.09	28.107	28.780	6.187
0.10	28.092	28.711	5.930
0.15	28.067	28.159	2.279
0.20	28.039	28.053	0.876
0.25	28.009	28.012	0.337
0.30	27.979	27.979	0.129

3-Phase fault at bus: **Jb1-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 41.334 kA Method C
Steady State = 18.363 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Jb1-10-B-1	Total	0.00	4.216	-18.654	4.4	19.125
Jb1-1-B-2	Jb1-10-B-1	11.53	0.009	-0.069	8.0	0.070
Jb1-1-B-2	Jb1-10-B-1	11.53	0.009	-0.069	8.0	0.070
Jb1-1-B-4	Jb1-10-B-1	11.53	0.011	-0.164	14.4	0.164
Jb1-1-B-4	Jb1-10-B-1	11.53	0.011	-0.164	14.4	0.164
B-10-Jb1-Mki-2	B-10-Jb1-Mki-1	37.69	0.553	-3.107	5.6	3.155
B-10-Gko-Jb1-1	B-10-Gko-Jb1-2	24.39	0.674	-3.812	5.7	3.871
B-10-Bre-Jb1-1	B-10-Bre-Jb1-2	45.80	1.925	-7.816	4.1	8.050
B-10-Jb-Rul-2	B-10-Jb-Rul-1	65.14	0.994	-2.913	2.9	3.078
B-10-Jb1-Jb2-2	B-10-Jb1-Jb2-1	0.42	0.029	-0.541	18.6	0.542
B-10-Bre-Jb1-2	Jb1-10-B-1	0.00	1.925	-7.816	4.1	8.050
B-10-Gko-Jb1-2	Jb1-10-B-1	0.00	0.674	-3.812	5.7	3.871
B-10-Jb-Rul-1	Jb1-10-B-1	0.00	0.994	-2.913	2.9	3.078
B-10-Jb1-Jb2-1	Jb1-10-B-1	0.00	0.029	-0.541	18.6	0.542
B-10-Jb1-Mki-1	Jb1-10-B-1	0.00	0.553	-3.107	5.6	3.155

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	19.097	23.603	13.871
0.02	19.088	20.588	7.715
0.03	19.077	19.517	4.121
0.04	19.065	19.192	2.201
0.05	19.051	19.106	1.448
0.06	19.047	19.064	0.807
0.07	19.043	19.048	0.449
0.08	19.038	19.040	0.250
0.09	19.034	19.034	0.139
0.10	19.029	19.029	0.121
0.15	19.020	19.020	0.008

(Cont.)

3-Phase fault at bus: **Jb1-10-B-1**

Nominal kV	=	110.000	
Voltage c Factor	=	1.10	(User-Defined)
Peak Value	=	41.334	kA Method C
Steady State	=	18.363	kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.20	19.010	19.010	0.001
0.25	18.999	18.999	0.000
0.30	18.988	18.988	0.000

3-Phase fault at bus: **Nde-1-B-1**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 43.028 kA Method C
Steady State = 15.256 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-1-B-1	Total	0.00	1.202	-16.732	13.9	16.775
Nde-10-B-1	Nde-1-B-1	85.10	0.530	-7.654	14.4	7.672
Nde-10-B-1	Nde-1-B-1	85.10	0.530	-7.654	14.4	7.672
Nde-1-L-4	Nde-1-B-1	100.00	0.142	-1.424	10.0	1.431

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	16.775	25.422	19.102
0.02	16.775	22.902	15.592
0.03	16.775	21.004	12.641
0.04	16.775	19.657	10.248
0.05	16.775	18.812	8.513
0.06	16.775	18.152	6.936
0.07	16.775	17.701	5.650
0.08	16.775	17.395	4.603
0.09	16.775	17.189	3.750
0.10	16.775	17.072	3.169
0.15	16.775	16.815	1.158
0.20	16.775	16.780	0.423
0.25	16.775	16.776	0.155
0.30	16.775	16.775	0.057

3-Phase fault at bus: **Nde-10-B-1**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.345 kA Method C
Steady State = 13.427 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Nde-10-B-1	Total	0.00	2.488	-13.907	5.6	14.128
Nde-1-B-1	Nde-10-B-1	7.35	0.009	-0.090	10.4	0.090
Nde-1-B-1	Nde-10-B-1	7.35	0.009	-0.090	10.4	0.090
Kse-1-B-6	Kse-10-B3	30.43	0.014	-0.267	19.3	0.267
C-GN	B-10-Gso-Nde-2	0.23	0.041	-0.362	8.9	0.365
C-BN	B-10-Bre-Nde-2	8.47	2.416	-13.098	5.4	13.319
B-10-Bre-Nde-2	Nde-10-B-1	0.00	2.416	-13.098	5.4	13.319
B-10-Gso-Nde-2	Nde-10-B-1	0.00	0.041	-0.362	8.9	0.365
G-Kse-1-B2	Nde-10-B-1	0.00	0.014	-0.267	19.3	0.267
Kse-10-B3	G-Kse-1-B2	0.00	0.014	-0.267	19.3	0.267

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	14.117	18.755	12.348
0.02	14.113	16.448	8.447
0.03	14.109	15.140	5.493
0.04	14.104	14.549	3.571
0.05	14.098	14.352	2.685
0.06	14.097	14.211	1.797
0.07	14.095	14.146	1.203
0.08	14.093	14.116	0.805
0.09	14.091	14.102	0.539
0.10	14.089	14.096	0.432
0.15	14.086	14.086	0.064
0.20	14.082	14.082	0.009
0.25	14.077	14.077	0.001
0.30	14.073	14.073	0.000

3-Phase fault at bus: **New-Gso-1-B-5**

Nominal kV = 15.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 31.012 kA Method C
Steady State = 11.310 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-1-B-5	Total	0.00	0.909	-12.113	13.3	12.147
New-Gso-10-B-5	New-Gso-1-B-5	84.24	0.417	-5.681	13.6	5.696
New-Gso-10-B-5	New-Gso-1-B-5	84.24	0.417	-5.681	13.6	5.696
Gso-1-L-56	New-Gso-1-B-5	100.00	0.075	-0.752	10.0	0.755

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	12.147	18.283	13.664
0.02	12.147	16.374	10.980
0.03	12.147	14.987	8.778
0.04	12.147	14.029	7.018
0.05	12.147	13.422	5.710
0.06	12.147	12.982	4.581
0.07	12.147	12.691	3.675
0.08	12.147	12.500	2.949
0.09	12.147	12.375	2.366
0.10	12.147	12.302	1.947
0.15	12.147	12.165	0.655
0.20	12.147	12.149	0.221
0.25	12.147	12.147	0.074
0.30	12.147	12.147	0.025

3-Phase fault at bus: **New-Gso-10-B-5**

Nominal kV = 110.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 22.018 kA Method C
Steady State = 9.336 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
New-Gso-10-B-5	Total	0.00	1.923	-9.677	5.0	9.866
New-Gso-1-B-5	New-Gso-10-B-5	5.29	0.005	-0.049	10.3	0.049
New-Gso-1-B-5	New-Gso-10-B-5	5.29	0.005	-0.049	10.3	0.049
C-GN	B-10-Gso-Nde-1	25.05	1.882	-9.310	4.9	9.498
B-10-Gso-Msh-2	B-10-Gso-Msh-1	3.67	0.031	-0.270	8.7	0.271
B-10-Gso-Msh-1	New-Gso-10-B-5	0.00	0.031	-0.270	8.7	0.271
B-10-Gso-Nde-1	New-Gso-10-B-5	0.00	1.882	-9.310	4.9	9.498

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	9.863	12.665	7.945
0.02	9.863	11.014	4.902
0.03	9.862	10.281	2.906
0.04	9.861	10.010	1.722
0.05	9.860	9.926	1.151
0.06	9.859	9.884	0.699
0.07	9.859	9.868	0.424
0.08	9.859	9.862	0.258
0.09	9.858	9.860	0.156
0.10	9.858	9.859	0.111
0.15	9.857	9.857	0.010
0.20	9.857	9.857	0.001
0.25	9.855	9.855	0.000
0.30	9.854	9.854	0.000

8. Switchover Procedures for Substation and Transmission lines (Draft)

8. Switchover Procedures for Substation and Transmission lines (Draft)

8.1. Switchover Procedures for New Gasogi Substation (Draft)

Switchover Procedures for New Gasogi Substation (Draft)

In order to cut-in 110 kV transmission line to New Gasogi SS, 110 kV transmission line between Ndera and Musha substations needs to be shut down. This is to study the duration of shutdown including work items and the schedule for Switchover from existing substation to new substation.

[Duration of Shutdown]

About 9 days

[Procedures]

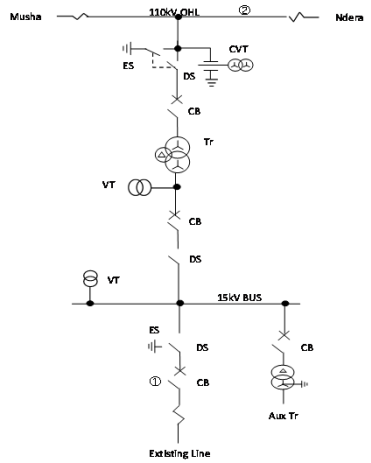
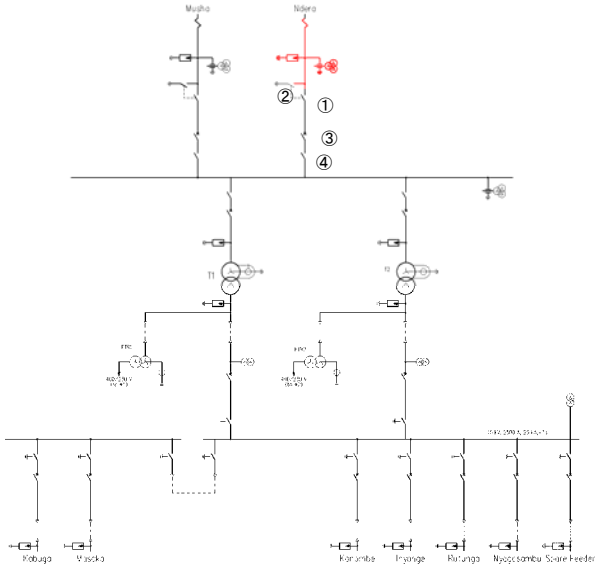
- Two additional towers should be constructed within the property of existing Gasogi substation for stringing new 110 kV conductors to new Gasogi substation. In order to minimize the the duration of shutdown of 110 kV transmission line, the foundation work and the assembling works of the lower part of new towers should be conducted even under live condition of the 110 kV transmission line.
- In order not to postpone the duration of shutdown for transmission line work, all possible works and tests of substation equipment should be done before the shutdown, except the works and tests for communication aspect through OPGW.

	Pre-works	No. of Shutdown Days on Ndera - Musha line										Remarks
		1	2	3	4	5	6	7	8	9	10	
110 kV Transmission Line	Energized condition	Shutdown ▼				Shutdown				Restored ▼	Energized	
Transmission Line Work	- Foundation works of new Towers - Assembling Works of new Towers (Lower part) (30 days)		- Assembling Works for new Towers (Upper part) - Stringing Main conductors and Grounding wires - Disassemling works for existing tower No. 227									
Substation Work	All possible works and tests of substation equipment to be done.		Cabling and Connection works of 15 kV feeders			Connection works of 110 kV conductors		OPGW connection	- SCADA Tests - 87L Tests	- Energization of 110 kV Bus - Power Transmission to Musha SS - Energization of 110/15 kV Transformer - Power Transmission for 15 kV feeders		

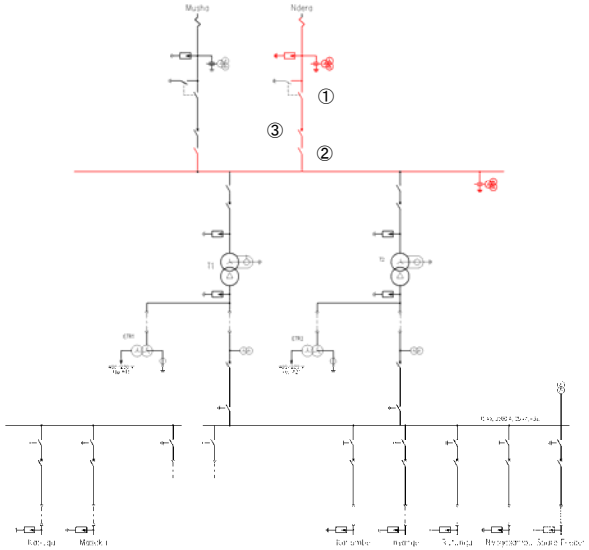
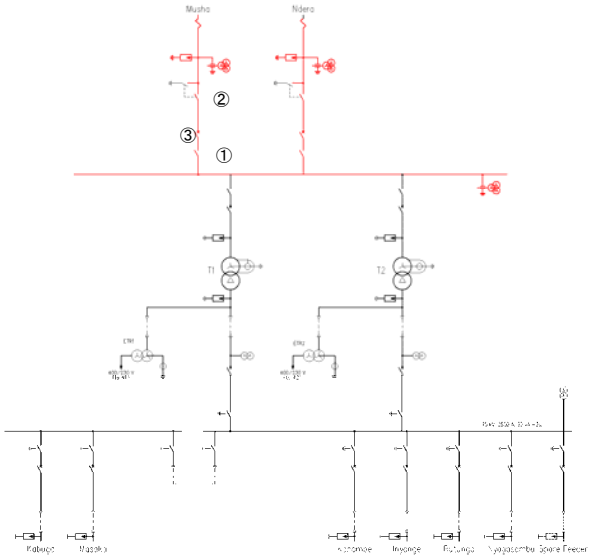
[Attachment]

- Switchover Procedure for 110 kV Transmission Line
- Switchover Procedure for Gasogi Substation

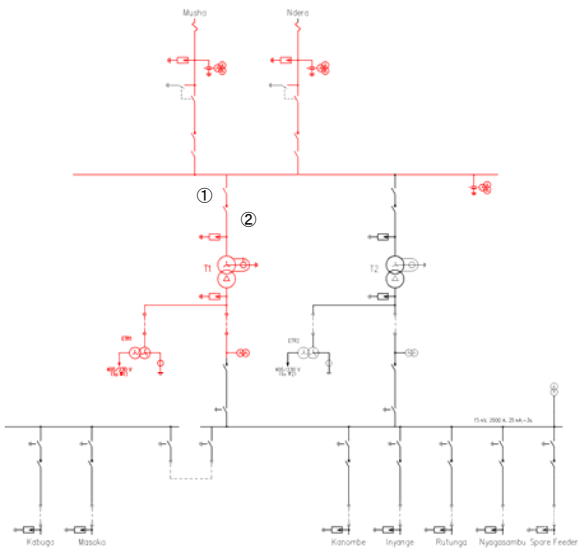
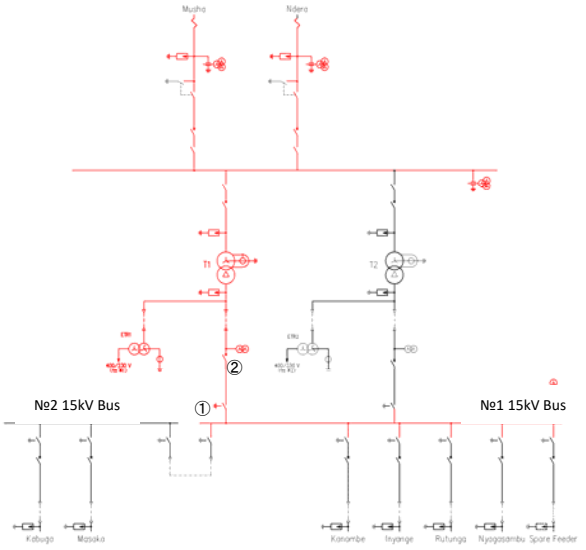
Switchover Procedure for Gasogi Substation (Draft)

Step	Item	Single Line Diagram	Procedure	Necessary Time
1	Preparation Work of Existing Facilities		[Shutdown of Existing Substation (SS)] - To open CB (①) of 15 kV Feeders - To de-energize 110 kV Ndera - Musha Line (②) for Shutdown of Gasogi SS [Connection change to New SS] - To connect OPGW cable to New SS - To install and connect 15 kV Cables for all 15 kV feeders [Test of Feeder Protection Relays (87L)] - To test 87L for Ndera SS and for Musha SS, utilizing OPGW. * All equipment in New Gasogi SS shall be installed and tested as much as possible before Switchover. * AC/DC supplis at this stage are fed from the temporary power supply for construction work.	-
2	Energization by Ndera Feeder		[Preparation work before Energization of New Gasogi SS] - To confirm all CBs, DSs to be open. - To re-confirm 2 x DS (① & ④), ES (②) and CB (③) on Ndera feeder to be open. [Energization from Ndera SS] - Close 110 kV CB at Ndera SS for Gasogi SS. (Energization of Ndera - Gasogi feeder) [Check] - To check the voltages of Ndera feeder and the phase angles	2 hours

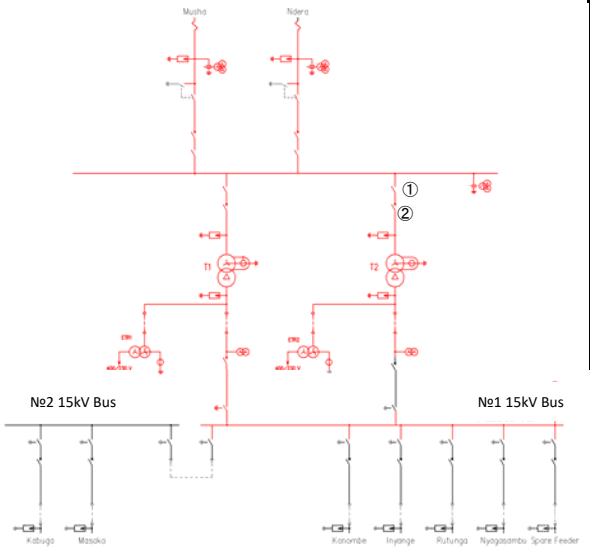
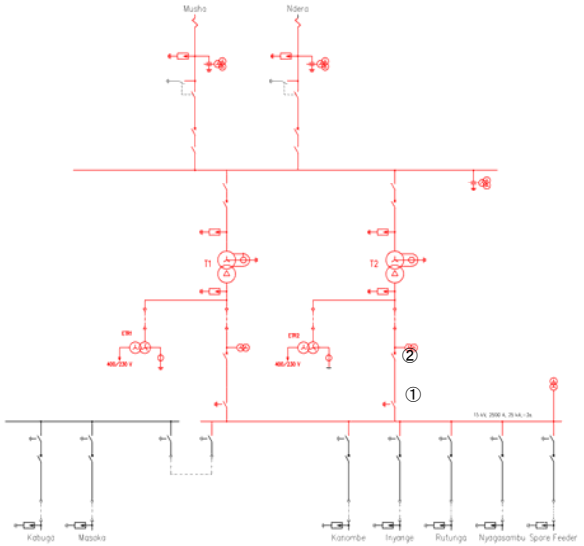
Switchover Procedure for Gasogi Substation (Draft)

Step	Item	Single Line Diagram	Procedure	Necessary Time
3	Energization of 110 kV Bus		[Operation of Power Receiving] - To close DS (①) on Ndera feeder - To close DS (②) on Ndera feeder - To close CB (③) on Ndera feeder (Energization of 110 kV Bus) [Check] - To check the voltages of 110 kV Bus and the phase angles	1 hour
4	Power Transmission to Musha SS		[Operation of Power Transmitting] - To close DS (①) on Musha feeder - To close DS (②) on Musha feeder - To close CB (③) on Musha feeder (Power transmitting to Musha SS) [Check] - To check the voltages of 110 kV Musha feeder and the phase angles	2 hours

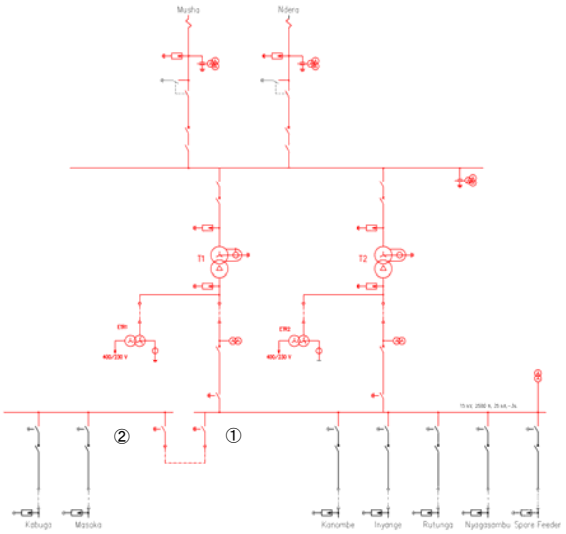
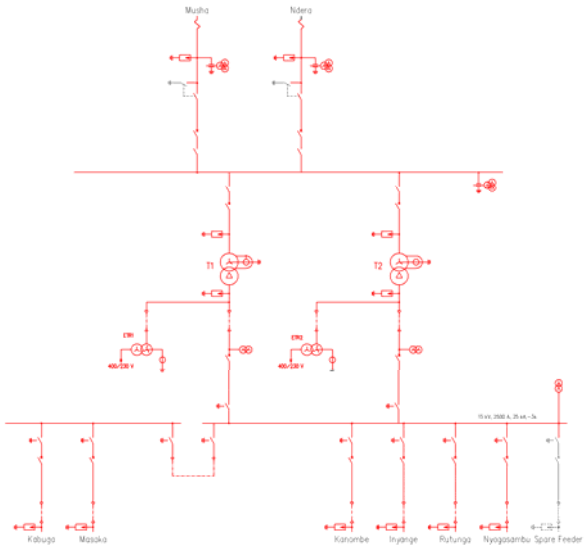
Switchover Procedure for Gasogi Substation (Draft)

Step	Item	Single Line Diagram	Procedure	Necessary Time
5	Energization of 110/15 kV No1.Transformer		[Operation of No1.Transformer Energization] - To close DS (①) on Transformer feeder - To close CB (②) on Transformer feeder (Energization of 110/15 kV No1.Transformer) [Check] - To check the voltages of 15 kV side and the phase angles	1 hour
6	Energization of No1.15 kV Bus		[Operation of No1.15 kV Bus Energization] - To close No1. 15 kV side DS (①) on Transformer feeder - To close No1. 15 kV side CB (②) on Transformer feeder (Energization of 15 kV Bus) [Check] - To check the voltages of 15 kV Bus and the phase angles	1 hour

Switchover Procedure for Gasogi Substation (Draft)

Step	Item	Single Line Diagram	Procedure	Necessary Time
7	Energization of 110/15 kV No2.Transformer		[Operation of No2.Transformer Energization] - To close DS (①) on No2. Transformer feeder - To close CB (②) on No2. Transformer feeder (Energization of 110/15 kV No2.Transformer) [Check] - To check the voltages of 15 kV side and the phase angles	1 hour
8	No1 & No2 Transformer Parallel Operation		[110/15 kV transformer parallel operation] -To adjust Transformer Tap - To close No2. 15 kV side DS (①) on Transformer feeder - To close No2. 15 kV side CB (②) on Transformer feeder (Parallel operation start) [Check] - To check the voltages and phase angles for each transformer	1 hour

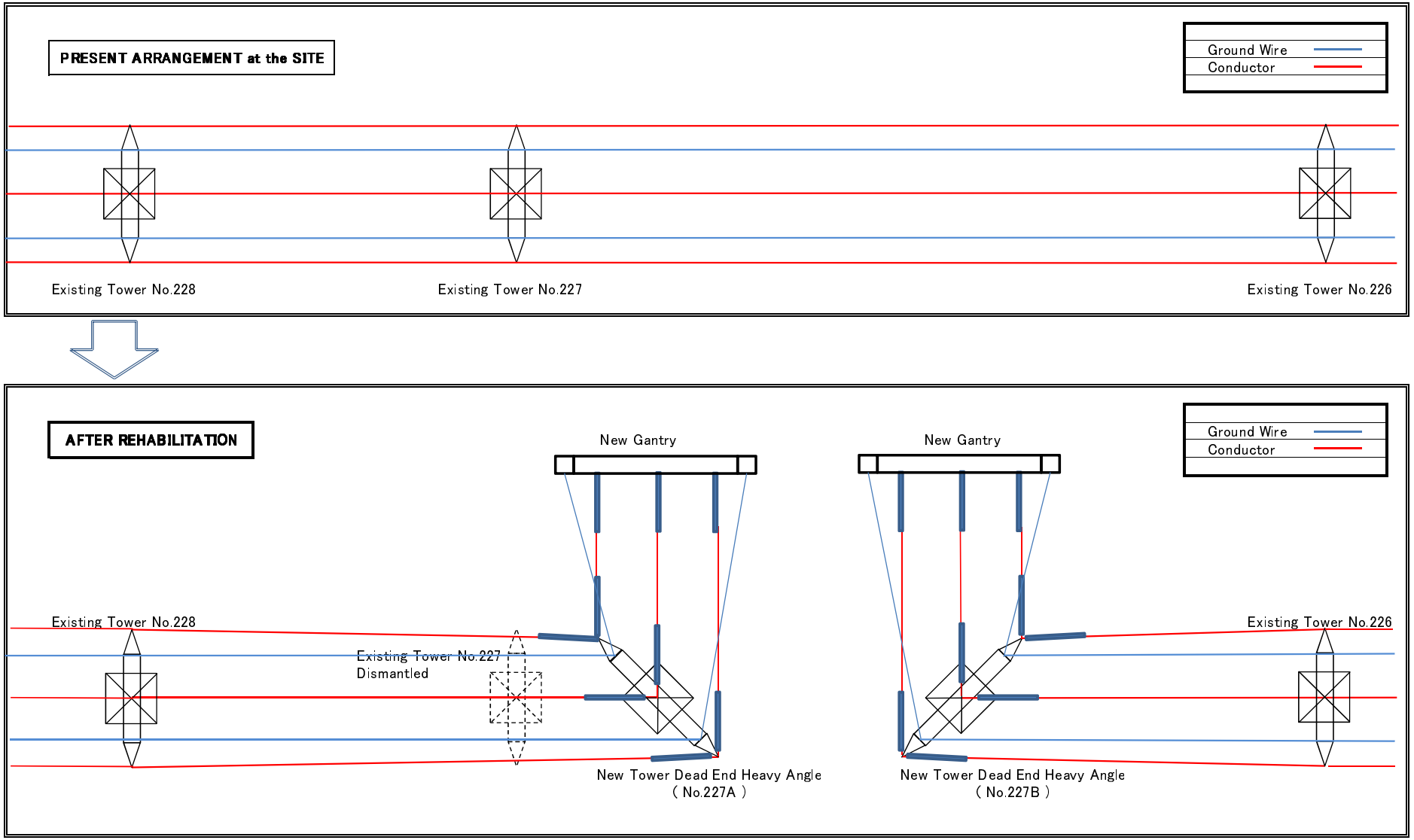
Switchover Procedure for Gasogi Substation (Draft)

Step	Item	Single Line Diagram	Procedure	Necessary Time
9	Energization of No2.15 kV Bus		[Energization of No2 15 kV Bus] - To close DS (①) on No1. 15 kV Bus side - To close CB (②) on No2. 15 kV Bus side (Energized for No2. 15kV Bus) Same operation of the above for other 15 kV feeders. [Check] - To check the voltages and phase angles of each 15 kV Bus	2 hours
10	Transmitted of 15kV feeder		[Operation of 15kV feeder] - To close DS (①) on Kanombe feeder - To close CB (②) on Kanombe feeder (Energization of kanombe 15 kV feeder) *Also Inyange Rutunga, Nyagasambu, masaka line [Check] - To check the voltages and phase angles of each feeder	1 hour

8.2. Switchover Procedures for Transmission line (Draft)

EXTENSION and UPDATE PLAN of GASOGI SUB STATION

This plan has been made for the purpose of checking feasibility and budgeting. Therefore, this paper does not bind the contractor's free hand to apply any method as far as it is reasonable.



DETAILED WORK STEP

1 Work shall be performed with maximum care to avoid collapse of existing towers during construction. To achieve this, it is essential to apply each and all adequate countermeasure.

2 Some of the preparatory work has to be done with energized condition. Maximum care is deemed to be necessary in order not to make electrical accident.

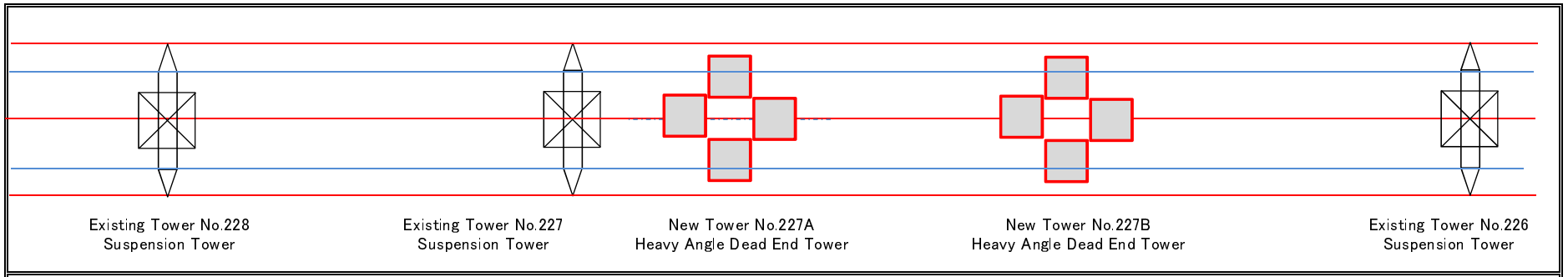
3 To minimize the shut down duration, it is essential to plan and apply parallel works as much as possible.

(days)

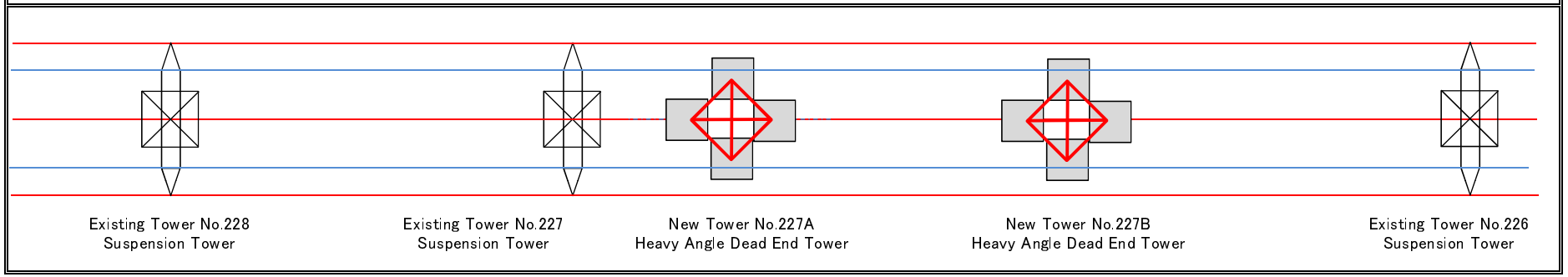
Step	WORK CONDITION	WORK to be DONE	Remarks		Expected Duration
1	Live Condition	New Foundation for Tower 227A & 227B to be constructed	Work to be done simultaneously.	Foundation shall be newly designed	30.0
2		New Tower 227A & 227B shall be elected up to the bent position		Tower shall be newly designed	
				Keep safety distance from energized conductor	
3		Stay wire foundations to be constructed at tower No.226 & No.228		Need to check the capacity of stay wire foundation	
4	Live to Shut down	Circuit to be shut down		By EDUL	0.5
5	Shut down Condition	Existing Tower No.226 & No.228 shall be tied to the ground by stay wire	Work to be done simultaneously.	Check necessary tension	1.0
6		Ground wire and conductor shall be tied to the arm at tower No.226 & 228		Check necessary tension	
7		Release ground wire & conductor from suspension clamp at tower No.226, No227 & 228		Avoid unbalance tension to towers	
		Cut and unloading ground wire & conductor between tower No.226 & No.228 to the grou		Cutting point shall be at the suspension clamp but maintain extra length in order to utilize for re connection	
				Edge of the ground wire shall be well protected to avoid damage and water immersion	
8				Ground wire & conductors shall be scrapped	
9	Shut down Condition	Erect new tower No.227A & 227B up to the top.	Work to be done simultaneously.	Use Truck Crane if available	3.0
10		Dismantle upper part of existing Tower No.227.			
11	Shut down Condition	String ground wire & conductor between Tower No.226 and tower No.227A	Work to be done at both tower simultaneously.	Ground wire and conductor shall be new and to be connected to the existing by sleeve at tower No.226 and No.228	1.0
12		String ground wire & conductor between Tower No.228 and tower No.227B			
13		String ground wire & conductor between Tower No.227A and Gantry			
14		String ground wire & conductor between Tower No.227B and Gantry			
15	Shut down Condition	Re connect ground wire with connection box at tower No.226 and Gantry & at tower No.228 and Gantry		Work shall be done with care to avoid over tension to ground wire and conductors	1.0
16		Re connect conductor at tower No.226 – Gantry – No.228 with suitable fittings			
17		Release stay wire at Tower No.226 & No.228			
18		Clear unloaded ground wire and conductor from the site			
19	Shut down to live	Energize the circuit		By EDUL	0.5
20	Live Condition	Dismantle existing Tower No.227 below bent Point		By EDUL	2.0
21		Stay wire foundations shall be removed at tower No.226 & No.228			

Total Expected Working days	39.0
Required Shutdown days	6.0

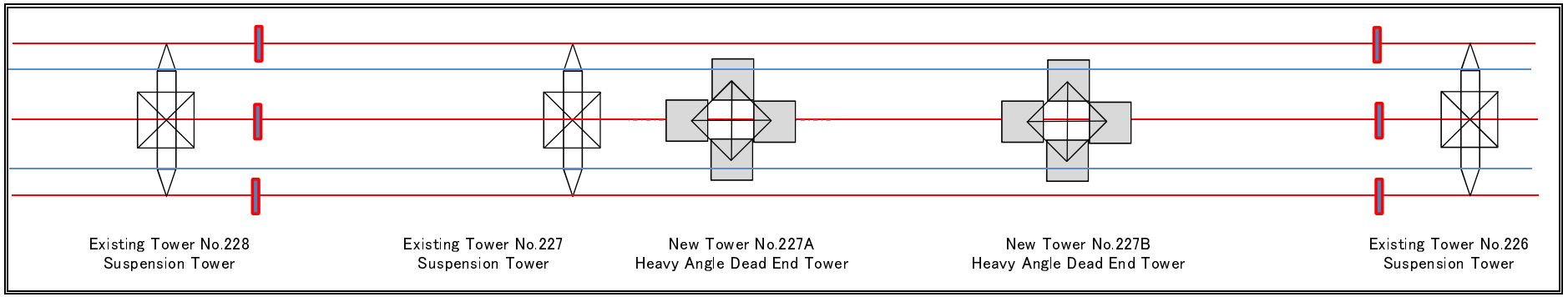
1	**New Foundation for Tower 227A & 227B to be constructed**	**LIVE CONDITION**



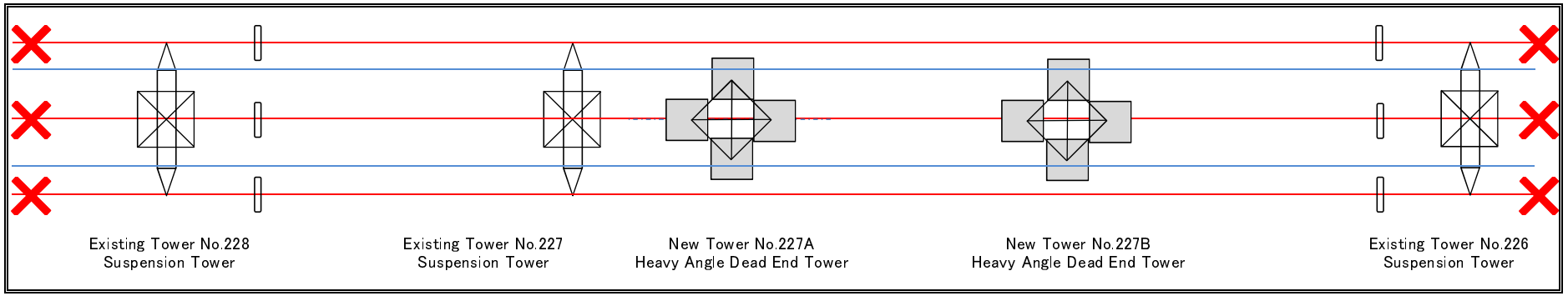
2	**New Tower 227A & 227B shall be elected up to the bent position**	**LIVE CONDITION**



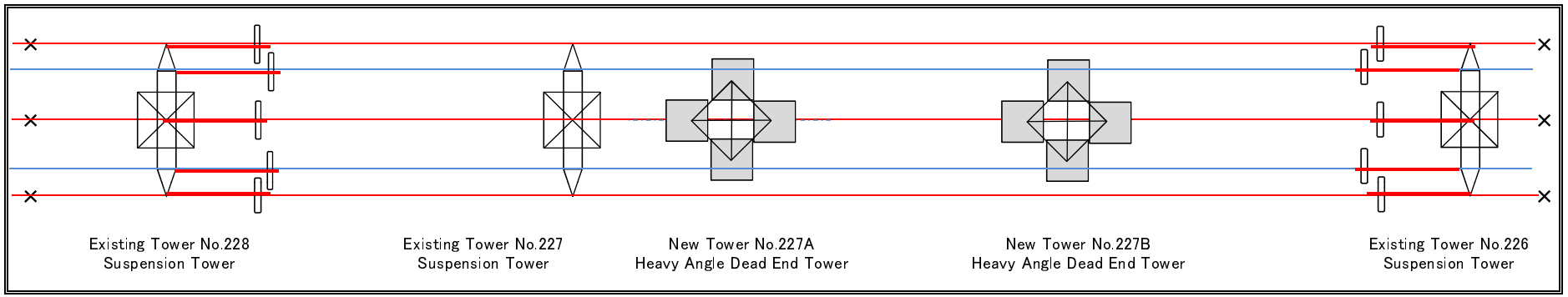
3	**Stay wire foundations to be constructed at tower No.226 & No.228**	**LIVE CONDITION**



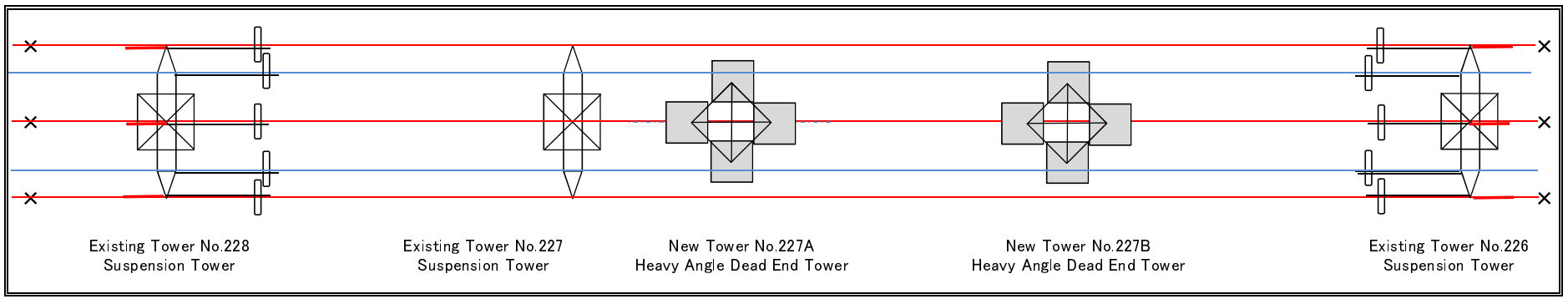
4	Circuit to be shut down	LIVE to SHUT DOWN



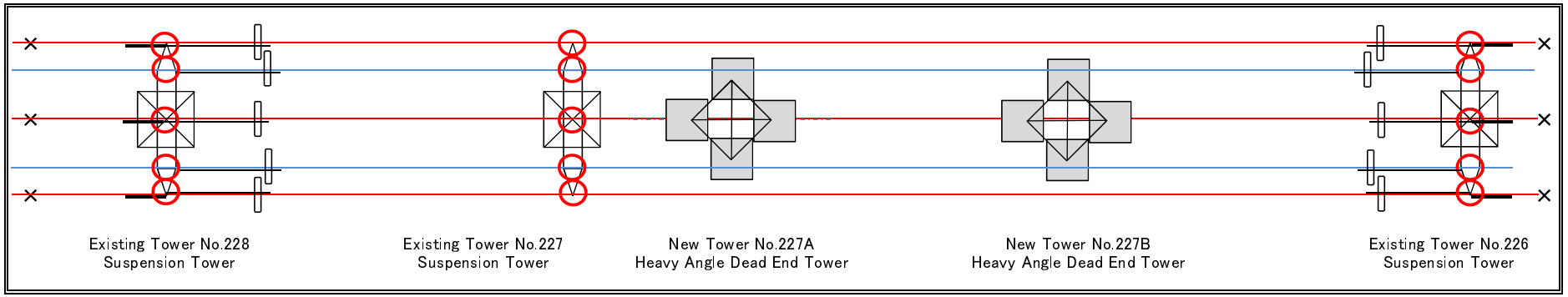
5	Existing Tower No.226 & No.228 shall be tied to the ground by stay wire	SHUT DOWN CONDITION



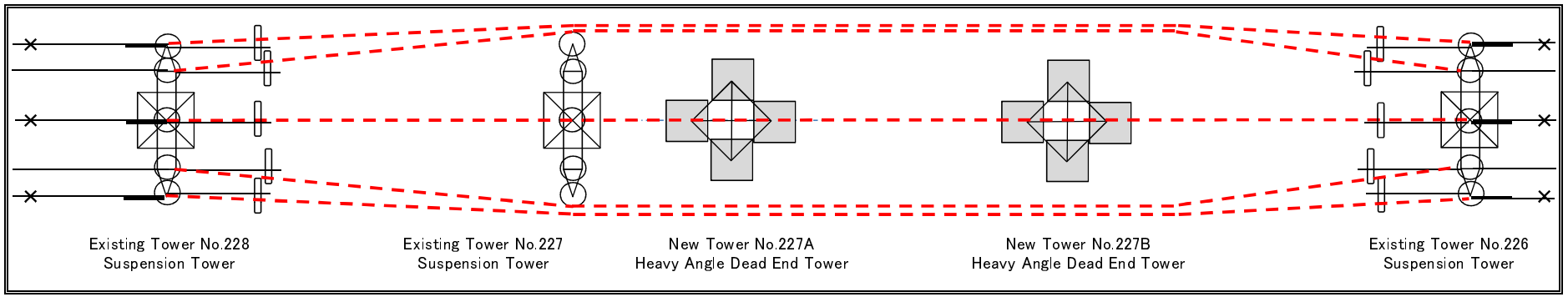
6	Ground wire and conductor shall be tied to the arm at tower No.226 & 228	SHUT DOWN CONDITION



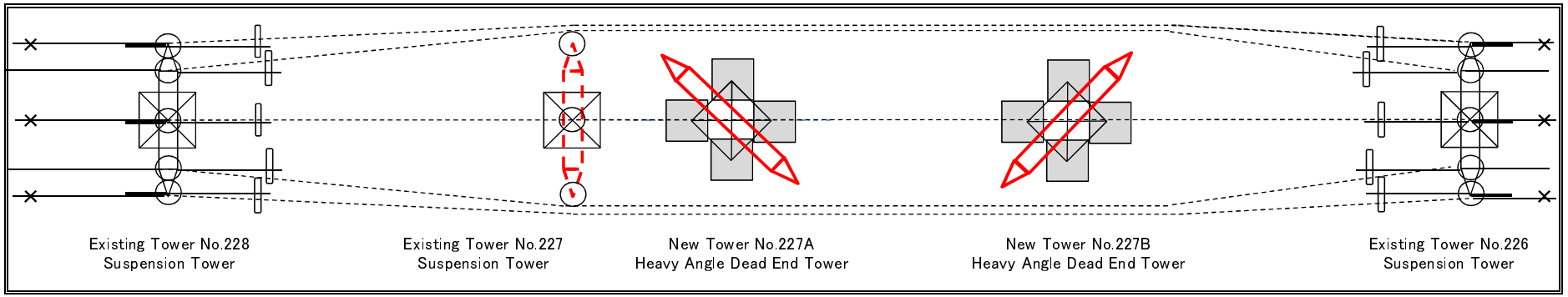
7	**Release ground wire & conductor from suspension clamp at tower No.226, No227 & 228**	**SHUT DOWN CONDITION**



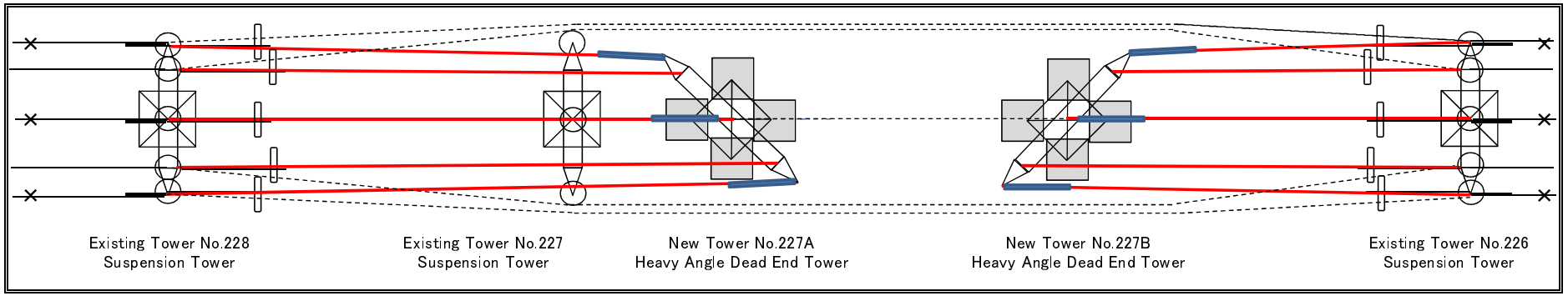
8	**Cut and unloading ground wire & conductor between tower No.226 & No.228 to the ground**



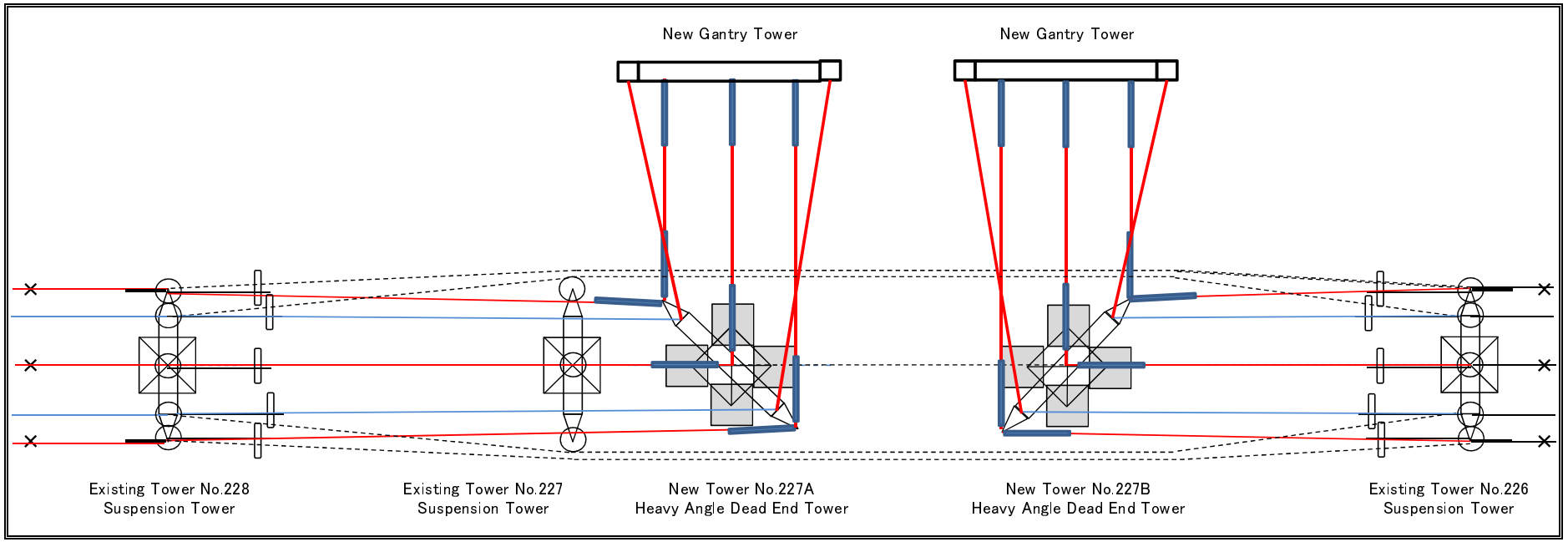
9	**Erect new tower NO.227A & 227B above bent point.**	**SHUT DOWN CONDITION**
10	**Dismantle upper part of existing Tower No.227.**	



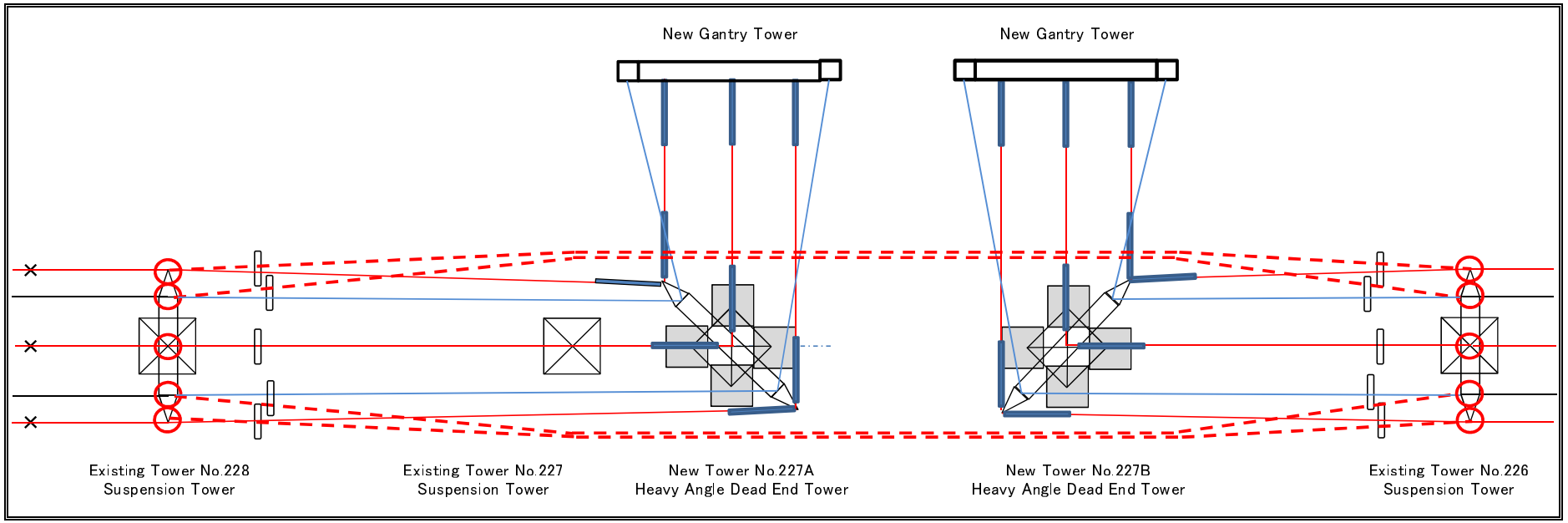
11	**String ground wire & conductor between Tower No.226 and tower No.227A**	**SHUT DOWN CONDITION**
12	**String ground wire & conductor between Tower No.228 and tower No.227B**	



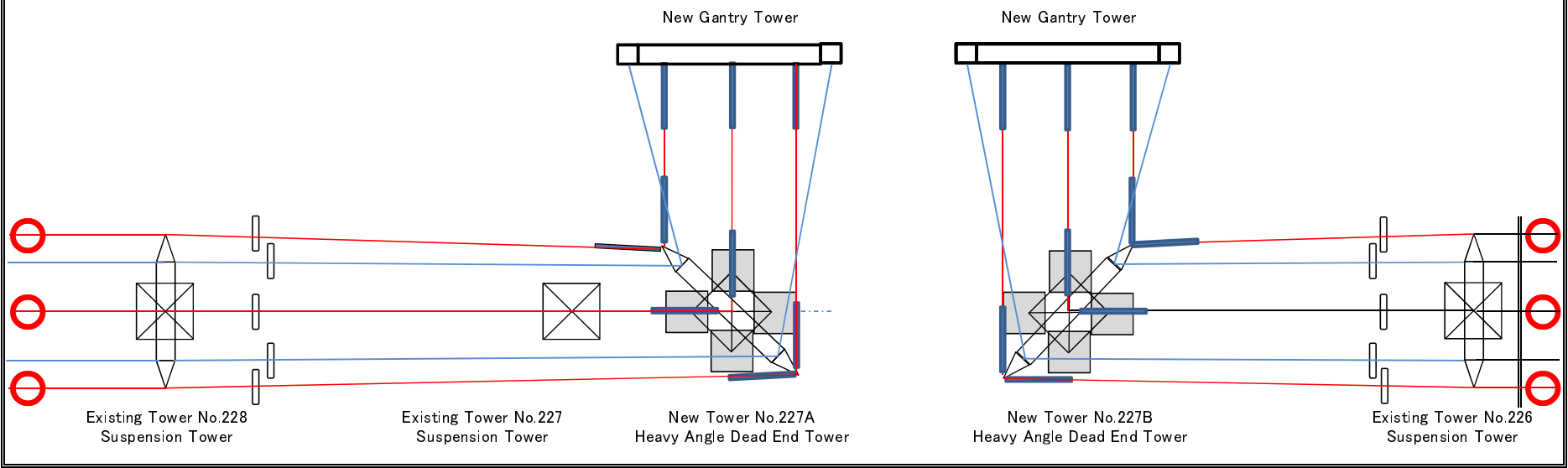
13	**String ground wire & conductor between Tower No.227A and Gantry**	**SHUT DOWN CONDITION**
14	**String ground wire & conductor between Tower No.227B and Gantry**	



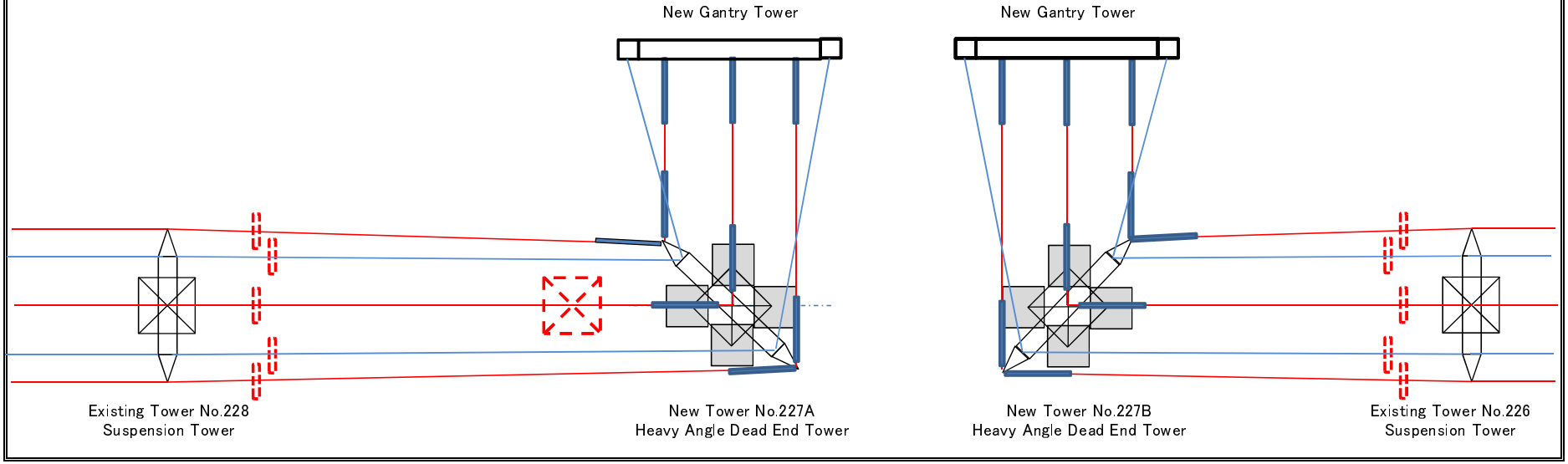
15	**Re connect ground wire with connection box at tower No.226 and Gantry & at tower No.228 and Gantry**	**SHUT DOWN CONDITION**
16	**Re connect conductor at tower No.226 – Gantry – No.228 with suitable fittings**	
17	**Release stay wire at Tower No.226 & No.228**	
18	**Clear unloaded ground wire and conductor from the site**	



19	**Energize the circuit**	**Shut down to live**



20	**Dismantle existing Tower No.227 below bent Point by EUCL**	**LIVE CONDITION**
21	**Stay wire foundations shall be removed at tower No.226 & No.228**	



End of the Paper

9. Letter related to Right-Of-Way (ROW) for transmission lines

ENERGY DEVELOPMENT CORPORATION LIMITED

9. Letter related to Right-Of-Way (ROW) for transmission lines

Kigali;.....12.JUN 2017
N° 11.07.023/.4956/17/MD-EDCL/EK/fk

Director General
Rwanda Utilities Regulatory Agency (RURA),
P.O BOX 7289 Kigali-Rwanda,
Email: info@rura.rw

Dear Sir;

RE: Rehabilitation and Re-conducting of the existing 110kV Jabana-Birembo

Reference is made to the following;

- application of Grant Aid from Japan through JICA to finance the project of **"Improvement of Substations and Distribution Network Phase-3** presented by Rwanda Ministry of Foreign Affairs and Cooperation in 2016.

- the Right-of -way for Power Lines Guidelines No.01/GL/EL-EWS/RURA//2015 adopted by the Regulatory Board of RURA especially on its article III.3 where expropriation shall be conducted in accordance with the Law into force governing expropriation for public interest in Rwanda.

- Japan Grant Aid guidelines states that a project expropriation affecting Two Hundred (200) people and above the ranking shall change and this contributes much regarding the project approval.

In view of the above references, we would therefore like to request for **Rehabilitation and Re-conducting of the existing 110kV Jabana-Birembo** to have ample power carrying capacity to meet the load demand in Kigali city. This re-conducting shall occur in the same line corridor without any damage to the properties of the closest landowners to avoid costs implication regarding expropriations on the side of Government consequently project delays.

Yours Sincerely,

ENERGY DEVELOPMENT CORPORATION Ltd
EDCL

Emmanuel KAMANZI
Managing Director

Cc:

- Hon. Minister of Infrastructure
- Hon. Minister of Local Government
- Mayor of Gasabo District
- Chief Executive Officer/REG

KIGALI

RURA
MAIL RECEIVED
FOLLOW UP
31/6/2017

RWANDA UTILITIES REGULATORY AUTHORITY
Inspiring development

Date: 28 JUN 2017
Ref: 1423/RURA/EL-EWS/DG/017

Managing Director
Energy Development Corporation Ltd (EDCL)
P.O. BOX: 537
KIGALI-RWANDA

Dear Sir,

Re: Rehabilitation and Re-conducting of the existing 110kV Jabana-Birembo

Reference is made to your letter No. 11.07.023/4956/17/MD-EDCL/EK/fk dated 12 June 2017 requesting to carry out rehabilitation and re-conducting of the existing 110kV transmission line from Jabana to Birembo;

Pursuant to Section II.2 of the guidelines N°01/GL/EL-EWS/RURA/2015 on Right-of-Way guidelines which stipulate that "*Right-of-Way dimensions for existing power lines may differ from values given in Schedule I of these guidelines*"

Considering that, as specified in your letter, the intended works are to be carried out within the existing corridor of the above mentioned line without any damage to the properties of the closest landowners;

You are advised to proceed with the planned rehabilitation of the above mentioned line.

Yours sincerely,

RWANDA UTILITIES REGULATORY AUTHORITY

Patrick NYIRISHEMA
Maj
Director General

C.C:
- Hon. Minister of Infrastructure
- Hon. Minister of Local Government
- Mayor of Gasabo District
- Chief Executive Officer/REG

10. Result of Screening by the RDB

RDB RWANDA DEVELOPMENT BOARD

Kigali 10/07/2017

Ref: RDB/EC/1262-6108-06-2017/07/17

Energy Development Corporation Limited(EDCL)

Tel.: 0788656310

Dear Sir/Madam,

RE: Terms of Reference for Environmental Impact Assessment Study

Reference is made to your letter submitting to Rwanda Development Board (RDB) the project brief related to Construction and inprovement of substation Transmission and Distribution Lines in the plot N^{o} located in Bwiza Cell, Ndera Sector, Gasabo District, Kigali City ;

We would like to inform you that after the screening of your project brief, the visit conducted in the project site and consultation of laws and regulations, it was found that your project is subject to an EIA study to the level specified in the Terms of Reference. Therefore, please find attached Terms of Reference which will guide your EIA Expert in the preparation of the Environmental Impact Report (EIR).

RDB will issue the EIA Certificate after the review and the approval of EIR.

Sincerely,

Clare AKAMANZI

Chief Executive Officer

Fred KAREMERA

CC:

- Governor/Mayor of Kigali City

- Director General of REMA

- Mayor of Gasabo District

EIA TERMS OF REFERENCE

CONSTRUCTION AND IMPROVEMENT OF SUBSTATIONS, ELECTRICAL TRANSMISSION LINES & DISTRIBUTION OF NETWORK IN KIGALI

A. Introduction

These Terms of Reference (TOR) outline the aspects of an Environmental Impact Assessment (EIA) which when thoroughly addressed will provide a comprehensive evaluation of the site, in terms of predicted environmental impacts, needed mitigation strategies, potentially viable alternatives to the development proposed and all related legislation.

Special consideration should be given to:

Upland Areas: Issues such as slope stability, impact on drainage patterns, property etc. should be examined. The path of the corridor cleared of vegetation for transmission lines and substations should be the major focus of this exercise.

Rivers/ Riverine Areas: Issues such as erosion and siltation, macro-invertebrate habitat destruction, disrupting of regular flow of the river and the possible impact of upstream activities on the wetland.

Distinct Terrestrial Forest Types: Issues relating to the specific growth form of the vegetation, the carrying capacity, the successional stage of the forest and the projected level of disturbance which the forest can withstand.

Sites located within and adjacent to areas listed as protected or having protected species: The main issue(s) of concern will in part be determined by the local legislation as well as GoR responsibilities under applicable international conventions. The impact of the development on the specific sensitivities of the

protected area should be highlighted. Mitigation of impacts should assess if the post mitigation status would be acceptable in the protected area context. Alternative sites should be rigorously evaluated.

Socio–Economic issues such as land acquisition and impact of these conveyances on daily subsistence and commerce in the community should be closely examined.

B. **Terms of Reference**

The Environmental Impact Assessment should:

1) Provide a complete description of the corridor proposed for development. This should include a description of the main elements of the development, highlighting areas to be reserved for construction, the creation of verges and other green areas.
2) Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.
3) Outline the Legislations and Regulations relevant to the project and highlight how compliant the project is and will be throughout its life span.
4) Predict the likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.
5) Identify mitigation actions to be taken to minimize adverse impacts and quantify associated costs.
6) Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.
7) Describe the alternatives to the project that could be considered at that

site

C. <u>Tasks</u>

To ensure that a thorough Environmental Impact Assessment is carried out, it is expected that the following tasks be undertaken:

1. Description of the Project

Provide a comprehensive description of the project, noting areas to be reserved for construction, verges and proposed green areas. This will also include an account of activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps; site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as pre-construction, construction, and post construction plans. If the project is to be done on a phased basis it is expected that all phases be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids be included.

The need and objectives of the project should be clearly elaborated in the report.

2. Description of the Environment

This task involves the generation of baseline data which is used to describe the study area as follows:

i) Physical environment

ii) biological environment

iii) socio-economic and cultural constraints.

It is expected that methodologies employed to obtain baseline and other data be clearly detailed.

Baseline data should include:

(A) Physical

i) a detailed description of the existing **geology** and **hydrology.** Special emphasis should be placed on storm water run-off and drainage patterns. Any slope stability issues that could arise should be thoroughly explored.

ii) **Water quality** of any existing rivers, ponds, or streams in the vicinity of the corridor or substation. Quality Indicators should include but not necessarily be limited to suspended solids, turbidity, oil and grease.

iii) Climatic conditions and air quality in the area of influence including particulate matter, NO_X, SO_X, wind speed and direction, precipitation, relative humidity and ambient temperatures,

iv) Noise levels of the undeveloped site and the ambient noise in the area of influence.

v) Topographic/relief aspect of the project corridor should be presented, together with the type of rock/soil (geology)

v) Obvious sources of pollution existing and extent of contamination.

(B) Biological

Present a detailed description of the flora and fauna (aquatic and terrestrial) in the proposed corridor of influence, with special emphasis on rare, endemic, protected or endangered species. Migratory species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, niche specificity, community structure and diversity ought to be considered.

(C) Socio-economic & cultural

Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored. The historical importance of the area should also be examined. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

3 - Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels.

The examination of the legislation will include those pertinent to electrical transmission line construction and operation projects and the appropriate international convention where applicable.

Emphasis should be put on showing how compliant the project is or will be with relation to the listed laws and regulations.

Demonstrate how the project goes in line with City Master Plan.

For the purpose of compliance monitoring, an institutional and administrative framework should be set in accordance and relevance of roles with regard to this specific project.

4 - Identification of Potential Impacts

Identify the major environmental and public health issues of concern and indicate their relative importance to the design and operation of the development. Identify potential impacts as they relate to, (but are not restricted by) the following:

- public health and safety
- change in drainage pattern
- flooding potential
- aesthetics
- landscape impacts of excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of potable, surface and ground water
- air pollution
- socio-economic and cultural impacts.
- risk assessment
- noise

Distinguish between significant positive and negative impacts, direct and indirect, long term and immediate impacts. Identify trigger, avoidable reversible and irreversible impacts. Characterize the extent and quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios. An exhaustive list of impacts including a numerical weighting based on a stated methodology should

be included.

5 Mitigation

Prepare guidelines for avoiding, as far as possible, any adverse impacts due to proposed usage of the corridor and utilizing of existing environmental attributes for optimum development. Quantify and assign financial and economic values to mitigating methods. Mitigation measures should be tangible and concrete actions.

6 Monitoring

Design a plan to monitor implementation of mitigatory or compensatory measures and project impacts during and post construction and decommissioning of the project. An Environmental Management Plan for the long term operations of the development should also be prepared.

An outline monitoring programme should be included in the EIA, and a detailed version submitted to RDB for approval after the granting of the permit and prior to the commencement of the development. At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.
- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to REMA

The Monitoring report should also include, at minimum:

- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary.

7 - Project Alternatives

Examine alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the use history of the overall area in which the corridor is located and previous uses of the site itself. Refer to REMA guidelines for EIA preparation.

All Findings must be presented in the **EIA report** and must reflect the headings in the body of the TORs, as well as references. The report should include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

11. EIA report (from EDCL to RDB)

Report

Environmental Impact Assessment (EIA)
For

The Preparatory survey on Improvement of substations and distribution network phase 3

Project Proponent:

RWANDA ENERGY GROUP Ltd
ENERGY DEVELOPMENT CORPORATION LIMITED (EDCL)
KN82 ST 3, Nyarugenge District, Kigali City,
P O Box 537 Kigali, RWANDA.

Submitted to:

RWANDA DEVELOPMENT BOARD (RDB)
Investment Implementation Division
Kigali, RWANDA.

Consultant:

Eco-Excellence Consultancy Ltd
Po Box 3418 Kigali, RWANDA
Office: MTN Center Nyarutarama
Phone: +250788356191
Email: mapetule1@gmail.com

July 2017

EXCUTIVE SUMMARY

1. Background

The Government of Rwanda (GoR), in its effort to sustain economic growth, has increased and stabilized the power production and distribution, hence reducing power shortages. In connection with this strategy, the Government of Rwanda through Energy Development Corporation Limited (EDCL) has embarked on a country-wide electricity distribution to realize the primary EDPRS target.

In response to the request from the GoR, Japan International Cooperation Agency (JICA), in consultation with the Government of Japan, decided to conduct a Preparatory survey on the project for improvement of Substations and Distribution Network Phase 3.

In line with National law No. 04/2005 determining modalities of protection, conservation and promotion of environment in Rwanda and Ministerial order No. 003/2008 relating to the requirements and procedure of Environmental Impact Assessment (EIA), this project requires an EIA. A project brief was submitted to RDB for screening, which confirmed the need for an EIA for the project.

Eco-excellence consultancy Ltd was recruited as the local consultant on behalf of the main consultant Yachiyo Engineering Co. Ltd (YEC) to prepare an EIA for this project..

Project objective and components- The main objective of this project is to increase access to electricity in Kigali and parts of Rwamagana District by:

i. Constructing a new substation at Gasogi.
ii. Constructing a single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point.
iii. Constructing a single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point.
iv. Reinforcement of the single circuit 110Kv transmission line (TL) between Jabana and Birembo substations.

Other associated facilities comprise of; access roads and site installation areas.

The ESMP was prepared in accordance with the requirements of (i) Article 67 of the Organic Law N° 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda; and (ii) compliant to the JICA 2010 Environmental and Social (E&S) considerations and World Bank safeguards.

2. Objectives of the study

The main objective of the assignment is to prepare an Environmental Impact Assessment (EIA) for the project, compliant to the JICA 2010 Environmental and Social (E&S) considerations and National Organic law.

The EIA describes the mitigation and management measures, clarify responsibilities for implementation, provide an implementation plan with the necessary time schedule and costs.

3. Approach and methodology of the study

The study begun with scoping to understand the project, identify its boundaries and relevant stakeholders. This was followed by Literature review of local and international Institutional, legislative and policy framework relevant to the EIA study, of which the most outstanding were; the National Organic law on environment and JICA E&S consideration 2010.

Public consultation- was carried out with; EDCL, RURA officials, Sector, Cell and Village local authorities, local communities, farmers, traders/vendors along the Right of way (ROW) of the proposed distribution and transmission lines. These consultations were guided by participatory methods such as; one-to-one discussions, Informed Consultation Persons (ICP), focused group discussions (FGD) and official meetings with stakeholders.

During these consultations, stakeholders were explained to; Project objectives, components and its boundaries, benefits and negative impacts the project could cause them, explained the purposes of the EIA consultant's visit and then requested to raise key concerns towards project activities. These concerns were summarized in chapter 5 and detailed in the appendix 1 of minutes of public consultation meetings.

Baseline data collection- Information was collected on the existing physical, biological, socio-economic environment of the project area. Data used in the socio-economic environment was obtained from the social impact assessment study done and complemented by National EICV3 survey done for the three Districts (Rwamagana, Gasabo and Kicukiro) in addition to data obtained from public consultation of the Sector and cell local officials.

A comprehensive report including all collected data, analysis of the data, anticipated impacts, proposed mitigation measures, an Environmental Social management plan and monitoring plan has been prepared.

4. Project Description

No.	Project Components	Distance covered	District	Sector	Cells	Village
1	New Gasogi substation	8,912m^2 (111.4m x 80m)	Gasabo	Ndera	Kibenga	Burunga
2	Single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka	Approximately 8.5km	Gasabo	Ndera	Kibenga	Burunga
					Cyaruzinge	Gashure
						Gatare
					Rudashya	Ruhangare
						Munini
						Kacyinyaga

	connection point. (South Distribution line)			Rusororo	Nyagahinga	Gisharara
						Kabutare
			Kicukiro	Masaka	Cyimo	Kiyovu
						Murambi
3	Single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point (North Distribution line)	Approximately 11.5km	Gasabo	Ndera	Kibenga	Burunga
					Mukuyu	Jurwe
				Gikomero	Murambi	Rugarama
					Munini	Rudakabukirwa
				Rusororo	Mbandazi	Karambo
					Kinyana	Nyagasozi
						Kigabiro
			Rwamagana	Fumbwe	Nyakagunga	Kirehe
						Akabeza
					Nyagasambu	Rambura
4	Single circuit 110Kv transmission line (TL) between Jabana and Birembo substations	Approximately 7km	Kicukiro	Jabana	Kabuye	Kabeza
			Gasabo	Kinyinya	Kagugu	Giheka
						Kagarama
						Dusenyi
					Murama	Ngaruyinka
					Gasharu	Kami
						Agatare

***Project Activities**:* Shall comprise of three (3) phases; Planning, construction and operation phase.

Planning/ mobilization phase- This shall comprise of; Preparatory survey of the project, detailed design, approvals by EDCL and JICA, full replacement compensation of Project Affected People (PAP), Tender document preparation, Procurement of Contractor, supervision firms and equipment.

Construction phase- This shall comprise of; Mobilization of equipment and labour force, Site clearing and installation, Construction activities that include; Excavation works, Foundation trenches, erection of towers and conductors, Preparation of as-built drawings, Handover of site, Defects liability period of 12months

Operation phase- Power line maintenance.

5. Consideration of Alternatives

The selected line routes, location of the new substation were the most feasible in light of the existing electricity network in the area. They possess the most direct line of route, least expropriation effects and the positive project benefits.

The alternative of "no-build" is not appealing since electricity is included as a measure of development in these urban and peri-urban areas and therefore is always given high priority in the list of developmental activities for Rwanda. While there will be no high environmental cost from these alternatives, with increasing population the demand for electricity connection increases and hence less power if these new networks are not constructed.

6. Environmental impact assessment

Chapter 5 gives a summary of issues raised during the public consultation likely to be caused by activities involved in distribution and transmission network. Details of the public consultation are addressed in the Minutes of public consultation meetings in appendix 1.

Scoping matrix anticipation of likely impacts both positive and negative impacts is discussed in chapter 6 and evaluated based on field survey, public consultation and literature review to come up with impact and risks under the Impact matrix in chapter 7.

7. Environmental Management Plan (EMP) and monitoring plan

In chapter 8 and 9, the report presents in tabular form, 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, cost estimates and implementation schedule of implementing the EMP.

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

Recommendations

Finally, a summary of mitigation measures have included as recommendations in this EMP for implementation which include:

<u>At Planning and design stage:</u>

- ***For Land acquisition and asset displacement***
  - Preparation of a RAP with detailed asset inventory displaced by the project at the stage of preparation of detailed engineering design.
  - Compensation of all displaced assets at full replacement cost before any construction can commence.
- ***To avoid electro-magnetic field exposure from power lines***
  - For Land acquisition and asset displacement
  - In compliance to the 2010 RURA guidelines for ROW of power lines, no habitat houses directly under the wire zone power lines is accepted and hence all shall be displaced and compensated during RAP implementation.

<u>At construction stage:</u>

- ***For environment and social protection***
  - To avoid redundancy at trading centres due to works, it is proposed that the contractor exercises an affirmative policy giving locals in the area first priority during employment for road works for skilled or unskilled labour
  - Propose to have a Storm water drainage master plan for the sites.
  - Liquid waste generation from human waste can be handled by installment of mobile toilets, while solid waste shall be regularly disposed off site to the designated District damp site.
  - To avoid or reduce air/ dust pollution; (i) water shall be sprayed regularly on site, (ii) soil shall be compacted for completed portions to reduce dust, (iii) On site, the contractor shall only possess automobiles with vehicle inspection certificates considered to be in good condition with less exhaust emissions and noise.
  - Noise pollution can be controlled by permitting noisy activities during working hours of 7-17h and only using automobiles for construction that have Automobile inspection certificate.
  - To avoid traffic accidents, the project shall ensure traffic personnel to guide traffic during construction and traffic signage at the sites are in place.
  - To ensure that during construction cultural heritage such as graveyards and any cultural monuments found within project boundaries are respected, a chance find procedure is proposed that follows:
    - The Contractor shall follow the requirements of the articles 14, 15, 16, 18, 19 of the National law N°11/2013 of 11/03/2013 Determining the organisation and use of Cemeteries.
    - Consultation with communities and designated government agencies on movement of the grave or cultural artifacts.
    - Relocation of grave or artifacts and structures associated with religious worship can occur only after consultation with ritual practitioners (priests and spirit mediums) and must include compensation for associated rituals.
    - Families must be compensated for both the logistical and the ritual costs of exhuming family graves and transferring remains to a new site.

- ***For Labour and working conditions***
  - To minimise occupational health hazards on site, the contractor shall present a site Health and Safety policy and plan.
  - Workers shall have Personal Protective Equipment (PPE) and safety wear while on site.
  - Employees shall have training on health and safety on site.
  - The site shall have a fire risk management plan.
  - Inform local communities about works and dangers.
  - Document accidents on site.
  - Hoard the site to avoid trespassers that could otherwise have accidents.
  - To avoid child labour, recruitment of workers shall be based on presented National ID, with a policy of not employing anyone under 16 years old.

- The contractor shall possess a labour policy and indicate compliance to it. It shall comprise but not limit to; prohibition of child labour, indicate contract formats for employment, obligations of the employer and employee, salary structure, leave, health and safety policy and an insurance policy for the site.
- Sensitisation of workers and neighbouring communities on HIV/AIDs and other infectious diseases shall be encouraged by the contractor and Sector authorities.

- ***Community health, safety and security***
  - For site security, the contractor shall ensure that; (i) the site is hoarded or fenced off with iron sheets, wire mesh or construction nets, (ii) there is sufficient lighting of the site, (iii) the site has security guards.
  - The contractor shall pay for the services of Community policing "locally called Kurara Irondo".

At operation stage

- **To avoid human electrocution**
  - Horizontal insulators are used to connect the two conductors attached to the tower.
  - Precautions panels on the towers with instructions in Kinyarwanda, English or French informing people of the dangers of getting close, touch or climbing the tower.
  - Sharp spokes at the lower horizontal members to prevent children or other people from climbing the tower.
  - Towers with a ground wire avoid lightning from striking the power lines.
  - Train and supervise EUCL operatives to ensure that they check house wiring carefully and reject if deficient.
  - Public education to raise villagers' awareness of dangers of electricity and how to utilize the system safely.

- **To avoid fire risks from lightning or short circuits**
  - Towers shall be designed to have a ground wire that provides a more direct current path to the earth for lightning to flow through than the transmission lines, hence avoiding lightning from striking the transmission lines and causing fires or electrocution.

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ABBREVIATIONS

EDCL	Energy Development Corporation Limited
EDPRS	Economic Development and Poverty Reduction strategy
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EUCL	Energy Utility Corporation Limited
E&S	Environment and Social
DL	Distribution Line
GoR	Government of Rwanda
JICA	Japan International Cooperation Agency
MINAGRI	Ministry of Agriculture and Animal Resources
MININFRA	Ministry of Infrastructure
MINIRENA	Ministry of Natural Resources
NISR	National Institute of Statistics of Rwanda
NLC	National Land Centre
PAP	Project Affected People
RAP	Resettlement Action Plan
RDB	Rwanda Development Board
REG	Rwanda Energy Group
REMA	Rwanda Environment Management Authority
TL	Transmission Line
ToRs	Terms of Reference
WB	World Bank
YEC	Yachiyo Engineering Co.Ltd

CHAPTER 1: GENERAL BACKGROUND

1.1 NATIONAL CONTEXT

The Government of Rwanda (GoR), in its effort to sustain economic growth, has increased and stabilized the power production and distribution, hence reducing power shortages. GoR also exercises a strong leadership role in donor coordination and has begun to work with donors on a clearer division of labour by identifying areas of individual donor comparative advantage. In connection with the mentioned strategy, the Government of Rwanda through Energy Development Corporation Limited (EDCL) has embarked on a country-wide electricity distribution to realize the primary EDPRS target.

A number of development partners so far committed to support the program including; World Bank IDA, World Bank, African Development Bank, BADEA, OFID, Saudi Funds, Netherlands, Japan, and others.

In response to the request from the GoR, Japan International Cooperation Agency (JICA), in consultation with the Government of Japan, decided to conduct a Preparatory survey on the project for improvement of Substations and Distribution Network Phase 3.

In line with National law No. 04/2005 determining modalities of protection, conservation and promotion of environment in Rwanda and Ministerial order No. 003/2008 relating to the requirements and procedure of Environmental Impact Assessment (EIA), this project requires an EIA. A project brief was submitted to RDB for screening, which confirmed the need for an EIA for the project.

Eco-excellence consultancy Ltd was recruited as the local consultant on behalf of the main consultant Yachiyo Engineering Co. Ltd (YEC) to prepare an EIA for this project.

1.2 PROJECT OBJECTIVE

The main objective of this project is to increase access to electricity in Kigali and parts of Rwamagana District by:

- Constructing a new substation at Gasogi.
- Constructing a single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point.
- Constructing a single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point.
- Reinforcement of the single circuit 110Kv transmission line (TL) between Jabana and Birembo substations.

1.3 OBJECTIVES OF THE ESIA

The *main objective* of the assignment is to prepare an EIA for the project, compliant to the JICA guideline for environmental and social considerations 2010 and National Organic law.

The *specific objectives* of the study are;

i. To analyze positive and negative impacts of the proposed project interventions and prescribe mitigating measures to be incorporated into the project design and construction;

ii. To provide an Environmental Management Plan (EMP) which describes the actions that will be taken to enhance positive impacts and to avoid, minimize, mitigate, compensate / offset negative impacts of the Project. The EMP will describe the mitigation and management measures, clarify responsibilities for implementation, provide an implementation plan with the necessary time schedule and costs.

1.4 SCOPING OF THE STUDY

First of all it is important to understand the hierarchy of local authorities in Rwanda relevant to the project. At the top is the *District*, which manages a number of *Sectors*, which in turn manage several *Cells* that also manage many *villages* comprising of a number of households. Each of these levels is managed by a group of qualified for all and elected people in the case of the village and District.

From the Scoping study undertaken by the local consultant, boundaries of the study were drawn in the following manner:

Project boundaries- The study covered the following project area:

Table 1 Project boundaries

No.	Components	Distance covered	District	Sector	Cells	Village
1	New Gasogi substation	8,912m² (111.4m x 80m)	Gasabo	Ndera	Kibenga	Burunga
2	Single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point. (South Distribution line)	Approximately 8.5km	Gasabo	Ndera	Kibenga	Burunga
					Cyaruzinge	Gashure
						Gatare
					Rudashya	Ruhangare
						Munini
						Kacyinyaga
				Rusororo	Nyagahinga	Gisharara
						Kabutare
			Kicukiro	Masaka	Cyimo	Kiyovu
						Murambi
3	Single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point (North Distribution line)	Approximately 11.5km	Gasabo	Ndera	Kibenga	Burunga
					Mukuyu	Jurwe
				Gikomero	Murambi	Rugarama
					Munini	Rudakabukirwa
				Rusororo	Mbandazi	Karambo
					Kinyana	Nyagasozi
						Kigabiro
			Rwamagana	Fumbwe	Nyakagunga	Kirehe
						Akabeza
					Nyagasambu	Rambura
4	Single circuit	Approximately	Kicukiro	Jabana	Kabuye	Kabeza

	110Kv transmission line (TL) between Jabana and Birembo substations	7km	Gasabo	Kinyinya	Kagugu	Giheka
						Kagarama
						Dusenyi
					Murama	Ngaruyinka
					Gasharu	Kami
						Agatare

Scope of work was to -

- Identify which legislation, policies (both National and JICA 2010) are likely to influence impacts caused by this project.
- Develop an overview of the baseline environment of the project intervention area. i.e. physical, biological and social environment.
- Develop an overview of likely impacts (positive or negative) that could be caused by the project.
- Propose mitigation measures against of the predicted adverse impacts identified.
- Analyse Alternatives
- 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.

1.5 APPROACH AND METHODOLOGY OF THE STUDY

The study adopted the following approach: (i) scoping study/ preliminary assessment, (ii) review of secondary data on baseline information (iii) review of policies, regulations and safe guards, (iv) review of meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the sites. This was done to gather information and data on various aspects of the sites.

Site locations, land cover, proposed infrastructure were described fully with clear maps (where necessary) for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts. The methodology is detailed hereafter.

1.5.1 Preliminary Assessment/ Scoping study

A preliminary scoping study involved; literature review of the Field report of the preparatory survey on improvement of substations and distribution network phase 3, a field visit along the proposed power lines to familiarize the consultant with existing features and proposed project activities.

The scoping exercise further entailed the following:

- Identification of the intervention sites that include especially of; location of the New Gasogi substation, the North and south distribution lines and the transmission line.

- Identification of Right of Way (ROW) corridor of the power lines that could be affected by project activities, such as; asset resettlement, land acquisition.
- Identification of local administrative jurisdiction in which the line route traverses and likely stakeholders that would be engaged 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.

1.5.2 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 components of project implementation, its sustainability and ensure enhancement of the environmental resources.

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

- JICA Guidelines for environmental and social considerations (2010).
- RURA Guidelines on right of way (ROW) for power lines.
- Organic Law no. 04.2005 establishing the modalities of protection, conservation and promotion of the environment,
- Ministerial order 003/2008 of 15/08/2008, relating to the requirements and procedure of environmental impact assessment,
- Ministerial order No. 004/2008 of 15/08/2008, establishing the list of activities or projects that have to undergo environmental impact assessment before commencement.
- Law No. 32/2015 relating to expropriation in public interest
- Field report of the preparatory survey on improvement of substations and distribution network phase 3.
- Government Economic Development for Poverty Reduction Strategy (EDPRS) II,
- District Development Plans (DDPs) (2013-2018).

An institutional framework was also elaborated, indicating roles and responsibilities of National and international Institutions that will have a stake in implementing the project, implementing and monitoring enhancement and mitigation measures proposed against anticipated adverse impacts.

1.5.3 Stakeholder engagement/ Public consultation

Identification and Involvement of stakeholders

Information collected from the preliminary desk review, preliminary scoping consultation and field survey, guided the consultant in identifying the project stakeholders.

Without chronological priority, stakeholders identified were:

- Government organ officials, (i.e. EDCL)
- Local government officials (Sector, Cell and Village leaders)

- Local communities likely to benefit or be affected by project activities. i.e. farmers, residents, traders
    - Regarding these local communities, consultations were done with;
        - General public
        - women,
        - youth, and
        - Vulnerable groups such as; disabled, elderly and poor.

Methods applied:

During the Public consultation, the study applied different participatory methods, namely;

- Interviews,
- one-to-one discussions with Key Informants (KIs),
- focused group discussions (FGD) and
- Public meetings with stakeholders.

Stakeholders consulted were informed on the proposed project and by using key guiding questionnaire, the study was able to guide discussions and obtain relevant information on the likely impacts of the project activities. Stakeholders raised their concerns on the proposed project. An issue raised by one individual or a group of people was cross-checked by discussing it over with other individuals or groups.

Public consultation provided required data for the baseline environment data (human, biophysical environment) of the areas in question. From the consultation, the study prepared a Public consultation or Issues and response report for the client's reference, which was included to the annexes of the EIA report. *(A Public consultation Issues report of the field visit may be referred in appendix 1).*

1.5.4 Baseline Data and Information

Information on the physical, biological, socio-economic environment, institutional and legal regimes was collected from a variety of sources, namely; literature review, visual and inspection, expert opinion, consultations with selected stakeholders, Sector, Cell and village representatives.

Field data / information collection

This involved field visits along the line route of the power lines earmarked by the Angle points coordinates from the New Gasogi substation to Masaka connection point and Nyagasambu connection point.

Subsequent field surveys were done to collect socio-economic data of the sites, existing physical and biological environment of the site areas.

1.5.4.1 Methods used for baseline data collection and analysis

Physical environment- Comprised collection of data and analysis of; area climate, hydrology, relief, soils.

Climate- The data required for the climate assessment includes; rainfall records, monthly evaporation and temperature. This information was used to understand the climate of the area and pattern followed by the main land use practice in the intervention area. i.e. agriculture. From this climate information, one would then understand the effects of climate risk patterns and eventually propose avoidance or mitigation measures.
Available meteorological data recorded at stations within the surrounding area was gathered from the relevant national institutions.
Field visits to the sites were used to crosscheck information obtained during the desk study and obtain any additional field information where necessary.

Climatic data (rainfall) was referred Rwanda Meteorological Agency climatology of Rwanda, annual rainfall and temperature distribution of Rwanda. *Verdoodt and Van Ranst. (2003)*

Soil - Soil types for different sites were referred from the MINAGRI soil mapping done in March 2015.

Ecological analysis
Assessment was done of flora and fauna for the project road linage and its surroundings. Tools such as; field observation combined with GIS mapping were used to determine land cover of these areas of sites. Literature review was used to predict likely fauna commonly observed with corresponding flora determined by the GIS land cover.

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

Social environment analysis
It involved collecting primary data from field and matching it with secondary data obtained from desk reviews. Methods of obtaining field data were mainly through public consultation/ stakeholder engagement, expert observation and most importantly data collected by the baseline study of the displaced communities.
Social data collected from field public consultation with local government and locals were on; local impression of the proposed project, project design suggestions, population and demography, land use patterns, gender difference, recent climate risk/impact patterns, basic infrastructure (roads, water, electricity), health and sanitation, education, cultural heritage. This data was interpreted to indicate anticipation of positive and adverse impacts, addressed in proceeding chapters.

1.5.5 Impacts Assessment

Impacts prediction and analysis involved assessment of the entire project cycle i.e. project planning/mobilization, construction, operation 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:

- *Scoping matrix*- Under this section, from the project activities preliminary risk/ impacts were predicted that might affect or enhance the livelihood in the project areas and drawn against their possibility of occurrence to determine their significance.
- *Impact evaluation Matrix*- Under the Impact evaluation matrix, the analysis by these tools of field analysis, GIS, Expert observations were applied to test the significance predicted under the scoping matrix. An Impact evaluation matrix in tabular format was drawn, in which actual impacts were rated based on their significance. Only those found to have negative impacts were advanced to the EMP where mitigation measures were proposed against each adverse impact.

The Scoping and Impact evaluation matrix were discussed in Chapter 6.

1.6 REPORT STRUCTURE

This report is organised in ten chapters.

- Chapter 1 gives a General background;
- Chapter 2 deals with the project description;
- Chapter 3 gives a description of pertinent policy, legal and institutional framework within which the project will operate;
- Chapter 4 presents the baseline data, environmental, socio-economic environment of the project intervention areas.
- Chapter 5 presents the findings of the Public consultation.
- Impacts identification, evaluation for significance and proposed mitigation measures are elaborated in Chapter 6 and 7,
- While Chapter 8 presents the Environmental management Plan (EMP).
- An Environmental Monitoring is presented in Chapter 9 and
- Chapter 10 provides conclusions and recommendations of the project.

CHAPTER 2: PROJECT DESCRIPTION

The components of the proposed project comprised of:

Table 2 Project components

	Components	Description
1	Procurement of installation work	
	1.1 New Gasogi substation a) 110 kV/ 15 kV transformer b) 110Kv switch gear c) 15Kv switch gear d) Control and supervisory facilities	 15MVA x 2 units 1 set 1 set 1 set
	1.2 Distribution line a) 15 kV distribution line (Single circuit) from New Gasogi substation to Masaka connection point b) 15 kV distribution line (Single circuit) from New Gasogi substation to Nyagasambu connection point	 Approx. 8.5km Approx. 11.5km
	1.3 Reinforcement of Transmission line between Birembo and Jabana Substations 1) 110 kV transmission line (Single circuit) from Birembo and Jabana Substation	 Approx. 7.0km
2	Procurement Work	
	2.1 Maintenance tools for the equipment to be procured	1 lot
	2.2 Spare parts for the equipment to be procured	1 lot
3	Construction work	
	3.1 Installation of Gantries, Towers, etc. 3.2 Construction of Control building of New Gasogi Substation 3.3 Civil works	1 lot 1 lot 1 building

The scope of the EIA study is limited to only section 1.1, 1.2 and 1.3.

A site layout of the proposed new Gasogi substation is shown below;

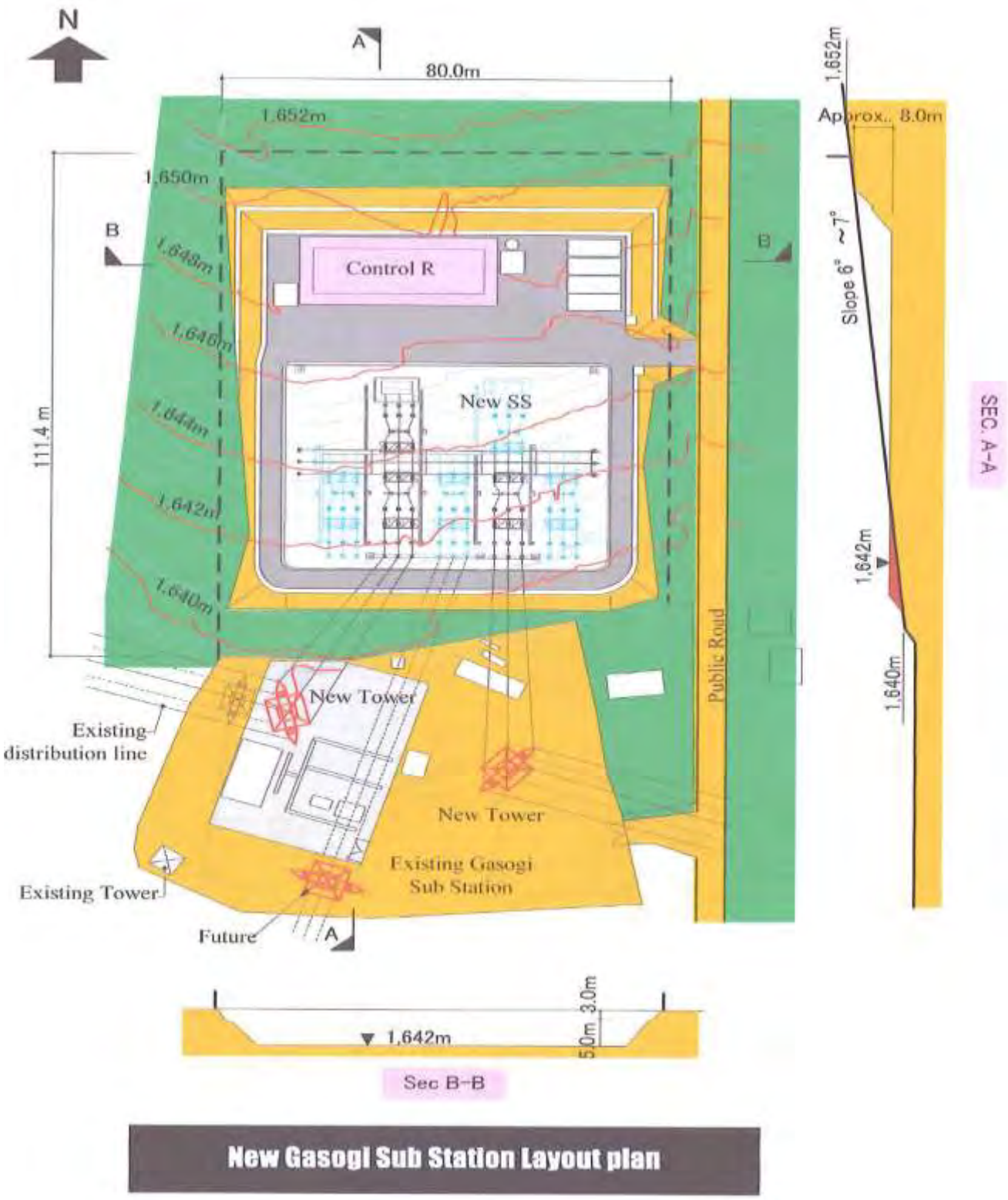
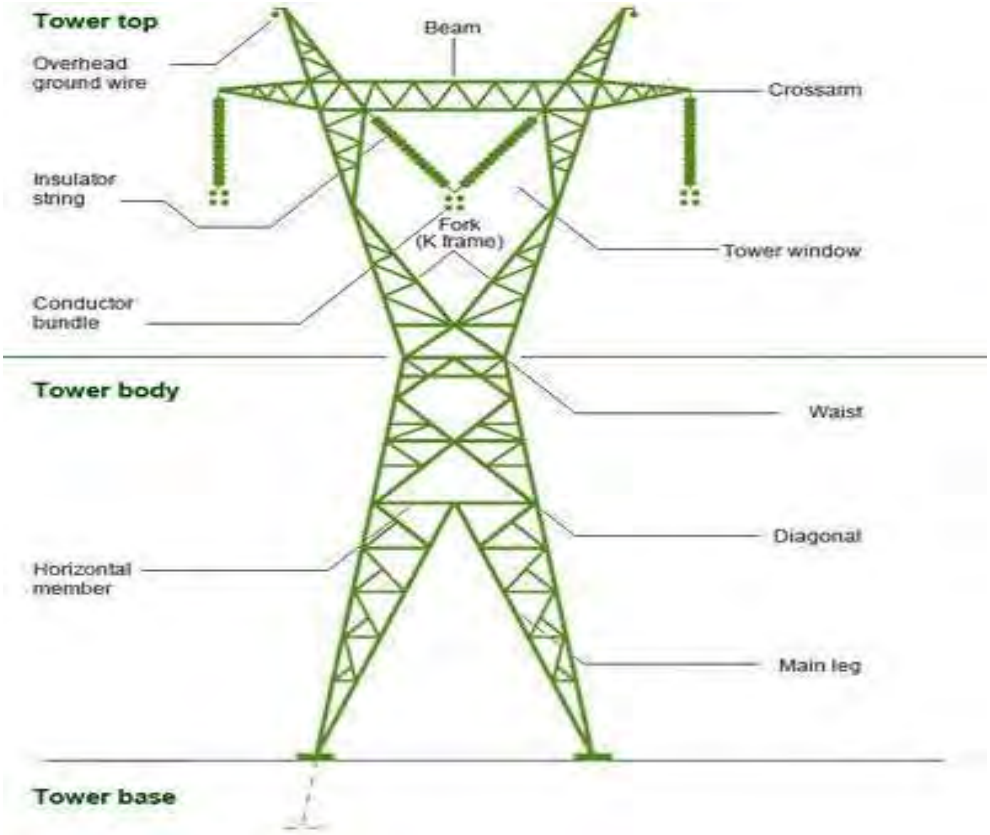


Figure 1 New Gasogi substation site layout plan

The project shall also involve erection of towers and conductors for the distribution and transmission lines. An example of what a tower would look like is shown in the figure below.



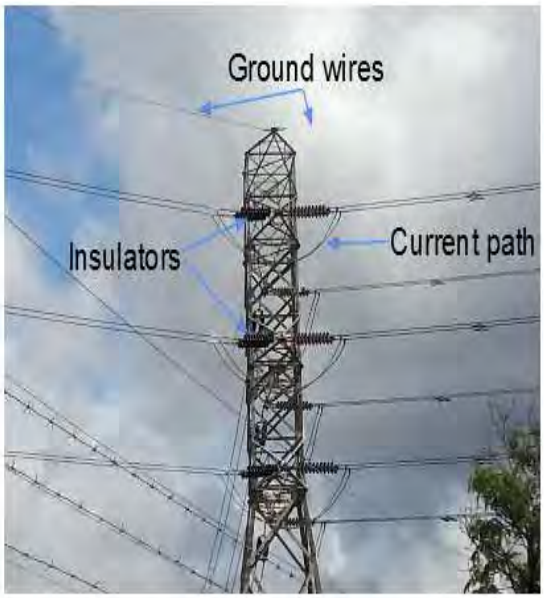


Figure 2 components of a tower

The project covered three (3) districts; Gasabo, Kicukiro and Rwamagana districts. Line of route of the distribution and power lines demarcated by the connecting Angle points are indicated by the following maps.

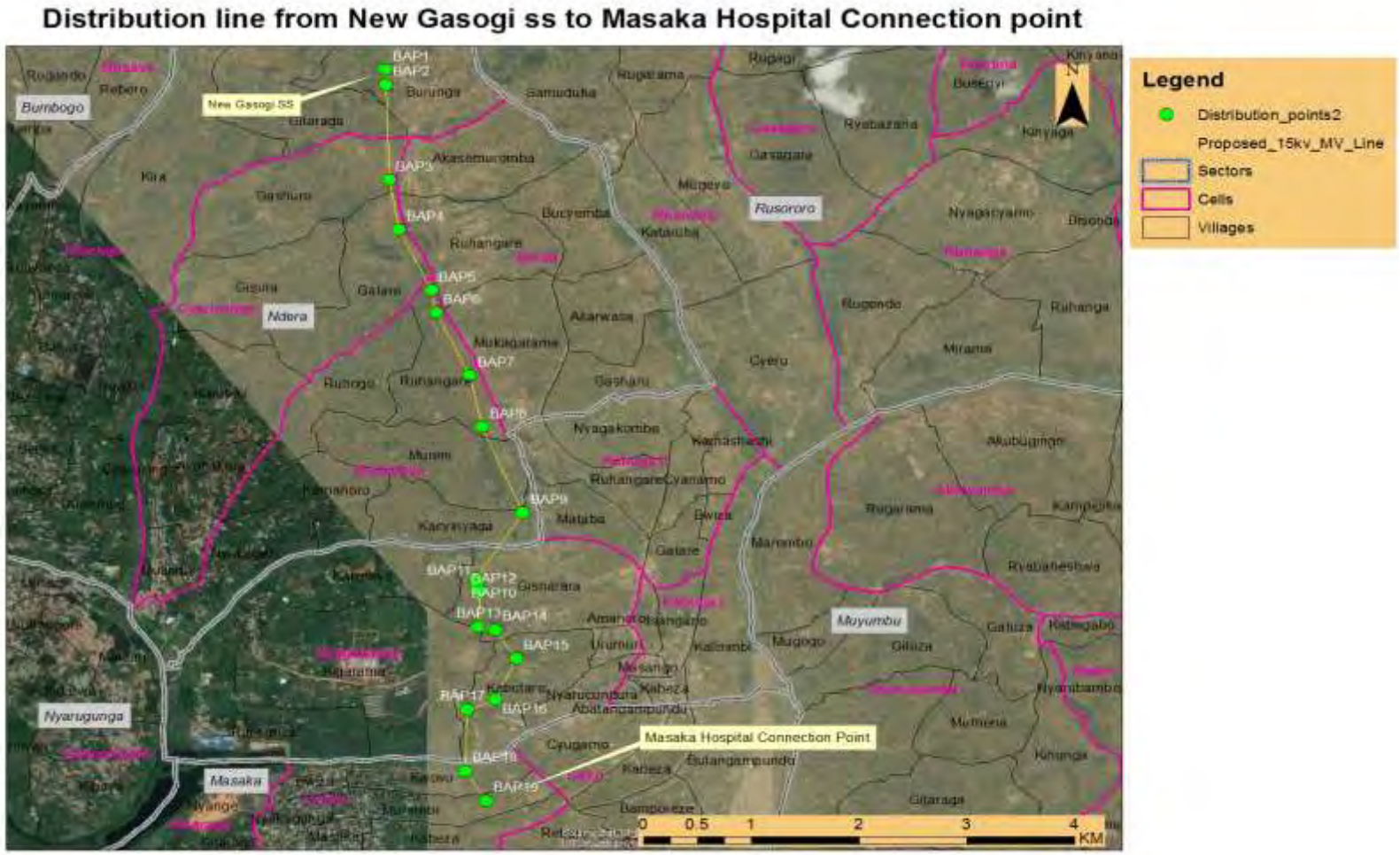


Figure 3 Distribution line from New Gasogi Substation to Masaka Hospital connection point

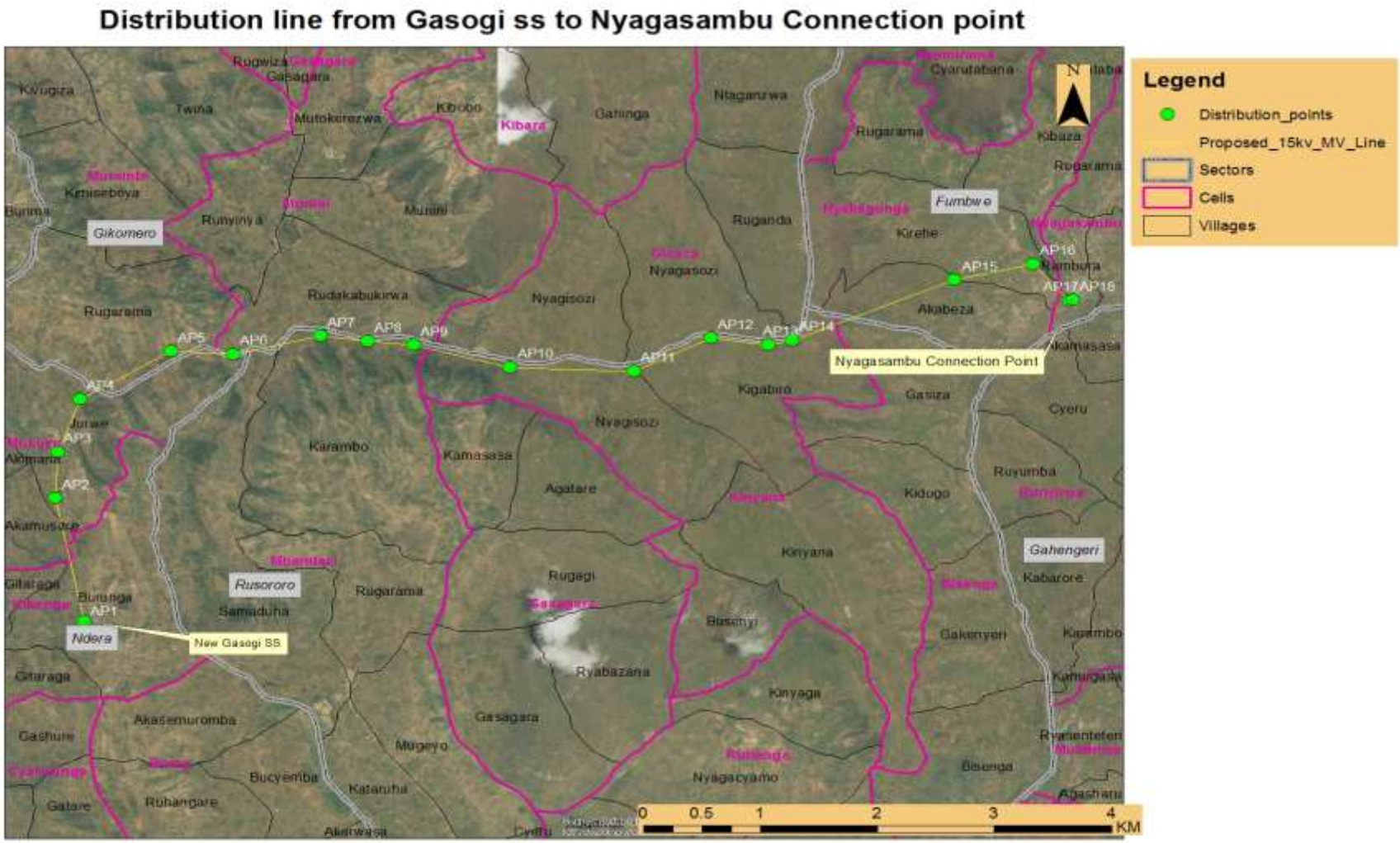


Figure 4 Distribution line from New Gasogi Substation to Nyagasambu connection point

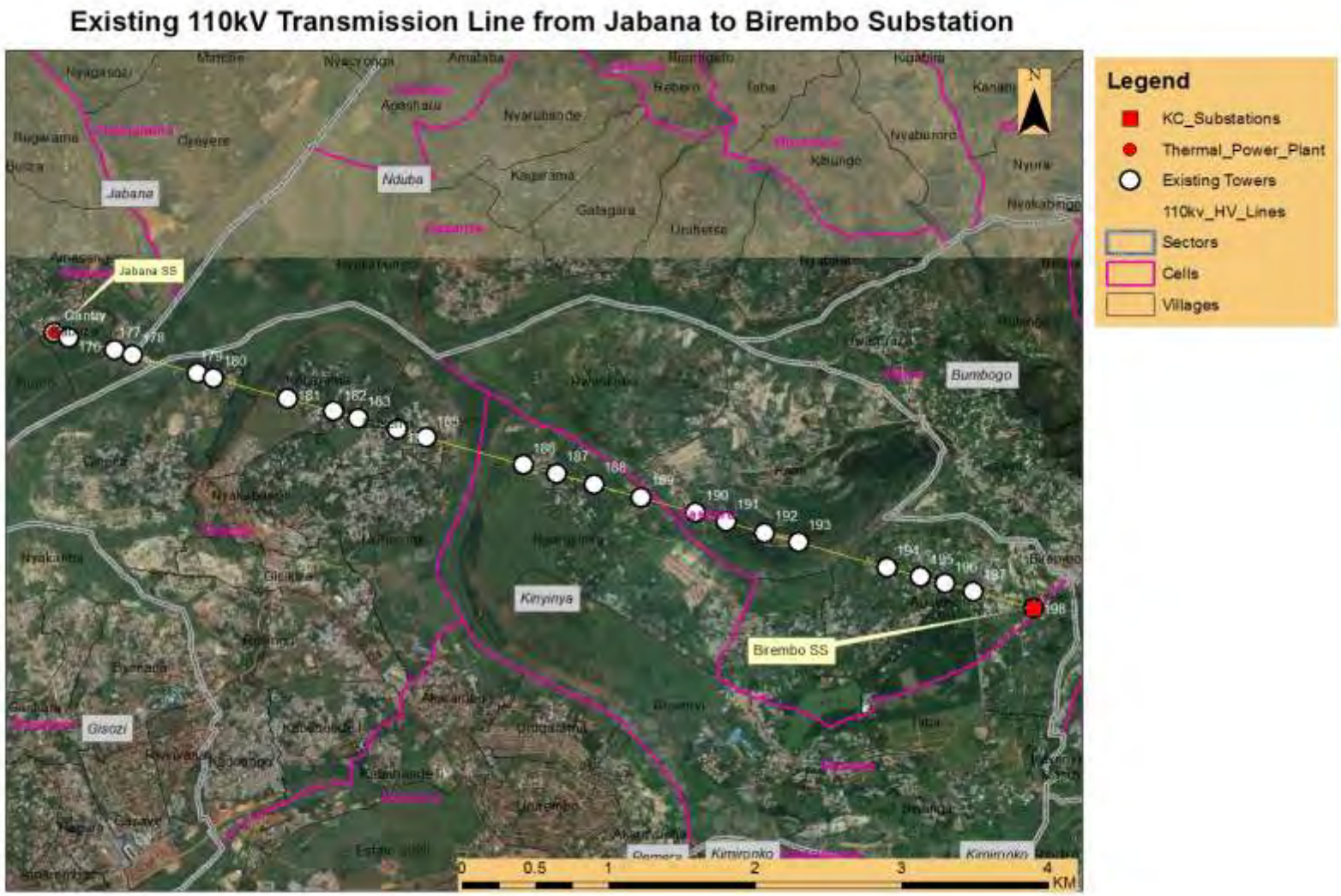


Figure 5 Existing 110kV Transmission line from Jabana- Birembo substation

2.3.2. Activities for the power line and construction

Planning/ mobilization phase- This shall comprise of;

- Preparatory survey which includes; preparation of the project design, EIA, ARAP and implementation of the ARAP.
- Project grant agreement signature.
- Reconfirmation of site situations and preparation of tender document for contracting out works and equipment.
- Procurement of equipment, Contractor and supervision firms.

Construction phase- This shall comprise of:

- Mobilization of equipment and labour force.
- Site clearing and installation.
- Topographical survey and mapping of power line corridor with reference to design.
- Construction activities that include; foundation works for towers, installation of towers, installation of distribution and transmission lines and building works at the substation.
- Preparation of as-built drawings.
- Handover of sites.
- Defects liability period of 12months

Operation phase- This shall include:

- Maintenance activities by EUCL.

CHAPTER 3: RELEVANT POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS

This chapter describes policies, laws, regulations and institutional framework relevant the project. Both national and international regulations are presented in the sections below.

3.1. NATIONAL LEGAL AND POLICY FRAMEWORKS

3.1.1. Economic Development and Poverty Reduction Strategy II (EDPRS II)

EDPRS II (2013-2018) indicates that the most significant infrastructure constraint to all sizes of firms relates to electricity, which is costly by comparison to the region (at $0.24/kwh compared to Kenya's $0.15/ kWh, Uganda's $0.17/kwh, and Tanzania's $0.05/kwh) and insufficient in quantity.

Priority area 1 of the EDPRS II is to increase the domestic interconnectivity of the Rwandan economy through investments in hard and soft infrastructure. Construction of the new Gasogi substations, construction of 15kV distribution power lines and rehabilitation of the 110kV transmission line, serves the purpose of increasing electricity in the districts of Kigali and Rwamagana.

3.1.2. Energy Policy

The national policy goal is to meet the energy challenges and needs of the Rwandan population for economic and social development in an environmentally sound and sustainable manner. The national policy objective for the development of the energy sector is to provide an input in the development process by establishing an efficient energy production, procurement, transportation, distribution, and end-user systems in an environmentally sound manner. The Energy Policy, therefore, focuses on market mechanisms and means to reach the objective, and achieve an efficient energy sector with a balance between national and commercial interests.

An interactive and participatory process between Government, other stakeholders and relevant groups has been necessary as part of the formulation process in order to incorporate views of market actors and energy consumers to address the complex nature of the sector. Specifically, the energy policy takes into consideration the need to:

i. Have affordable and reliable energy supplies country wide;
ii. Reform the market for energy services and establishes an adequate institutional framework, which facilitates investment, expansion of services, efficient pricing mechanisms and other financial incentives;
iii. Enhance the development and utilisation of indigenous and renewable energy sources and technologies,
iv. Adequately take into account environmental considerations for all energy activities,
v. Increase energy efficiency and conservation in all sectors; and
vi. Increase energy education and build gender-balanced capacity in energy planning, implementation and monitoring.

Domestic energy demand has grown rapidly due to population growth and the increase in economic activities especially during the last ten years. The vision of the energy sector is to effectively contribute to the growth of the national economy and thereby improve the standard

of living for the entire nation in a sustainable and environmentally sound manner. The mission of the energy sector is to create conditions for the provision of safe, reliable, efficient, cost-effective and environmentally appropriate energy services to all sectors on a sustainable basis. By fulfilling its vision and mission, the energy sector will contribute to social economic development, and in the long-term framework, poverty reduction.

The policy objectives are to ensure availability of reliable and affordable energy supplies and their use in a rational and sustainable manner in order to support national development goals. The national energy policy, therefore, aims to establish an efficient energy production, procurement, transportation, distribution and end-use systems in an environmentally sound and sustainable manner.

3.1.3. Organic law, determining the modalities of environmental management

This organic law 04/2005 of 08/04/2005 determines the modalities of protecting, conserving and promoting the environment in Rwanda. In the framework of implementation of this organic law, the Rwanda Environment Management Authority (REMA) is the public establishment with legal personality and authority to implement the articles of this law.

Under article 67 of the organic law 04/05, every programme shall be subjected to environmental impact assessment (EIA), before obtaining authorization for its implementation. This applies to projects and policies that may affect the environment.

The ministerial order *N° 004/2008 of 15/08/2008* establishes the list of activities or projects that have to undergo environmental impact assessment before commencement. The Power line fits the description of projects that require EIAs mentioned in annex 2 of this ministerial order.

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

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

The project design study understands these regulations and hence the reason for commissioning this ESIA study.

3.1.4. Law relating to expropriation in the public interest

Based on the law no. 32/2015, relating to expropriation in the public interest, article 3, Only Government shall carry out expropriation and only in the public interest and with prior and just compensation. No person shall hinder the implementation of the programme of expropriation on pretext of self- centered justifications. It also informs us that a person to be expropriated shall be informed of the beginning of the process of the land survey and the

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

In regard to asset inventory and valuation, article 22 of the law states that Land values and prices for property incorporated on land consistent with the prevailing market rates provided under this Law shall be established by the Institute of Real Property Valuers in Rwanda. The criteria for determining fair compensation stated in article 28 is that without prejudice to other laws, the value of land and property incorporated thereon to be expropriated in the public interest shall be calculated on the basis of their size, nature and location and the prevailing market rates. Contesting of assessed value can be done seven (7) days after the approval of 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 the Institute of Real Property Valuers in Rwanda to carry out a counter-assessment of the value as implied in article 33.

Article 35 states that fair 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 order for the expropriation to be authorized, the fair compensation must be paid to the expropriated person before he/she relocates.

Regarding the time frame of payment of fair compensation, article 36 states that the approved fair compensation shall be paid within a period not exceeding one hundred and twenty (120) days from the day of its approval by the District or City of Kigali Council or the relevant Ministry. If fair compensation is not paid within the period, expropriation shall become null and void unless otherwise agreed upon between the expropriator and the person to be expropriated. Subsequent to receiving fair compensation, the expropriated person shall have a period not exceeding one hundred and twenty (120) days to relocate. However, the person to be expropriated shall not be allowed to plant crops that require more than one hundred and twenty (120) days of growth before they can be harvested.

Any expropriator that retracts his/her project for expropriation in the public interest after the valuation of the property of the persons to be expropriated or fails to pay fair compensation within the period provided under Article 36 of this Law shall be bound to pay compensation of five per cent (5%) of fair compensation that had to be paid to the person to be expropriated.

During project implementation, land acquisition and resettlement of houses, trees, crops and any other objects in the ROW of the power lines will require compliance to the expropriation law.

3.1.5. Guidelines on Right of Way (ROW) for Power lines

Guidelines No. 01/GL/EL-EWS/RURA/2015 states that the Licensee shall obtain a ROW for a power line through an easement from the property owner or through purchasing the title ownership of the required land. In the latter case, a landowner shall sell the strip or be

expropriated of the land to the Licensee (licensed electric power) outright. RURA views the easement as a private agreement between two parties and would therefore not to be directly involved, unless asked by one of the parties to provide an independent and unbiased response to practices that contravene these guidelines by any of the parties. Easement is an agreement between the Licensee and the Landowner which grants a permanent right to the Licensee to cross or use land to build, maintain, operate and protect the power lines, while permitting the landowner to retain the general ownership and control of the land.

Regarding the ROW dimensions minimum horizontal Right-of-Way width requirement for overhead lines are elaborated in the table below. However, these dimensions for existing power lines or when special circumstances may differ from values given in the table below. When the power line parallels other existing infrastructure ROW such as roads, railroads, a lesser width may be required as part of the ROW of the existing infrastructure can often be combined with the ROW needed for the power line.

The safety clearance distances to power lines shall comply with the following standards: (i) RS 474-1: 2011 for Power Installations exceeding 1kV a.c. – Part 1: Common rules; (ii). RS EAS 811-2: 2014 on Code of practice for safety of electrical installations; (iii) Any other relevant standards issued by the National Standards Bureau.

Expropriation of the ROW shall be conducted in accordance with the Law into force governing expropriation for public interest in Rwanda. The landowner shall subsequently hand over all the rights and responsibilities for the expropriated strip of land. Procedures for land acquisitions and land transfer shall comply with the domestic laws and regulations governing the matters.

Table 3 Nationally acceptable Horizontal ROW for different voltage levels

Voltage levels	**0.4kV**	**15kV< V<30kV**	**110kV**	**220kV**	**400kV**
Horizontal ROW (m)	3	12	25	30	50

Note: The power lines shall be centered in the Right-of-Ways given in the table above.

The ROW shall generally be clear of unauthorized structures that could interfere with a power line operation.

The guideline continues to state that relative to the features observed of any powerline project area, some of the crucial acts forbidden under the ROW are to construct any building or structure or carry out cultivation, farming or any other activity within the ROW prior to the consent of the Licensee (i.e.REG).

However, derogation is in place stating that as long as minimum clearances from poles and conductors are maintained and with a prior written consent of the Licensee, the ROW can be used for certain activities such as yards, gardens, pastures and farming, recreational fields, streets, roads, driveways, parking lots, lakes, fences, drainage ditches, grading or any other

activity that may not interfere with the line operation. Furthermore, temporary buildings or structures that are small and easily movable may be acceptable in the ROW with prior approval of the Licensee, provided that: (a) they are located away from the Licensee' works and access roads and not directly beneath overhead conductors; (b) they are not habitable.

An exception to the above mentioned requirements for the ROW and based on the discussion held between RURA and EDCL on 21st June 2017 (*refer to JICA field report, 2017*), it was agreed and stated that the following criteria of resettlement and land acquisition are applied for reinforcement of the existing 110kV transmission line between Birembo and Jabana substation.

Table 4 Right of way for existing transmission line Jabana- Birembo

No.	Items	Right of Way (ROW), Criteria for land acquisition and resettlement
1	Right of Ways	110kV transmission line: **25m width(12.5m+12.5m)**
2	Land acquisition	Lands are required **only where towers will be erected**.
3	Resettlement of structures lived or use by people such as houses, shops, etc.	A minimum vertical clearance from the lowest conductor to the top of structures is 5m. Structures within Right-of-way that do not meet the above minimum clearance, meaning the distance between the lowest conductor and the top of structures is less than 5m, are subject of resettlement.
4	Resettlement of trees	All trees within the above Right of way must be removed.
5	Resettlement of other objects	Other objects within the above Right of way not meeting the minimum clearance (5m) will be evaluated based on social impacts and safety.

This is interpreted as such; that during asset inventory and valuation of property for compensation only land on which towers are built, habitable buildings under the power lines, trees and perennial crops with in the corridor of the ROW that grow long and associated facilities like access roads to construction points will be eligible for compensation.

3.2. JICA Guidelines for Environmental and social considerations (2010)

JICA, which is responsible for Official Development Assistance (ODA), plays a key role in contributing to sustainable development in developing countries. The inclusion of environmental and social costs in development costs and the social and institutional framework

that makes such inclusion possible are crucial for sustainable development. Internalization and an institutional framework are requirements for measures regarding environmental and social considerations and JICA is required to have suitable consideration for environmental and social impacts.

The objectives of the guidelines are to encourage Project proponents to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. In doing so, JICA recognizes the following seven principles to be very important: (i) wide range of Environmental and social (E&S) impacts must be addressed, (ii) Measures for E&S considerations must be implemented from an early stage to a monitoring stage, (iii) JICA is responsible for accountability when implementing cooperation projects, (iv) JICA asks stakeholders for their participation, (v) JICA itself discloses information on E&S considerations in collaboration with project proponents, (vi) JICA makes efforts to enhance the comprehensive capacity of organizations and operations in order for project proponents, (vii) JICA addresses request of acceleration for the prompt implementation of projects while undertaking E&S considerations.
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 Japan Ministry of Foreign Affairs (MOFA), (4) Technical cooperation for development planning, and (5) Technical cooperation projects.
The process of E&S consideration comprises of; (i) information disclosure, (ii) categorization of projects, (iii) impacts to be assessed, (iv) consultation with local stakeholders, (v) concern about social environment and human rights, (vi) Laws, regulations and standards of reference of host governments, (vii) advice of advisory committee for E&S considerations, (viii) decision making by JICA and (ix) ensuring appropriate implementation of and compliance with the guidelines.

Regarding categorization of projects, JICA classified projects into four categories.

- *Category A*- Such projects 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.
- *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.

Whereas one of the sensitive sectors identified for classification of a project as Category A is power transmission and distribution lines involving large-scale involuntary resettlement, large-

scale logging, or submarine electrical cables, this particular project was observed to require large scale involuntary resettlement and its impacts are site specific, hence declassified to Category B but with recommendation of an EIA as instructed by Rwanda Development Board (RDB) (i.e. the National organ responsible for screening a project and determining whether or not an EIA is required and the extent of assessment).

JICA guidelines indicate impacts to be assessed with regard to E&S considerations to 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.

For critical impact such as involuntary resettlement, indigenous people, JICA guidelines desire that reference is made to World Bank (WB) safeguard policies. Regarding indigenous people, Rwanda does not have indigenous groups on grounds that it is a nation with a single/common culture, tribe, language and with a National constitution that recognises all Rwandans are born and remain equal in rights and freedom (*article 16 of Rwandan Constitution, 2015* and hence this safeguard is not applicable and not triggered.

The EIA study has gone further to consider other relevant WB safeguards in identifying which ones are triggered by project activities as discussed hereafter.

3.3. Relevant World Bank Safeguard policies

Among the 10 safeguard policies, only four (4) are likely to be triggered and are discussed in the following sub-sections.

3.3.1. Environmental Assessment- OP 4.01

This project is classified as a Category B project which requires; limited environmental analysis of specific environmental impacts that might be caused by the project. Projects in this category may include but not limited to; agro-industries (small scale), aquaculture & marine culture, small industries, mini-hydropower station, public facilities (hospitals, schools, housing complexes, rural electrification, telecommunications, small-scale tourism, rural water supply, etc.

3.3.2. Involuntary resettlement OP 4.12

International experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production

systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.

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

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

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

Considering the project involves construction of a new Substation, 15kV distribution and 110kV power lines, it is likely that there will be physical and economic displacement comprising of; land, structures, crops and trees.

A Resettlement Action Plan (RAP) is therefore required here and can be reduced to an Abbreviated RAP (ARAP) if the number of Project Affected People (PAP) is less than 200.

3.3.3. Natural habitat- OP 4.04

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

In the areas of project intervention, the proponent should identify; (a) natural habitat issues and special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats), and (b) measures for protecting such areas in the context of the country's development strategy.

Considering the entire project area has either been settled on or under cultivation for such a long time that indigenous flora and fauna has been replaced, it is unlikely that there are protected flora or fauna in this area. However, detailed field observation is required to

determine whether the ROW does not affect any of the listed local protected plants and animal species as per National ministerial order no. 007/2008.

3.3.4. Physical Cultural resources- OP 4.11

This policy addresses management of physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices.

Table 5: Safeguard policies triggered by the project

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP 4.01) The project has been classified under category B as per the JICA and World Bank categorisation. The project will involve construction of power lines and a substation. Each of these bares impacts on the physical, biological and social environment existing hence triggering this policy.	[X]	[ ]
Natural Habitats (OP 4.04) Since the project is linear project covering a combined distance close to 20km, it is likely that the ROW could require displacement of local protected plants, hence the possibility of triggering this policy.	[X]	[ ]
Physical Cultural Resources (OP 4.11) Field studies, consultation with locals and cultural institutions such as National Museum and scholars from University of Rwanda (UR) did not indicate cultural heritage. Again this being a linear project, there is no certainty that graveyards could not be found during construction works. It is only in 2013 that the law prohibiting burial anywhere other than designated cemeteries was enacted. Before this, people buried anywhere and in a number of cases in their homes or plantations, hence a possibility to trigger this safeguard policy.	[X]	[ ]
Involuntary resettlement (OP- 4.12) ROW for the 15kV distribution and 110kV transmission power lines and the new Gasogi substation shall displace existing structures, crops and trees. This implies therefore that the project will involve involuntary resettlement, hence triggering this safeguard.	[X]	[ ]

3.4. INSTITUTIONAL FRAMEWORK

For the project to succeed in achieving design activities and implementing mitigation measures proposed for the management of impacts caused by its activities, a number of key implementers shall be involved that include; MININFRA, REG, REMA/RDB and the three

Districts (i.e. Rwamagana, Gasabo and Kicukiro). The roles and responsibilities of each of these implementers are elaborated hereafter.

MININFRA

Ministry of Infrastructure (MININFRA) is government hand responsible for infrastructure. Its mission is to initiate programs to develop, rehabilitate and maintain an efficient and integrated national transport infrastructure network, ensure sustainable power generation and provide affordable shelter with adequate water and sanitation. Under MININFRA are different agencies responsible for specific sectors; water and sanitation, energy, transport. REG is the autonomous body supervised by MININFRA, responsible for energy.

REG

Rwanda Energy Group (REG) is tasked to create conditions for the provision of sufficient, safe, reliable, efficient, cost-effective and environmentally appropriate energy services to households and to all economic sectors on a sustainable basis, with a purpose of contributing effectively to the growth of the national economy and thereby improve the standard of living for the entire nation in a sustainable and environmentally sound manner. REG is a holding group of two implementing corporations; Energy Development Corporation Ltd (EDCL) and Energy Utility Corporation Ltd (EUCL).

EDCL- is currently the single *building* institution of all energy connectivity infrastructure feeding into the National grid, mostly comprising of; transmission power lines, distribution lines and substations. EDCL will be responsible for preparing the EIA for approval by RDB, preparation of the RAP or ARAP, the asset inventory and valuation for compensation before any commencement of construction.

EUCL- is currently the single utility responsible for managing the electricity connectivity installed by EDCL.

The project at this stage is working closely with EDCL.

RURA

Rwanda Utilities Regulatory Agency (RURA) is the autonomous body with the mandate to control and regulate an efficient, sustainable and reliable energy sector in a transparent and fair manner for the benefit of all stakeholders. It has set guidelines on the ROW of power lines which shall be respected during construction of the power line.

REMA/RDB

Rwanda Environment Management Authority (REMA) is the authorized Government institution to determine modalities of protection, conservation and promotion of the environment in Rwanda.

RDB has been authorised by REMA to review EIA and EMP reports, authorize project to proceed by issuing an EIA certificate and periodically monitor the project activities to ensure mitigation measures are implemented and that it has no adverse impacts on the environment.

For the project to commence construction, it shall require approval of the EIA and certificate from RDB to that effect. REMA will periodically inspect the project for compliance to environmental mitigation measures proposed, occupation health and safety norms.

Three Districts (Gasabo, Kicukiro and Rwamagana,)

These Districts will play a key role in sensitization of the PAPs of the importance of the project and most importantly facilitate the process of public consultation during land acquisition and resettlement for assets lost to project activities. Sector and Cell officials for areas in these Districts that will be directly affected either by the ROW of the lines, will be key players in facilitating smooth access to these resources for success of project implementation.

During Asset inventory and valuation of property displaced eligible to compensation, approvals of signed agreements between EDCL and PAPs will be sought from the cell, sector and district authorities.

MINECOFIN

The Ministry of finance and economic planning (MINECOFIN), is responsible for payment of compensation of all property lost by PAP into their personal accounts, against the asset inventory and valuation report presented by EDCL.

JICA

JICA is likely to be the funder of the project to construct the new substations, distribution network phase 3 upon recommendations of the preparatory survey currently going on.

CHAPTER 4: BASELINE ENVIRONMENTAL CONDITIONS

4.1. PHYSICAL ENVIRONMENT

Physical environmental survey involves understanding the actual status of the area, in regard to; Physical features, Climate (temperature, rainfall), relief, hydrology, vegetation, soil, water of the administrative area the power lines will traverse. Fumbwe sector (part of the project area) in Rwamagana district is located in the eastern province of the country and shares similar physical and biological environment with the project areas in Gasabo and Kicukiro districts of the central part of the country. These environment parameters are discussed hereafter.

4.1.1. Climate

Rwanda is located within the equatorial belt. It, however, has a modified humid climate including rainy forest and Savannah types. The central and eastern part of the country is generally of semi-arid type owing to its position in the rainy shadow of the western highlands. With the three districts of project intervention (Gasabo, Kicukiro and Rwamagana districts) located in the central and eastern part of the country, they experience moderate volumes of rainfall and low to medium temperatures, details of which are included hereafter.

4.1.2.1 Temperature

Reference made to the figure 6, the average annual temperature for the project area, is in the range of 18-20°C but might rise slightly to 21°C during the dry season, while it might drop to 15°C in the rainy season as the figure below indicates.

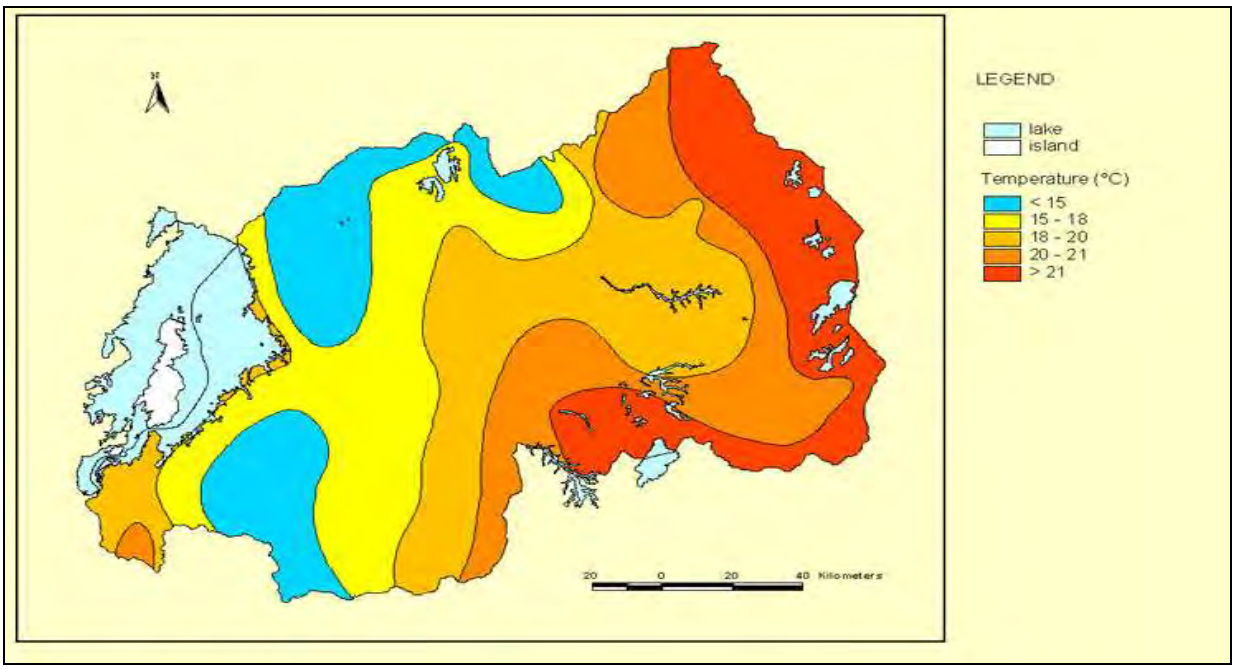


Figure 6 Average Temperature (Source: Verdoodt and Van Ranst , 2003)

4.1.2.2 Rainfall

The rainfall characteristics for the project areas of concern is in the range of 900-1100mm/yr, as may be observed from the figure below, part of the central and eastern region of the country.

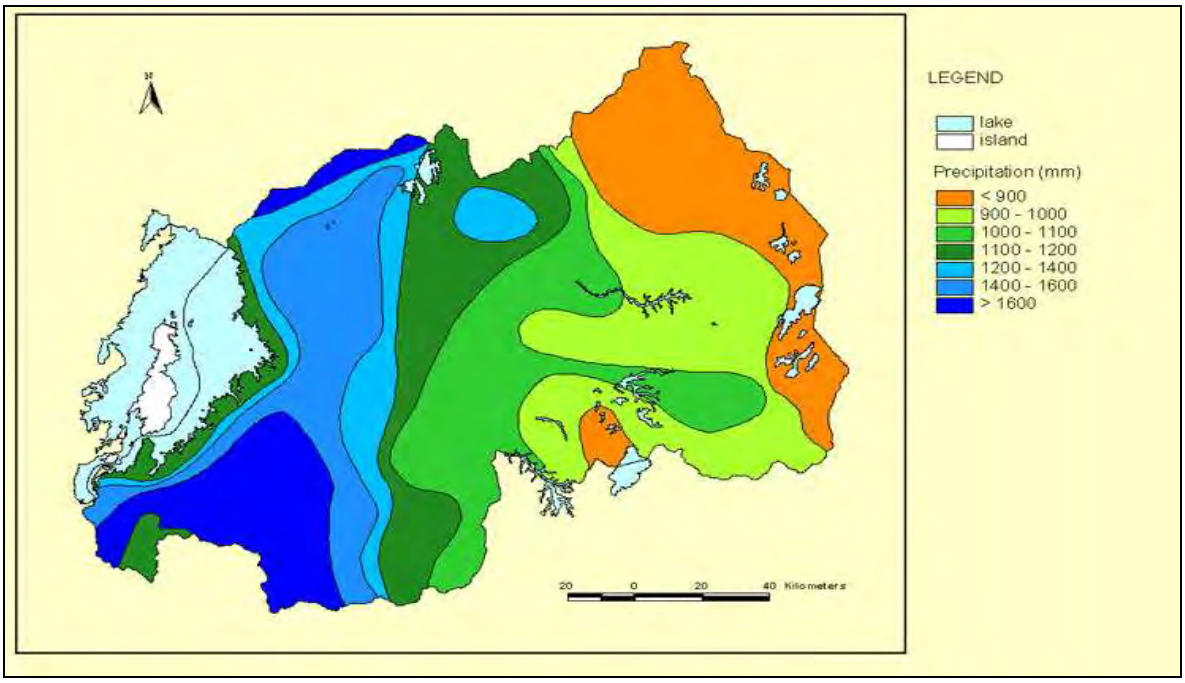


Figure 7 Average rainfall (Source: Verdoodt and Van Ranst , 2003)

The area experiences two rainy seasons (September-November, March-May) and two dry seasons (June-August, December- February). Understanding the rainfall pattern, the wet and dry periods could guide the planning of the site activities.

4.1.2. Soils

Reference from the MINAGRI soil map of March 2015, soils of the project influence area are of mostly red soils of type ultisols in the central region and oxisols towards the east. Soil depths are greater than 2.5m. Soil acidity/ pH is in the range of 4.5-5, moderately acidic.

Agriculture is favourable in these soils as evidenced by the cultivation and high yields in most parts of these Districts, with most common crops being; bananas, maize and beans.

Considering that towers will cover relatively small sizes of land and scattered areas have structures built, it is evident that soils are suitable for the construction of the towers. To ensure soil reliability for such construction, current preparatory survey is conducting soil tests of tower angle points.

4.2. BIOLOGICAL ENVIRONMENT

4.2.1. Existing flora and fauna of the project area

The natural ecosystems along the line corridor of the proposed power lines have been modified by human activities such as; agriculture, houses and small trading centres. For agricultural areas, changes caused secondary flora species consisting essentially of graminaceous plants, numerous seasonal or perennial species alternating with crops, while the structures, mostly bare ground exposing soils or cemented or tarmacked grounds with barely any flora or fauna.

Flora common along the ROW were mostly crops such as; banana, maize, sorghum, beans, sweet potato plantations, planted eucalyptus tree forests and scattered fruit trees, a sign of dominance of agriculture as the main source of household income.

Fauna commonly observed from trees along the ROW on eucalyptus and pine comprised of; birds, reptile living under fallen logs, rodents, invertebrates such as; millipedes, centipedes, bugs, earthworms, spiders and many related invertebrates.

Terrestrial fauna is dominated by granivorous birds possibly because of the maize and sorghum. While the most common fauna is domestic livestock, either cattle zero grazed in domestic kraals or goats and sheep allowed to graze out in the fields.

From the field visit, assessment of the sites, interviews with the locals and consultation with University of Rwanda ecologist, there was no sensitive/ protected flora or fauna species observed at the project sites especially since it is an area that has for long been under human settlement and commercial activities.

4.3. SOCIO-ECONOMIC ENVIRONMENT

This section attempts to understand the current social status of the area of project influence versus the likely effects of the proposed project. It involved collecting primary data from field investigations, group meetings, public consultations and expert field observations. It therefore describes the baseline of the socio-economic parameters of the area before project implementation.

Data discussed herein will include the following but not limited to it; population and demography, income and expenditure pattern, gender differences, land use pattern and tenure, gender issues, HIV/AIDS, access to basic service infrastructure (roads, water, electricity), health and sanitation, education, cultural and historical issues and other issues relevant.

During the socio-economic study, a number of methods were applied to gather information; through desk review of existing statistical information from the National Integrated Household living conditions survey EICV3 and EICV4 of the administrative area of route of way (ROW),

through public consultations. Meetings with sector, cell and authorities to obtain relevant information, household interviews with likely PAPs were done guided by a checklist.
The following information is a view of the socio-economic status of people living and working along the ROW of the power lines.

3.3.1 Population and demography
The EICV3 survey results show that the total population of Gasabo district in 2010–2011 was 477,000, representing 45% of the total population of Kigali City and 4.4% of the total population of Rwanda. Females comprised 51.6% of the population of Gasabo district.
It was also observed that the majority of the population of Gasabo district is young, with 86% of the population aged less than 40 years old.
The average size of the household is 4.8 for Gasabo district, which is the same as the national average. This may be due to some peri-urban and rural areas which are administratively included in these urban districts.
The EICV3 survey results show that the total population of Kicukiro district in 2010–2011 was 301,000, representing 28% of the total population of Kigali City and 2.8% of the total population of Rwanda. Females comprised 49.8% of the population of Kicukiro district.
It was also observed that the majority of the population of Kicukiro district is young, with 87% of the population aged less than 40 years old; females in this age group represent 86% of all females, while males represent 87% of all males.
The average size of the household is 4.7 for Kicukiro district, which is a slightly below the national average. This may be due to some peri-urban and rural areas which are administratively included in these urban districts.
The EICV3 survey results show that the total population of Rwamagana district in 2010–2011 was 318,000. Females comprised 52.1% of the population of the district.
It was also observed that the majority of the population of Rwamagana district is young, with 82% of the population aged less than 40 years old.
The average size of the household is 4.7 for the district, which is a slightly below the national average.

From this demography of the 3 districts, the study was able to understand that female population dominate male considering they are over 51% of the population. It also informs us that the population is a young one with over 82% with less than 40 years. This data gives an insight of the ratio of demography that will benefit from electricity connectivity, employment from project activities, business growth reliant on electricity but also those that will be affected by displacement of their assets by project activities.

3.3.2 Infrastructure

3.3.2.2 Housing and energy
The EICV3 shows that Gasabo district is the third top district in terms of cement flooring being the most commonly used material with 50.3%. Beaten earth comes second with 43.1%. Half of urban households have cement flooring, but at national level the average is only 17.1%.
In Gasabo district, 24% of households (HH) use mud-covered tree trunks as wall material; while HH with mud bricks covered with cement are 46.4%. At national level, 35.2% of

households have mud-covered tree trunks as wall material; in urban areas this represents only 17.1% and 38.3% in rural areas.
Regarding energy connectivity, 47.3% of HH use electricity as their main source of lighting, coming third among all districts. The urban area has 46.1% of households using electricity as the main source of lighting, compared with only 4.8% in rural areas and 10.8% at national level.

The EICV3 shows that Kicukiro district is the first district in terms of cement flooring being the most commonly used material with 69.3%. Beaten earth comes second with 25%.
In Kicukiro district, only 6% of households use mud-covered tree trunks as wall material; mud bricks covered with cement is the most commonly used with 66%. At national level, 35.2% of households have mud-covered tree trunks as wall material.
In Kicukiro district, 63% of households use electricity as their main source of lighting, meaning that the district comes first among all districts. The urban area has 46.1% of households using electricity as the main source of lighting.

The EICV3 shows that Rwamagana district is ranked fifth among all districts in terms of HH with cement flooring with 21%. Beaten earth comes second with 73%.
In Rwamagana district, 51% of households use mud-covered tree trunks as wall material; while mud bricks covered with cement comes to 20%.
46.1% of households use electricity as their main source of lighting.

From the data elaborated in this section, it is clear the importance of this project to increase electricity connectivity mostly in Gasabo area with just 47% connectivity. It also indicates the type of housing that will be valued during the exercise of resettlement as mostly houses made of cemented mud bricks walls and cemented floors.

3.3.3 Economic activity and income
The EICV 3 shows that that most people aged 16 and above in Gasabo have wage non-farm as main job (48%). The second most frequent main job is independent farmer (25%).
It shows that household income is driven by wage income (42%), followed by business income (18%) and agricultural income (16%). The smallest contributors to household income in Gasabo district are transfers (public and private).

The EICV 3 shows that 'other services', including utilities and financial services, is the main industry for 26.5% of the population aged 16 and above, followed by trade (18.9%), agriculture (18.6%) and government services (14.2%).
It shows that the half of household income is driven by wage income (50%), followed by business income (21%) and private transfer income (10%). The smallest contributor to household income in Kicukiro district is public transfers, making up 2.4% of income. Rental income (9%) is greater than agriculture income (7%) in Kicukiro district.

The EICV 3 shows that most people aged 16 years and above in Rwamagana have independent farmer as their main job (68%); this is followed by wage non-farmer (13%), independent non-farm (10%) and wage farm (6%).

It shows that household income is driven by agriculture (42%), followed by wage income (22%), business income (21%) and rents (10%). The smallest contributor to household income in Rwamagana district is public transfer income, with 0.2%.

It appears that for Gasabo and Kicukiro, economic activity and HH income depend more on non-farm wages, which are paid from businesses or government organs that operate with dependence on electricity, hence importance of increase of electricity connectivity in the area.

3.3.5 Gender disparities

Regarding gender disparities in the three districts, the following data was obtained.
In Gasabo District, the EICV 3 shows that 26% of households in Gasabo district are headed by females and 4% are 'de facto female-headed households', i.e. headed by females in the absence of a male head who is ordinarily present. It also shows that the majority of females in the district are small-scale farm workers (36%) and 35% are wage non-farm workers.

In Kicukiro District, the EICV 3 shows that 20% of households in Kicukiro district are headed by females and 7% are 'de facto female-headed households'. It further shows that the majority of females in Kicukiro district are wage non-farm workers (48%); small scale-farm workers and independent non-farm workers each represents 21.3%.

In Rwamagana District, the EICV 3 shows that 33% of HH are headed by females and 8% are 'de facto female-headed households'. It also shows that the majority of females in the district are small-scale farmers (78%), followed by independent non-farmers (8%), and wage farm and wage non-farm (6% each).

These particular parameters of socio-economic environment of the project area give an insight of how the communities shall be affected by project activities.

CHAPTER 5: PUBLIC CONSULTATION

Stakeholder's identification

The consultant begun by identifying the stakeholders that would be affected by or influence project activities.

Information collected from the preliminary desk review, preliminary scoping consultation with the design engineering consultant (YEC), EDCL and a site tour of the proposed lineage of the project, guided the local consultant in identifying the project stakeholders.

Without chronological priority, stakeholders identified were:

- EDCL on behalf of REG.
- RURA.
- Local government officials for:
    - Gasabo District- Ndera and Gikomero Sectors and their Cells,
    - Kicukiro Distict- Masaka sector and one of its cells
    - Rwamagana District- Fumbwe sector and its cells.
- Local communities likely to benefit or be affected by project activities.
    - Regarding these local communities, consultations were done with;
        - General public who included; local residents, farmers and traders, women, and youth.

Methods applied:

During the Public consultation, the study applied different participatory methods, namely;

- Interviews,
- one-to-one discussions with Key Informants (KIs),
- focused group discussions (FGD),
- Informed Consultation and Participation (ICP) and
- Public meetings with stakeholders.

Stakeholders consulted were informed on the proposed project and by using key guiding questionnaires, the study was able to guide discussions and obtain relevant information from the stakeholders on the issues faced, suggestions on project design, likely impacts of the project activities and mitigation measures. An issue raised by one individual or a group of people was cross-checked by discussing it over with other individuals or groups. It is from these concerns that the common issues were determined and summarized hereafter.

Table 6 Time schedule for stakeholder engagement

Time frame for stakeholder engagement																																
	June											July																				
Activities	19	20	21	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Stakeholder's engaged																																
EDCL officials																																
RURA officials																																
Site visits																																
Sector Executive secretaries																																
Cell Executive secretaries																																
Village leaders and local communities																																
Weekends																																
Days of stakeholder engagement																																

Disclosure of information

EDCL sent letters to all three (3) districts (Gasabo, Kicukiro and Rwamagana) and the Sectors through which the power lines would traverse, informing of the project objectives and requesting the authorities to facilitate all requirements of project implementation.

Basing on these letters, the consultant scheduled stakeholder engagement meetings.

All meetings begun with the consultant introducing his team to the attendees, where they are coming from and purpose of their visit.

Similar procedure was followed during the public consultation meetings and individual consultations of the local authorities and local residents. For meetings held with the local authorities (Sector , cell or village authorities), the consultant requested for a rendezvous either by phone call. Meetings were then scheduled and organized by the local authorities at their availability.

Upon meeting the Sector leader and explaining the purpose of the project, he/she would then facilitate the consultant by informing the Cell leaders to avail themselves for a meeting with the consultant and in turn Cell leaders would facilitate in organizing meeting at cell and village level. Once the sector or Cell leaders were on board, they facilitated the consultant in meeting the communities in the project area of intervention.

In all the meetings held, the agenda followed this structure:

- *Project introduction*- Project components, project objectives, project benefits, likely adverse impacts mostly from displacement, the EIA study objectives and purpose of the visit.
- *Project site identification*- Referring to already fitted concrete pegs indicating the position of Angle point towers, stakeholders were informed of the position of the new Gasogi substation, ROW corridor of the 15kV distribution line and 110kV transmission line.
- *Issues faced* from lack or insufficient access to electricity were recorded from the engagement, to justify the project
- *Suggestions* of what to include in the designs were also recorded
- *Benefits* of the project to the public
- *Risks and negative impacts* by project activities, for example, asset loss from land acquisition

and resettlement.

- *Proposed mitigation measures* to these risks/ impacts
- Understanding of the *socio-economic set up* of the project intervention area

Opinions and questions from the meeting attendees and those interviewed on above items presented to them were recorded and where necessary response given to questions raised. Follow up on those questions that were not answered was also included.

Meetings and group gatherings with stakeholders were scheduled as summarized in the table below:

Table 7: Summary of Stakeholder engagement schedule

Date and Time	Place	Methods	Type of participants	Number of participants	Purpose of meeting.
19th and 23rd June 2017	Kigali	ICP	EDCL	3	*To understand;* the project objectives, executing agency, their part in the project (institutional framework), institutional capacity to manage the project, *To record and understand*: likely benefits and impacts of the project and proposed mitigation measures.
21st June 2017	Kigali	ICP	RURA	7	To understand guidelines on ROW of power lines and most importantly guidelines pertaining existing power lines that require rehabilitation.
3rd- 7th July 2017	Gasabo, Rwamagana, Kicukiro Districts	ICP	Sector Executive secretaries for; Ndera, Rusororo, Gikomero, Fumbwe and Masaka	5	*To explain*; Project objectives, Components of the project, project area of development, benefits gained from the project and the purpose of the consultation,. *To record and understand*; local perception of the project, likely benefits, the likely impacts by the Project and proposals on mitigation measures to negative impacts.
5th – 12th July 2017	Ndera, Rusororo, Gikomero, Fumbwe and Masaka sectors	ICP	Cell Executive secretaries for; Kibenga, Cyaruzinge, Rudashya, Mukuyu and Gikomero in Ndera Sector. Nyagahinga, Mbandazi	11	

Date and Time	Place	Methods	Type of participants	Number of participants	Purpose of meeting.
			and Kinyana cell in Rusororo sector. Cyimo in Masaka sector. Nyakagunga and Nyagasambu in Fumbwe sector		
10th – 21st July 2017	Project intervention Cells	Public meetings, FGD	Cell leaders, village leaders and communities in project affected areas.	52	

Summary of items recorded during discussions held at stakeholder engagement meetings comprised of;

Benefits anticipated from improvement of the substation and distribution network:

- Increased power capacity in the project areas of Gasabo, Kicukiro and Rwamagana districts, allowing for increased electricity connectivity of households, businesses and institutions.
- Increased electricity to Masaka hospital.
- Employment opportunities during the construction stage.
- Possibility of increment of businesses in trading centres as a result of increased amount of power in the area.

Common issues/ impacts raised by stakeholders:

- Locals expected to lose land, structures, crops and trees to the power line project and wanted to know whether they would be fairly compensated.
- Questions were raised on whether Job opportunities were available for locals during construction phase.
- Questioning whether the power lines would serve their communities.
- Worry of exposure to electro-magnetic for those under the power line.
- Worry of human electrocution.
- Fire risks from lighting or short circuits of conductors.
- Soil erosion from excavations and soil piles on sites at tower positions and the associated facilities like access roads.
- Increase in thefts and insecurity in communities around construction works.
- Pollution of air by dust from soil piles.
- Traffic accidents during construction period, especially for children coming from school.
- Poor disposal of construction debris and unused soils contaminating soils and water sources.
- Increase in spread of diseases like HIV/AIDS and other infectious diseases from alcohol abuse and promiscuity that comes with wages earned from construction works.
- Possibility of occupation health hazards on site.

Mitigation measures proposed by stakeholders and some responses from consultant

- A RAP or ARAP will be prepared and PAPs compensated for losses at full replacement cost by Government of Rwanda under mandate of EDCL.
- An affirmative program was suggested that gives locals in the area, employment priority during construction.
- Communities were informed that purpose of the power lines was to increase the amount of power in the Sectors of Ndera, Rusororo, Gikomero, Fumbwe and Masaka.
- To answer the question of exposure to electro-magnetic fields and electrocution, it was explained that a clearance of more than 5m above the lowest conductor was maintained for all structures within which no electrocution can occur. It was also explained that these fields only revolve around the conductor and not beyond. Sharp spokes shall be placed at lower members of the tower to prevent unauthorised people from climbing.
- To prevent fire risks from lightning, it was explained that a ground wire for each tower shall be designed to direct lighting current to the earth and avoid lightning from striking.

- Compaction and water spraying of completed soil stabilization to reduce generation of dust.
- Traffic signage and personnel to control traffic close to operating sites.
- Regular disposal of all solid waste from sites shall be ensured by a RURA registered waste disposal company, in contract with the contractor.
- Hoarding, lighting and employment of security at construction sites.
- Sensitization of local communities on prevention of HIV/AIDS contraction was recommended.
- For Occupation health and safety (OHS), Safety gear for workers involved in construction, first aid kit on site, prohibition of unauthorised public from site, Contractor's Insurance for calamities or death on site shall be part of the contract, are all mitigation measures proposed for employee safety on site.

CHAPTER 6: NATURE AND EXTENT OF KEY ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROJECT

With reference to activities around construction of the new Gasogi substation, the two (2) distribution lines and rehabilitation of the existing Jabana- Birembo transmission line, the project is likely to have potential impacts (both positive and negative) on the environment, neighbouring communities. The analysis of impacts begun with a scoping matrix where impacts were anticipated at commencement of the study, after desk review and preliminary field visits. This was followed by an impact matrix that validated the impacts from scoping matrix.

Under this chapter, a scoping matrix is discussed of risks/impacts (positive and negative) that were anticipated during review of project document literature, preliminary consultations and field visit. These were anticipated impacts that could arise from the project site activities; during the planning, construction phase or the operational phase.

Table 8: Scoping Matrix

Legend applied in Scoping matrix:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination was needed beyond this scoping anticipation of impacts, and the impact could be clarified in the next chapter at impact analysis)

D: No impact is expected.

No.	World Bank Safeguards Operational Policies(OP)	Impact / challenges	Evaluation during Scoping		Evaluation Basis
			Planning /Construction	Operation	
		Positive Impacts anticipated			
1	**OP 4.01: Environmental Assessment**	Increased amount of power in Ndera, Rusororo, Masaka and Fumbwe Sectors	D	A+	The New Gasogi substation, the new 15kV distribution lines from Gasogi substation towards Nyagasambu connection point and Masaka connection points will increase amount of power for increased electricity connectivity to households and businesses in these areas.
2		Specific power increment to	D	A+	The south distribution line of 15kV to Masaka connects right at Masaka hospital, which will increase the amount of power

No.	World Bank Safeguards	Impact /	Evaluation during Scoping		Evaluation Basis
		support effective operation of medical equipment at Masaka Hospital			to the hospital thereby ensuring all kinds of equipment at the hospital operate efficiently.
3		Employment opportunities	B+	A+	In the event that the project is implemented, jobs are anticipated at the different stages; during the design of the distribution and transmission network, contractor and workers during the construction.
4		Expansion of businesses in trading centres of the project area of influence	D	C+	Existing settlements and trading centres are likely to expand as a result of increased amounts of electricity in the area.
	OP 4.01: Environmental Assessment	**Adverse negative Impacts/ Risks anticipated**			
1		Soil erosion from construction works	B-	C-	Construction road works involve; excavation of tower foundations, access roads. Such works create soil piles on site which are prone to erosion resulting in destruction of plantations and houses downhill.
2		Air pollution	B-	D	Dust from excavation works and greenhouse gas emissions (CO, CO_2, NO_x) from heavy machines, automobiles during construction phase pollute the air around. No impact during planning and operation phase anticipated.
3		Soil pollution from oil spillage	B-	D	In addition to the liquid and solid waste generation effect of pollution, during construction, there is also a risk of pollution of soils from oil spillage of heavy equipment, trucks, mostly from mechanical repairs and fuelling

No.	World Bank Safeguards	Impact /	Evaluation during Scoping		Evaluation Basis
4		Noise nuisance	B-	D	Noise from excavation works, compaction, vibration activities during construction could affect the neighbourhood.
5		Traffic accidents during works	B-	C-	During construction, heavy trucks ferrying construction material and debris could cause accidents to those on site and those in the neighbouring communities.
6		Thefts on site	B-	B-	During construction phase, Construction material on site shall definitely attract theft on and off site. New infrastructure often attracts thieves, alcohol and drug abuse around such facilities.
7		Occupational health hazards	B-	D	During the construction phase, workers could be exposed to accidents from electrocution while welding, accidents from heavy equipment repair or from sharp objects, accidents from traffic accidents, exposure to dust and drinking unboiled water on site. All these could have safety effects on human health of the employees on site if not contained.
8		Children's rights and possible child labour	C-	C-	Relaxed monitoring of recruitment of casual labour during construction could result in employment of workers under the national employment age of 16 years, therefore breaching the child labour code.
9		Human electrocution	D	B-	No impact during planning and construction phase. Children climbing the towers are examples of possible cases of electrocution.
10		Exposure to electro-magnetic fields	D	C-	No impact during the planning and construction. Exposure to electro-magnetic fields of people living under these power lines could be cancerous in the future.
11		Fire risk	D	B-	During operation, electrical circuits could be caused by broken conductors, lightning, resulting in fires.
12		Poor Site working conditions	B-	D	During construction, Contractors are likely to come short on a number of worker's rights including; contracts with workers, payment of workers on time, working longer hours than

No.	World Bank Safeguards	Impact /	Evaluation during Scoping		Evaluation Basis
					9hours per day acceptable nationally, safety wear, fire risk management, security of employees on site and sanitation on site (e.g. clean toilets, water on site, boiled drinking water)
13		HIV/AIDS and other Infectious diseases	B-	B-	During construction phase, spread of HIV/AIDS, sexually transmitted diseases (STDs) and infectious diseases to existing communities is likely to occur, such as; HIV/AIDS carried by migrating skilled labourers employed on site and also from prostitution, alcohol and drug abuse that comes with such construction works.
14		Water related diseases caused to communities from poor sanitation and stagnant water	B-	D	During construction and operation phase, poor sanitation and stagnant water could expose communities to diseases such as; diarrhoea, dysentery, malaria.
15		Poor site management could be a safety and security issue to the community	B-	D	During construction phase, Large piles of soil left unattended could cause injury to children playing around, slide and destroy neighbouring structures. Also unprotected construction material shall attract thieves not only to the site but also to the neighbouring trading centres and settlements.
16		Pollution from construction debris and murrum for disposal	B-	D	If not thought through during the planning and construction phase, poor management of disposal of construction debris and unused soils could result in contamination of soil or water sources. e.g. disposal of soils in nearby wetlands, a practice some drivers use to save on fuel cost of waste transportation.
17		Water and soil pollution from poor human waste disposal	B-	B-	During construction phase, lack of proper solid waste disposal management, sanitation facilities and poor management of human waste could degrade ground or nearby surface water by run-off or infiltration. Poor human waste disposal and treatment could also degrade soils.
18		Redundancy	B-	D	During the construction works, planting for some PAPs where

No.	World Bank Safeguards	Impact /	Evaluation during Scoping		Evaluation Basis
		and loss of income of traders during the construction period.			the towers are positioned are likely to stop as works go on. This could affect the agricultural production for these seasons and hence affect livelihood.
19	***OP 4.10: Indigenous People***	Indigenous/Minorities	D	D	Regarding indigenous people, Rwanda does not have indigenous groups on grounds that it is a nation with a single/common culture, tribe, language and with a National constitution that recognises all Rwandans are born and remain equal in rights and freedom (article 16 of Rwandan Constitution, 2015 and hence this safeguard is not applicable and not triggered. Furthermore, regarding gender, this article 16 of the Rwanda constitution not only covers Women but also the land law article 4 on Equal right to land, that states that all forms of discrimination, such as that based on sex or origin, in relation to access to land and the enjoyment of real rights shall be prohibited. This therefore implies that even women cannot be considered vulnerable.
20	***OP.4.12: Involuntary resettlement***	Land acquisition, asset displacement and compensation	C-	D	The proposed site for the new Gasogi substation, distribution and transmission network are likely to displace structures, private land, trees and crops. Displacement will require compensation at full replacement cost to the PAPs before construction works can begin.
21	***OP 4.04: Natural habitat***	Likelihood of impact in protected area	C-	D	Likelihood that the ROW of the power lines could comprise of areas with protected ecosystems such as; natural forests, water bodies, wetlands either by National legislations or ratified international conventions.

No.	World Bank Safeguards	Impact /	Evaluation during Scoping		Evaluation Basis
22		Likelihood of impact on protected flora and fauna	C-	D	Likelihood that the ROW of the power lines could comprise of habitat or migratory paths of protected plant or animal species.
23		Likelihood of impact on hydrology of nearby water sources	C-	D	Likelihood that the ROW of the power lines could comprise of or be with in buffer zones of water sources such as; lakes, rivers, wetlands.
24		Bird electrocution	D	C-	No impact during planning and construction phases. During operation, Migratory birds could get entangled with these conductors and get electrocuted.
25	***OP 4.11: Physical cultural resources***	Encroachment on cultural Heritage from existing graveyards and other cultural monuments	C-	D	During the scoping site visit, there was no visible existence of cultural properties and heritage observed. However, there is a possibility that during field survey and public consultation or even during construction such heritage could be found. In case they are any suspicions, then Chance find procedures could then apply under such circumstances.

CHAPTER 7: IMPACTS EVALUATION

Impacts/ Risks anticipated in the scoping matrix of chapter 6 were verified and analysed at the time of field survey, socio-economic survey and public consultation at positions likely to be affected by distribution and transmission network, to determine the extent of their significance. Methods applied for analysis were; (i) consultation with local stakeholders, (ii) expert observation, (iii) past experience.

The Impact matrix in the Table below indicates final impacts/risks that were verified and against which adaptive and mitigation measures were proposed in the ESMP.

From detailed field survey and stakeholder engagement/ public consultation, most of the negative impacts anticipated in the scoping matrix were observed to remain the same. However, of all impacts anticipated in the scoping matrix, the following are impacts to which more detailed explanation were given and those whose significance changed in the impact matrix as opposed to what was suggested previously in the scoping matrix, based on the analysis done after field survey, stakeholder consultation and expert observation;

1. Water and soil pollution from poor human waste disposal
2. Land acquisition and asset displacement for compensation
3. Likelihood of impacts in protected areas
4. Likelihood of impacts on protected flora and fauna
5. Exposure to electromagnetic fields from the power line.
6. Bird electrocution.

Table 9: Impact Evaluation

Legend applied in Impact matrix:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed during the project is implementation.)

D: No impact is expected.

No.	World Bank Safeguards Operational Policies(OP)	Impact / challenges	Evaluation during Impact analysis		Study methods	Evaluation Basis
			Planning /Construction	Operation		
		Negative/ Adverse impacts				
1	**OP 4.01: Environmental Assessment**	Soil erosion from construction works	B-	D	Field observation and previous	Construction road works involve; excavation of tower foundations, access roads. Such works create soil piles on site

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
					experience of similar projects	which are prone to erosion resulting in destruction of plantations and houses downhill.
2		Air pollution	B-	D	Past experience of similar construction projects	Dust from excavation works and greenhouse gas emissions (CO, CO_2, NO_x) from heavy machines, automobiles during construction phase pollute the air around. No impact during planning and operation phase anticipated.
3		Soil pollution from oil spillage	B-	D	Past experience of similar construction projects	In addition to the liquid and solid waste generation effect of pollution, during construction, there is also a risk of pollution of soils from oil spillage of heavy equipment, trucks, mostly from mechanical repairs and fuelling
4		Noise nuisance	B-	D	Past experience of similar construction projects	Noise from excavation works, compaction, vibration activities during construction could affect the neighbourhood.
5		Traffic accidents during works	B-	D	Past experience of similar construction projects	During construction, trucks ferrying construction material and debris could cause accidents to those on site, those in the neighbouring communities.
6		Thefts on site	B-	B-	Past experience of similar construction	During construction phase, Construction material on site shall definitely attract theft on and off site. Expanding trading centres along the in the

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
					projects	area could attracts thieves, alcohol and drug abuse.
7		Occupational health hazards	B-	D	Past experience of similar projects	During the construction phase, workers could be exposed to accidents from electrocution while welding, accidents from heavy equipment repair or from sharp objects, accidents from traffic accidents, exposure to dust and drinking un-boiled water on site. All these could have safety effects on human health of the employees on site if not contained.
8		Children's rights and possible child labour	B-	D	Past experience of similar projects	Relaxed monitoring of recruitment of casual labour during construction could result in employment of workers under the national employment age of 16 years, therefore breaching the child labour code.
9		Human electrocution	D	B-	Past observation of power lines	No impact during planning and construction phase. Children climbing the towers are possible cases of electrocution after power lines have been erected.
10		Exposure to electro-magnetic fields	D	B-	Expert observation and literature review	In compliance to the 2010 RURA guidelines for ROW of distribution power lines, no habitat houses directly under the wire zone power lines is accepted, while for the existing Transmission line ROW Criteria shall follow specifics agreed between RURA and EDCL in *table 4*. This would mean that at the time of RAP or ARAP implementation

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
						all such houses shall be resettled to avoid exposure to electro-magnetic fields that could be cancerous in the future.
11		Fire risk	D	B-	Past observation of similar projects.	During operation, electrical circuits could be caused broken conductors, lightning, resulting in fires.
12		Poor Site working conditions	B-	D	Past experience of similar projects	During construction, Contractors are likely to come short on a number of worker's rights including; contracts with workers, payment of workers on time, working longer hours than 9hours per day acceptable nationally, safety wear, fire risk management, security of employees on site and sanitation on site (e.g. clean toilets, water on site, boiled drinking water)
13		HIV/AIDS and other Infectious diseases	B-	B-	Past experience of similar projects	During construction phase, spread of HIV/AIDS, sexually transmitted diseases (STDs) and infectious diseases to existing communities is likely to occur, such as; HIV/AIDS carried by migrating skilled labourers employed on site and also from prostitution, alcohol and drug abuse that comes with such road works.
14		Water related diseases caused to communities from poor sanitation and stagnant water	B-	D	Past experience of similar projects	During construction and operation phase, poor sanitation and stagnant water could expose communities to diseases such as; diarrhoea, dysentery, malaria.

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
15		Poor site management could be a safety and security issue to the community	B-	D	Past experience of similar projects	During construction phase, piles of soil left unattended could cause injury to children playing around, slide and destroy neighbouring structures. Unprotected construction material shall attract thieves not only to the site but also to the neighbouring trading centres and settlements.
16		Pollution from construction debris and murrum for disposal	B-	D	Past experience of similar projects	If not thought through during the planning and construction phase, poor management of disposal of construction debris and unused soils could result in contamination of soil or water sources. e.g. disposal of soils in nearby wetlands, a practice some drivers use to save on fuel cost of waste transportation.
17		Water and soil pollution from poor human waste disposal	B-	D	Past experience of similar projects	During construction phase, lack of proper solid waste disposal management, sanitation facilities and poor management of human waste could degrade ground or nearby surface water by run-off or infiltration. Poor human waste disposal and treatment could also degrade soils.
18		Redundancy and loss of income of traders during the construction period.	B-	D	Consultation and past experience of similar projects	During the construction works, activities in trading centres are likely to stop as works go on. This could affect the regular income of these traders and hence affect livelihood. Alternative sources of income might need to be formed to avoid redundancy and loss of income.
19	***OP 4.10: Indigenous***	Indigenous/Minorities	D	D	Literature review and	Regarding indigenous people, Rwanda does not have indigenous groups on grounds that

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
	People				public consultation	it is a nation with a single/common culture, tribe, language and with a National constitution that recognises all Rwandans are born and remain equal in rights and freedom (article 16 of Rwandan Constitution, 2015 and hence this safeguard is not applicable and not triggered. Furthermore, regarding gender, this article 16 of the Rwanda constitution not only covers Women but also the land law article 4 on Equal right to land, that states that all forms of discrimination, such as that based on sex or origin, in relation to access to land and the enjoyment of real rights shall be prohibited. This therefore implies that even women cannot be considered vulnerable.
20	***OP.4.12: Involuntary resettlement***	Land acquisition, asset displacement and compensation	B-	D	Field survey and expert observation	Areas so far identified that shall cause displacement of structures, private land, trees, crops are the new Gasogi substation plot, tower positions at angle points and the ROW corridor . Displacement will require compensation at full replacement cost to the PAPs before construction works can begin.
21	***OP 4.04: Natural habitat***	Likelihood of impact in protected area	D	D	Field survey and expert observation	No protected areas shall be affected by the ROW corridor of the distribution line.
22		Likelihood of impact on	D	D	Field survey and expert	No habitat or migratory paths of protected plant or animal species exist along the ROW.

No.	World Bank Safeguards	Impact /	Evaluation during Impact analysis		Study methods	Evaluation Basis
		protected flora and fauna			observation	The project area has been settled on or cultivated for a long time to have such protected species.
23		Likelihood of impact on hydrology of nearby water sources	D	D	Field survey and expert observation	No water sources exist along the ROW.
24		Bird electrocution	D	D	Field observation.	No bird migratory path in the project area. Also in the area already exists power lines hence addition of new lines will not cause significant impact.
25	***OP 4.11: Physical cultural resources***	Encroachment on cultural Heritage from existing graveyards and other cultural monuments	B-	D	Public consultation and literature review	During field survey and public consultation, the consultant was not able to identify any graveyards or cultural monuments. However, it is important to know that only after the new law No. 11/2013 of 2013 prohibiting burial anywhere other than designated cemeteries, did people stop burying with in homes and adjacent land. Visible or not, graveyards and other cultural monuments have cultural attachments to people and hence require a form of respect. In case they are found during construction, then Chance find procedures could then apply under such circumstances.

At this point, it is important to note that only those items with negative impacts (B- and C-) from the impact matrix were considered in proposing mitigation measures under this Environmental Management Plan (EMP) in chapter 8.

7.1 CONSIDERATION OF ALTERNATIVES

The purpose of this section is to examine the possible alternatives for delivering the goals and objectives of the project in a sustainable manner. For this particular project, some options have been considered. In seeking the best alternative, the "status quo" or "do nothing" option and the actual on grid electrification were considered and the alternatives analysis show the best alternative for implementation of the project.

Alternative line routes

An analysis of alternative line routes was undertaken by the surveying and design team through mapping and involvement of all the stakeholders in this selection process. At the end of this process, the line of routes chosen for this project based on the following:

i. The lines of route proposed were the most direct compared, shorter than going along the road. i.e. Gasogi to Nyagasambu and Masaka connection points.
ii. Also the line of routes chosen required less expropriation and hence less costly than other alternative routes.
iii. For the 110kV Transmission Line (TL) route of Jabana- Birembo, it is a line over 50 years old that is critical in the transmission power in Kigali and yet degraded to hold conductors. It therefore required rehabilitation.

New Gasogi Substation location

Possible alternatives for the location of the sites for the construction of the New Gasogi substation were considered. After analysis, the selected sites were retained due to the following reasons:

i. Close adjacent proximity of the new substation site to the existing Gasogi substation simplifies construction and equiping process of a new substation compared to any further site.

No Project Alternative

A No Project (Do nothing option) alternative would primarily mean that the status quo will be maintained and in a sense the environmental impacts (adverse) will not occur. However the positive benefits will be forgone in terms of providing more access to electricity to the Rwandan population which would have in turn spurred and contributed to economic growth.

If the "do nothing option" was considered, some benefits would be missed out such as:

- Increased electricity supply to Masaka Hospital, Ndera, Gikomero, Rusororo, Masaka and Fumbwe Sector areas.
- The Masaka and Nyagasambu lines supplying Masaka and Fumbwe would continue to be strained and provide low amount of electricity to an area that is rapidly growing into a mixed use area (i.e. residential and institutions).
- During the construction phase there would be no temporary employment opportunities for local contractors,
- There would be no employment or supply services and provisions for workers and to contractors,
- Within the respective project areas there would be no opportunities for petty trading and small business service provision along the power line routes,
- Potential beneficiary enterprises such as small industries and other agricultural processing businesses lacking electricity would still be affected,
- Data management with computers and communication facilities like access to internet, charging of mobile phones; electric lighting at night, extended opportunities for work and study would be evidently missed out,
- Socio-economic development would not be achieved if the project is not implemented,
- Generally, employment opportunities that would be created by the programme would be miss out,

Comparison of Alternatives

The selected line routes and location of substation were the most feasible in light of the availability of the phase 3 electricity network in the area, the positive environmental benefits, and most importantly because this is what the local communities prefer. The alternative of "no-build" is not feasible because electricity is included as a measure of development in a village

and therefore is always given high priority in the list of developmental activities for any country. While there will be no high environmental cost from these alternatives, with increasing population it is expected that the demand for fuel wood will increase each year, putting very heavy pressure on the already dwindling forest resource.

CHAPTER 8: ENVIRONMENTAL SOCIAL MANAGEMENT PLAN (ESMP)

Avoidance and mitigating measures to adverse risk/ impacts from the Impact matrix in chapter 7 are proposed, for adoption by the project to minimize the potential significant impacts. The Environmental Management Plan (EMP) described in *Table 10 below* provides a way forward for implementation of the identified mitigation measures.

EDCL shall be responsible for overall implementation of the EMP. A project Environmental and social safeguards officer may be designated to make day to day follow ups (e.g. supervision and liaising with stakeholders). The estimated costs for implementation of the mitigation measures are just indicative. Appropriate bills of quantities should clearly give actual figures. In any case the consultant used informed judgment to come up with these figures.

Table 10: Environmental Management Plan (EMP)

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
	Planning phase			
1	Land acquisition, asset displacement and compensation	• Propose preparation of a Resettlement Action Plan (RAP) with detailed asset inventory displaced along the ROW of the power lines at the stage of preparation of detailed engineering design. • Compensation of all displaced assets at full replacement cost before any construction can commence.	-EDCL	An estimate cost of 58,000USD for the RAP, referred from previous RAPs for similar linear projects. Full replacement compensation cost estimates shall be determined by the asset inventory and valuation.
2	Exposure to electromagnetic fields from power lines that could be cancerous in the long run	• In compliance to the 2010 RURA guidelines for ROW of power lines, no habitat houses directly under the wire zone power lines is accepted. This would mean that at the time of RAP or ARAP implementation all such houses shall be resettled to avoid exposure to electro-magnetic fields that	-EDCL	Cost of displacement of habited houses under the wire zone will be part of the full replacement compensation cost. Cost not able to be determined now.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
		could be cancerous in the future.		
	Construction phase			
3	Soil erosion from construction	The contractor is required to include in the construction approach at stage of contract negotiations the following: • Storm water drainage master plan for critical points of the road to manage run-off from destroying houses or crop land. • Plan for hoarding portions of the site where soil excavations are anticipated with iron sheets hold the excavated soils from eroding and destroying crops or homes of those at the site boundaries.	Contractor	Cost shall be met under the contractor's sum. Estimate cost not able to be determined now, only after detailed designs are complete.
4	Air pollution/ dust from site	• Only contract automobiles and heavy equipment with inspection certification, which are expected to be in good condition and have less exhaust emissions. • Water spraying regularly on site. • Soil compaction of completed portions to avoid dust.	Contractor	A $5m^3$ water truck for spraying could cost up to 40,000Rwf (54US$). It costs 13USD/ automobile to acquire an Inspection certificate indicating it is in good condition not to pollute with exhaust fumes.
5	Soil degradation/pollution	• Soil compaction of completed portions. • Proper storm water drainage channels to avoid run-off from carrying away soils. • Plant grass at completed areas. • As for oil spillage prevention, re-fueling shall be done on cemented grounds with sand to absorb the spilled oil.	Contractor	Cost inclusive in construction contract
6	Noise/Vibration	• Noisy activities shall be restricted to working hours 7-17h. For example activities such as; vibrations, compaction and other earth	Contractor	No cost applicable to the proposed mitigation measure.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
		worksthat require heavy machine • Contractor shall use automobiles with Inspection certificates since they are in good condition emitting less noise.		It may however be relevant to know that it costs 13USD/ Vehicle to acquire an automobile Inspection certificate for a period of 6months indicating it is in good condition not to pollute with noise.
7	Traffic accidents on or around the site	• Traffic signage should be placed at points of construction. Such as; "Heavy trucks turning", "Men at work", "slow down", "speed limit signage". • Traffic worker directing traffic in and around site should be in place	Contractor	Cost shall be met under the contractor's sum. Estimate cost not able to be determined now, only after detailed designs are complete.
8	Theft/ insecurity at the project site	• Hoarding of construction sites with wire mesh fencing or iron sheets to restrict trespassing, • lighting of construction site at night and • Hiring of security guards on site.	Contractor	Hiring a Security guard will cost 30,000Rwf (38US$) per month. Number of guards can be determined on site. Cost of security shall be inclusive in construction contract.
9	Redundancy and loss of income for local farmers during construction	• The contractor is required to present an affirmative policy that states that he/she will give locals in the area first priority during employment for works for skilled or unskilled labour. This way those whose income has been affected by the works, can earn from wages during the construction	-EDCL -Contractor -Districts of Rwamagana, Gasabo and Kicukiro	No cost applicable. It's with in obligations of the Districts paid off their salaries to inspect sites and see whether its locals are benefitting from employment of such projects.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
10	Pollution from construction debris and murrum for disposal	• Construction debris and murrum shall be disposed by trucks with covered tarpaulins to avoid littering. • Construction debris and murrum shall be disposed at designated district damp sites only lest the contractor is fined for non-compliance.	Contractor	Cost shall depend on the volume of debris or murrum generated on site. Estimates can be determined during the topographic survey of the sites. The cost shall be included by the contractor in the contractor's sum.
11	Water and soil pollution from human waste disposal	• Mobile toilets shall be installed at positions of current construction works for use by workers to avoid littering the area with human waste. • Collection bins on site are required for disposal of solid waste and organic waste by workers on site. These bins shall be regularly emptied and waste disposed off at designated district damp sites	Contractor	Cost shall be met under the contractor's sum. Estimate cost not able to be determined now, only during construction.
12	Occupation health hazards	• The contractor in tendering shall submit and be prepared to implement a site Health and safety plan/policy that includes measures to: o Exclude the public from all constructions sites; o Ensure that workers use personal protection equipment (PPE) where necessary. During construction have overalls, boots, helmets, gloves safety belts while on scaffolding in case of work at heights higher than 2m. o Provide Health & Safety training for all personnel; o Document procedures for all site	Contractor	Cost estimates for Health, Environment and safety shall be determined at detailed design stage. Not able to determine estimate costs now.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
		activities; o Keep accident reports and records; o Inform local communities about the work and dangers o Have a fire risk management plan and procedure with fire escape directions on site and fire extinguishers.		
13	Children's rights and possible child labour	• Recruitment of workers shall be based on submission of a copy of National ID, where those below the age of 16 years shall not be employed as per article 4 of the National law regulating labour in Rwanda Nº. 13/2009.	-Contractor -Site relevant District and Sector authorities	No cost applicable. It is part of the obligations of District and sector authorities to inspect sites, for which they are paid a monthly salary.
14	Poor Site working conditions	• Contractor should have a labour policy and its compliance that elaborates its stand on but not limited to: o Prohibition of Child labour, forced works, freedom of worker's opinion, o Contracts of employment that may include; probation period, employment period, obligations of employer and employee, salaries and payment procedure, conditions and procedure of termination, damages. o Work leaves, health and safety policy at work place, medical insurance, prevention policy. o Insurance policy of the site, works and workers on it.	Contractor	No cost applicable instead a requirement for a contractor to be awarded the contract and random site inspection by the District to enforce it.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
15	HIV/ AIDS and other infectious diseases	• Contractor shall have regular sessions (preferably monthly) to sensitise employees on how to prevent contracting infectious diseases such as HIV/AIDS and sexually transmitted diseases. • Sector authorities may organise such sensitisation on infectious diseases and also include free testing and counselling of those already infected. • Encourage workers to have at least the national medical insurance "Mutuelle de santé"	• Contractor • Site relevant Sectors	Cost estimates towards HIV/ AIDS sensitization shall be determined during construction stage as need arises. It is important to know that National medical insurance cost at the least 3000Rwf (4USD)/ person/ year.
16	Water related diseases caused to communities from poor sanitation and stagnant water	• Mobile toilets installed on site with a person in-charge of ensuring proper hygiene of these toilets. • Clearing all stagnant water or bushes created on site to prevent mosquitoes from breeding.	Contractor	Cost inclusive in Contractor's daily operation cost.
17	Poor site management could be a safety and security issue to the community	• Hoarding of construction sites with wire mesh fencing or iron sheets to restrict trespassing, • lighting of construction site at night and • Hiring of security guards on site. • Contractor shall contribute financially to community policing in the area "locally called irondo" to offset any risk of insecurity caused by project activities.	Contractor	Cost of community policing could be 2000Rwf (2.6USD)/month. Other mitigation measures proposed have their cost inclusive in contractor's sum therefore no extra cost for the EMP.

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
18	Encroachment on cultural heritage such as; graveyards or other cultural monuments	In case of "chance find" of grave or cultural monument that requires relocation. The chance find procedure shall comprise of: • The Contractor shall follow the requirements of the articles 14, 15, 16, 18, 19 of the National law N°11/2013 of 11/03/2013 Determining the organisation and use of Cemeteries. • Consultation with communities and designated government agencies on movement of the grave or cultural artefacts. • Relocation of grave or artefacts and structures associated with religious worship can occur only after consultation with ritual practitioners (priests and spirit mediums) and must include compensation for associated rituals. • Families must be compensated for both the logistical and the ritual costs of exhuming family graves and transferring remains to a new site.	Contractor	At the moment cost of chance finds of graveyards or cultural monuments could not be determined since none of these items was identified, however, these costs shall be determined at the time of identification of the cultural heritage. The cost shall be included in additional works to the contract sum.
	Operation phase			

No.	Adverse Risk/impact	Mitigation Measures	Responsible Institutions	Cost (USD or Rwf)
19	Human electrocution	1-To avoid towers with live conductors from electrocuting people that touch them, horizontal insulators are used to connect the two conductors attached to the tower. (Refer to figure 2 above) 2-Also panels shall be placed on the towers with instructions in Kinyarwanda, English or French informing people of the dangers of getting close, touch or climbing the tower. 3-Sharp spokes shall be placed at the lower horizontal members to prevent children or other people from climbing the tower. 4-Towers are also designed to have a ground wire that provides a more direct current path to the earth for lightning to flow through than the transmission lines, hence avoiding lightning from striking the power lines and causing fires or electrocution. 5-Train and supervise EUCL operatives to ensure that they check house wiring carefully and reject if deficient. 6-Public education to raise villagers' awareness of dangers of electricity and how to utilize the system safely	-Contractor, -EDCL engineers	Cost part of the construction contract
20	Fire risk	Towers shall be designed to have a ground wire that provides a more direct current path to the earth for lightning to flow through than the transmission lines, hence avoiding lightning from striking the transmission lines and causing fires or electrocution.	Contractor	Cost inclusive in construction contract

CHAPTER 9: ENVIRONMENTAL MONITORING PLAN

In this chapter a monitoring plan is proposed in *Table 11* below indicating measurements of parameters, responsibility and cost estimates of outcomes of the proposed mitigation measures.

Table 11: Environmental and Social Monitoring Plan

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	Planning phase						
1	Land acquisition, asset displacement	• Preparation of a RAP with detailed asset inventory displaced at the stage of preparation of detailed engineering design. • Compensation of all displaced assets at full replacement cost before any construction can commence.	• RAP report • Bank slips as proof of compensation payment of PAPs	Document verification.	Before construction commencement	-EDCL.	No clear cost applicable for verification. It is the duty of the responsible institutions.
2	Exposure to electromagnetic fields from power lines that could be cancerous in the long run.	• In compliance to the 2010 RURA guidelines for ROW of power lines, no habitat houses directly under the wire zone power lines is accepted.	• No houses under the power lines	Document verification.	Before construction commencement	-EDCL.	No clear cost applicable for verification. It is the duty of the responsible institutions.

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	Construction phase						
7	Soil erosion from construction	• Storm water drainage master plan to manage run-off from destroying houses or crop land. • Plan for hoarding portions of the site where huge soil excavations are anticipated.	- storm water master plan - hoarding at site - record of complaints from neighbourhood of destroyed assets from project soil erosion	Site inspection	Throughout construction phase	-EDCL -Districts of Rwamagana, Gasabo, Kicukiro	No clear cost applicable, inspection is an in-house obligation of the responsible institutions.
9	Air pollution	• Only contract automobiles with vehicle inspection certification, which are expected to have less exhaust emissions.	-Automobiles on site with inspection certificates	Site inspection	Quarterly in a year throughout the construction phase	-EDCL - Relevant District Sector infrastructure department in which the power line works occur.	No cost applicable for monitoring since its within the EDCL and Sectors' operation budget.
10	Soil degradation/pollution	• Soil compaction of completed portions. • Proper storm water drainage channels. • Plant grass at completed areas. • As for oil spillage prevention, re-fuelling shall be done on cemented	Soil parameters tested can be; PAHs, BTEX,	Soil sample analysis by Gas chromatograph-Mass spectrometry	Before construction as baseline data, mid-term of construction and end of construction	-Contractor	249USD/ soil sample analysis

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
		grounds with sand to absorb the spilled oil.					
11	Noise/Vibration	• Noisy activities during working hours 7-17h. • Use automobiles with Inspection certificates.	-Daily site schedule -Automobiles with inspection certificates	Site inspection	Throughout the construction phase	-Contractor - Relevant District Sector infrastructure department in which the works occur	No cost applicable for monitoring since its within the Sectors' operation budget.
12	Traffic accidents	• Traffic signage on site • Traffic personnel directing traffic	-Traffic signs -Traffic personnel on site	Site inspection	Throughout the construction phase	-Contractor -EDCL - Relevant District Sector infrastructure department in which the works occur	No cost applicable for monitoring since its within the Sectors' operation budget.
	Theft/ insecurity on site	• Hoarding of construction sites with wire mesh fencing, • lighting of construction site at night and • hiring of security guards	-Hoarding fence. -lighting and -security guards	Site inspection	Throughout the construction phase	-EDCL - Relevant District Sector infrastructure department in which the works occur. -Contractor	No cost applicable for monitoring.

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	Encroachment of cultural heritage from existing graveyards or cultural monuments	Compliance to the proposed chance find procedure comprising of: • The National law N°11/2013 of 11/03/2013 Determining the organisation and use of Cemeteries. • Consultation with communities and designated government agencies on movement of the grave or cultural artefacts. • Relocation of grave or artefacts and structures associated with religious worship can occur only after consultation with ritual practitioners (priests and spirit mediums) and must include compensation for associated rituals. • Families must be compensated for both the logistical and the ritual costs of exhuming family graves and transferring remains to a new site.	-Records of number of exhumed graves. - Records of procedure applied and confirmed approval from local authorities and families of full compensation	Site inspection	Quarterly in the year throughout the construction phase	-EDCL - Relevant District Sector infrastructure department in which the road works occur. -Contractor	No cost applicable for monitoring since its within the EDCL and Sectors' operation budget.

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	Redundancy and loss of income by farmers during construction	• Exercise an affirmative policy giving locals in the area first priority during employment for skilled or unskilled labour.	- List of workers and where they come from	Site inspection	Quarterly in a year throughout the construction phase	- Relevant District Sector infrastructure department in which the works occur. -Contractor	No cost applicable for monitoring since its within the Sectors' operation budget.
	Pollution from construction debris and murrum for disposal	• Construction debris and murrum disposed by trucks with covered tarpaulins to avoid littering along the route. • Construction debris and murrum disposed at designated district damp sites only lest the contractor is fined for non-compliance	-Record of volume of debris disposed off site. -Record of lists signed off by the receiving damp sites	Site inspection	Throughout the construction phase	-EDCL - Relevant District Sector infrastructure department in which the road works occur. -Contractor	No cost applicable for monitoring since its within the EDCL and Sectors' operation budget.
	Water and soil pollution from human waste disposal	• Mobile toilets on site. • Collection bins on site, regularly emptied and waste disposed off at designated district damp sites	-Number of toilets on site - Volume of solid waste disposed (m^3) - Record of lists signed off by the receiving damp sites	Site inspection	Throughout the construction phase	-EDCL - Relevant District Sector infrastructure department in which the road works occur. -Contractor	No cost applicable for monitoring since its within the EDCL and Sectors' operation budget.
13	Occupation health hazards	• Site Health and safety (HES) policy and plan. • public prohibition from all	-Workers with protective gear.	Site inspection	Monthly	-Contractor - Project relevant Sector	No cost applicable for monitoring

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
		constructions sites; • personal protection equipment (PPE) for workers; • Provide Health & Safety training for all personnel; • Follow documented procedures for all site activities; • Keep accident reports and records; • Inform local communities about the work and dangers	- records of accidents			infrastructure department	since its within the Sectors' operation budget.
14	Children's rights and possible child labour	• Recruitment based on National ID for those only above 16 years	- Worker's ID	Site inspection	Quarterly (every 3 months)	-Contractor -EDCL - Project relevant Sector Infrastructure department	No cost applicable for monitoring since its within these institutions' operation budget.
15	Poor Site working conditions	Contractor's labour policy and it's compliance	-Safety on site. -Human resource records -paid salary rosters	Site inspection	Quarterly (every 3 months)	-Contractor -EDCL - Project relevant Sector Infrastructure department	No cost applicable for monitoring since its within these institutions' operation budget.

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
16	HIV/ AIDS and other infectious diseases	Sensitisation on infectious diseases by Contractor and Sector authorities	Records of sensitisation meetings	Site inspection	Quarterly (every 3 months)	-Contractor -EDCL - Project relevant Sector Infrastructure department	No cost applicable for monitoring since its within these institutions' operation budget.
17	Water related diseases caused to communities from poor sanitation and stagnant water	Dry VIP Toilets with good hygiene	Clean VIP Toilet	Site inspection	Quarterly (every 3 months)	-Contractor -EDCL -Project relevant sector Infrastructure department	No cost applicable for monitoring since its within these institutions' operation budget.
18	Poor site management could be a safety and security issue to the community	• Contractor shall contribute financially to community policing in the area "locally called irondo" • Hoarding of construction sites with wire mesh fencing or iron sheets to restrict trespassing, • lighting of construction site at night and • Hiring of security guards on site.	-Records of community policing fee. -hoarded site. -lights on site. -security guards on site	Site inspection	Daily during construction phase	-Contractor - Project relevant sector Infrastructure department	No cost applicable for monitoring since its within these contractor's operation budget.
	Operation phase						
	Human	1-Horizontal insulators are	Towers with	Site	At	EUCL/ Sector	No cost

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	electrocution	used to connect the two conductors attached to the tower. 2-Precautions panels on the towers with instructions in Kinyarwanda, English or French informing people of the dangers of getting close, touch or climbing the tower. 3-Sharp spokes at the lower horizontal members to prevent children or other people from climbing the tower. 4-Towers with a ground wire avoid lightning from striking the power lines. 5-Train and supervise EUCL operatives to ensure that they check house wiring carefully and reject if deficient. 6-Public education to raise villagers' awareness of dangers of electricity and how to utilize the system safely.	proposed mitigation precautionary measures installed.	inspection	commissioning of the construction completion	infrastructure department	applicable for monitoring since its within the EUCL/ Sectors' operation budget.

No	Risk/impact	Mitigation Measures	Parameters to be monitored	Method	Frequency	Responsible institutions	Cost (USD or Rwf)
	Fire risk	Towers shall be designed to have a ground wire that provides a more direct current path to the earth for lightning to flow through than the transmission lines, hence avoiding lightning from striking the transmission lines and causing fires or electrocution.	Towers with proposed mitigation precautionary measures installed	Site inspection	At construction completion. Also inspection throughout operation as part of Operation and Maintenance.	EUCL/ Sector infrastructure department	No cost applicable for monitoring since its within the EUCL/ Sectors' operation budget.

CHAPTER 10: CONCLUSIONS AND RECOMMENDATIONS

10.1. CONCLUSIONS

The Scoping Exercise identified a number of risks and impacts pertaining to the proposed project activities to improve the Gasogi substation, Distribution and transmission network phase 3. The issues/impacts have been assessed and described in detail to gain an adequate understanding of possible environmental effects of the proposed project – from planning, construction to operation/implementation, in order to formulate mitigation measures in response to negative aspects which have emerged.
The EMP provides a way forward for implementation of the identified mitigation measures. The ESIA 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 for each activity should clearly give the actual figures. In any case the consultant has used informed judgment to come up with these figures.

The Environmental Monitoring Plan provides parameters to be monitored and responsibility of institutions to follow up. The consultant is recommending that EDCL assigns an Environmental and social safeguard officers to undertake the monitoring of the mitigation measures for the project through its existence. This way the project will achieve sustainable project implementation.

Given the nature and location of the development, the conclusion is that the project objectives bring positive benefits with any potential adverse impacts of a nature and extent that can be avoided, reduced, limited or eliminated by the application of the proposed appropriate mitigation measures.

10.2. RECOMMENDATIONS

Based on the findings of this EIA study, a summary of proposed measures regarding avoidance and minimising of negative impacts caused by the Project are recommended hereafter:

<u>At Planning and design stage:</u>

- ***For Land acquisition and asset displacement***
  - Preparation of a RAP with detailed asset inventory displaced by the project at the stage of preparation of detailed engineering design.
  - Compensation of all displaced assets at full replacement cost before any construction can commence.
- ***To avoid electro-magnetic field exposure from power lines***
  - For Land acquisition and asset displacement

- In compliance to the 2010 RURA guidelines for ROW of power lines, no habitat houses directly under the wire zone power lines is accepted and hence all shall be displaced and compensated during RAP implementation.

At construction stage:

- ***For environment and social protection***
  - To avoid redundancy at trading centres due to works, it is proposed that the contractor exercises an affirmative policy giving locals in the area first priority during employment for road works for skilled or unskilled labour
  - Propose to have a Storm water drainage master plan for the sites.
  - Liquid waste generation from human waste can be handled by installment of mobile toilets, while solid waste shall be regularly disposed off site to the designated District damp site.
  - To avoid or reduce air/ dust pollution; (i) water shall be sprayed regularly on site, (ii) soil shall be compacted for completed portions to reduce dust, (iii) On site, the contractor shall only possess automobiles with vehicle inspection certificates considered to be in good condition with less exhaust emissions and noise.
  - Noise pollution can be controlled by permitting noisy activities during working hours of 7-17h and only using automobiles for construction that have Automobile inspection certificate.
  - To avoid traffic accidents, the project shall ensure traffic personnel to guide traffic during construction and traffic signage at the sites are in place.
  - To ensure that during construction cultural heritage such as graveyards and any cultural monuments found within project boundaries are respected, a chance find procedure is proposed that follows:
    - The Contractor shall follow the requirements of the articles 14, 15, 16, 18, 19 of the National law N°11/2013 of 11/03/2013 Determining the organisation and use of Cemeteries.
    - Consultation with communities and designated government agencies on movement of the grave or cultural artifacts.
    - Relocation of grave or artifacts and structures associated with religious worship can occur only after consultation with ritual practitioners (priests and spirit mediums) and must include compensation for associated rituals.
    - Families must be compensated for both the logistical and the ritual costs of exhuming family graves and transferring remains to a new site.

- ***For Labour and working conditions***
  - To minimise occupational health hazards on site, the contractor shall present a site Health and Safety policy and plan.
  - Workers shall have Personal Protective Equipment (PPE) and safety wear while on site.

- Employees shall have training on health and safety on site.
- The site shall have a fire risk management plan.
- Inform local communities about works and dangers.
- Document accidents on site.
- Hoard the site to avoid trespassers that could otherwise have accidents.
- To avoid child labour, recruitment of workers shall be based on presented National ID, with a policy of not employing anyone under 16 years old.
- The contractor shall possess a labour policy and indicate compliance to it. It shall comprise but not limit to; prohibition of child labour, indicate contract formats for employment, obligations of the employer and employee, salary structure, leave, health and safety policy and an insurance policy for the site.
- Sensitisation of workers and neighbouring communities on HIV/AIDs and other infectious diseases shall be encouraged by the contractor and Sector authorities.

- ***Community health, safety and security***
  - For site security, the contractor shall ensure that; (i) the site is hoarded or fenced off with iron sheets, wire mesh or construction nets, (ii) there is sufficient lighting of the site, (iii) the site has security guards.
  - The contractor shall pay for the services of Community policing "locally called Kurara Irondo".

<u>At operation stage</u>

- **To avoid human electrocution**
  - Horizontal insulators are used to connect the two conductors attached to the tower.
  - Precautions panels on the towers with instructions in Kinyarwanda, English or French informing people of the dangers of getting close, touch or climbing the tower.
  - Sharp spokes at the lower horizontal members to prevent children or other people from climbing the tower.
  - Towers with a ground wire avoid lightning from striking the power lines.
  - Train and supervise EUCL operatives to ensure that they check house wiring carefully and reject if deficient.
  - Public education to raise villagers' awareness of dangers of electricity and how to utilize the system safely.

- **To avoid fire risks from lightning or short circuits**
  - Towers shall be designed to have a ground wire that provides a more direct current path to the earth for lightning to flow through than the transmission lines, hence avoiding lightning from striking the transmission lines and causing fires or electrocution.

REFERENCES

- *EDPRS II (2013-2018)*. Economic Development and Poverty Reduction Strategy II.
- *EICV 3 (2010-2011).* National Integrated Household living Conditions survey for Gasabo, Kicukiro and Rwamagana Districts.
- *Government of Rwanda, (2008).*Ministerial order No. 003/2008. Relating to the requirements and procedure for Environmental Impact Assessment, 2008.
- *Government of Rwanda, (2008).*Ministerial order No. 004/2008.Establishing the list of works, activities and programmes that have to undertake Environmental Impact Assessment, 2008.
- *Government of Rwanda, (2008).*Ministerial order No. 007/2008.Establishing the list of Animal and plant species, 2008.
- *Government of Rwanda, (2008).* Organic law 04/2005 of 08/04/2005.Organic law determining the modalities of protection, conservation and promotion of the environment in Rwanda.
- *Government of Rwanda, (2005).*Organic law N° 08/2005 of 14/07/2005.Determining the use and management of Land in Rwanda.
- *JICA, 2010.* Japan International Cooperation Agency (JICA) Guidelines for environmental and social considerations.
- *JICA, 2017.* Field report for Preparatory survey on Improvement of substations and distribution network phase 3 in the Republic of Rwanda.
- *MININFRA, 2004.* Rwanda Energy Policy.
- *RURA, 2015.* Guidelines for Right-of-way for power lines.
- *World Bank OP/BP 4. 01* Environmental Assessment
- *World Bank OP/BP 4. 04* Natural Habitat
- *World Bank OP/BP 4. 11* Physical Cultural Resources
- *World Bank OP/BP 4. 12* Involuntary resettlement
- *World Bank OP/BP 4. 10* Indigenous people.

APPENDICES

APPENDIX 1: MINUTES OF PUBLIC CONSULTATTION MEETINGS

Akarere ka Gasabo

Kuwa 15/07/2017

Umurenge wa Rusororo

Akagali ka Kinyana

Umudugudu: Kigasiro

Impamvu: Gusobanurira abaturage ibyerekeye Umushinga w'amashanyarazi Uzaturuka Gasogi ugana Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu atanga ikaze kubashyitsi aribo Songa Silvin, olivier Rukemampunzi na Ruhamyambuga J. paul

Songa yafashe ijambo atangira kubasobanurira ibyerekeye imigendekere y'umushinga, ibyerekeye amambo n'ibyo kubarirwa ibintu byabo bishobora kwangizwa n'umushinga.

Impungenge z'abaturage, uwa mbere yatangije abaza ibyangombwa azitwaza mugihe ayo kubarirwa; undi yatanze ikibazo aye abaza niba uwo murino nabo uzabagereraho ayangiza niba ari ugushinga amapoto gusa awutambutsa; Undi yabajije niba abaza yishyurwa ari abafite amambo gusa cyangwa niba n'ibindi bintu bizangizwa bizishyurwa, undi yabajije ibyerekeye amambo kubera ko zitandukanye kuri ayishiti n'izindi za sima

Umuyobozi w'Umudugudu: Mwizerwa Germain

Umwanditsi: SONGA Silvin

Akarere ka Gasabo

Umurenge wa Rusororo

Akagali ka Kinyana

Umudugudu : Kigasiro

Kuwa 15/07/2017

Impamvu: Gusobanurira abaturage ibyerekeye Umushinga w'amashanyarazi Uzaturuka Gasogi ugana Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu atanga ikaze kubashyitsi aribo : SONGA Silvin, olivier Rukemampunzi na Anathazimana J. paul

songa yafashe ijambo atangira kubasobanurira ibyerekeye imigendekere y'umushinga, ibyerekeye imitungo n'ibyo kubarirwa ibintu byabo bishobora kwangizwa n'umushinga.

Impungenge z'abaturage, uwa mbere yatangiye abaza ibyangombwa azitwaza ngo kubarirwa, undi yatanze ikibazo aho abaza niba uwo murino nabo uzabagezaho ayongeza niba ari ugushinga amapoto gusa awutambutsa, undi yabajije niba abazishyurwa ari abafite imitungo gusa cyangwa niba n'ibindi bintu bizangizwa bazishyurwa, undi yabajije ibyerekeye imitungo kubera ko zitandukanye kuri ubutaka cyangwa ari kuri zo sima

Umuyobozi w'Umudugudu : Mwizerwa Germain

Umushyitsi : SONGA Silvin

Akarere ka Gasabo
Umurenge wa Ndera
Akagali ka Mukuyu
Umudugudu wa Jurwe ~~Mukuyu~~

Kuwa 20/07/2017

Impamvu: Gusobanurira abaturage ibyerekeye Umushinga w'amashanyarazi uzaturuka Gasogi ujya Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu atanga ubusobanuro buke kubyerekeye Umushinga anadusobanurira n'ikiyabonto bagiye gupima, asoza aha ikaze abashyitsi aribo Songa, J. Paul na Olivier.
Songa yafashe ijambo atangira asobanurira abaturage ibyerekeye umushinga, anababwira ko umushinga uzabora kugira ibyo wangiza mu mitungo y'abaturage.
Yababwiyeko kandi amapoto azashingwa mu butaka bw'abaturage cyangwa se kuri mazu y'abantu, aiyo mpamvu bazabarirwa kugirango babishyure ibyabo bizaba byangiritse.
Abaturage bafashe ijambo bagaragaza impungenge zabo, abaza niba igihe bapoeenyeye inzu niba bapfuha amafaranga cyangwa bakapfuha ahandi utura, undi yabajije niba ahantu hatagiye ipoto naho baha bariha, banasabye ko bakurirwa ubuvugizi mu byerekeye kubarirwa no kwishyurwa, bafite ubibazo cy'ibyangombwa by'ubutaka byerekana ubuhinzi kandi bakeneye kuhatura.
Barasaba ubuvugizi niba ba kwishyurwa aho insinga zizanyura hose

Umuyobozi w'umudugudu: BAKUNZI ferdinand [signature]
umushyitsi: SONGA Silvin: [signature]

Kuwa 21/07/2017

Akarere ka Gasabo

Umurenge wa Ndera

Akagari ka Rudashya

Umudugudu wa Ruhangare & Kakinyaga

Impamvu: Gusobanurira abaturage ibyerekeye umushinga w'amashanyarazi uzava i Gasogi ugana i Nyagasambu

Inama yatangijwe n'umuyobozi ushinzwe imibereho myiza y'abaturage mu kagari ka Rudashya aho twaje abashyitsi aribo; Songa, J.paul na Olivier Songa yafashe ijambo atangira abwira abaturage ikigenza abashyitsi abasobanurira ibyerekeye umushinga w'amashanyarazi uzaturuka Gasogi ugana Nyagasambu; yabasobanuriye ko hari amapoto azashingwa mu masambu yabo; abasobanurira ko ayo mapoto hari ibyo azangiza ariyo mpamvu bagomba kubarirwa kugirango bazishyurwe ibyangijwe

Hakurikiye impungenge z'abaturage, uwambere yabajije ikibazo giteye gitya ko hari abantu bashinze amapoto mu mirima yabo kandi ntibishyurwe, avuga ko hashize imyaka ibiri bibaye; abenshi bafite ikibazo kuri phase ya 2 barabaruwe ariko ntibishyuwe; ikindi kibazo n'icyabantu bapuze ubutaka ariko batarakora mutation afite ntikibazo kandi kubarura imirima zizanyura kugirango izo ariko ntabwo bamubariye inzu yiwe.

Umuyobozi ushinzwe imibereho myiza y'abaturage: GASANA Jonathan 21/07/2017

Umushyitsi SONGA

APPENDIX 2: LIST OF PUBLIC or PARTICIPANTS CONSULTED

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1. Nyiramahoro Odette	Akagari: [illegible] Umudugudu, Nyagisozi		[signature]	Le 19/07/2017	Borne
2. RUTONESHA Athanase	UMUDUGUDU/NYAGISOZI		[signature]	Le 19/07/2017	
3° KAYITESI [illegible]	NYAGISOZI		[signature]	Le 19/07/2017	
4° MUKAKARISA Jacqueline	NYAGISOZI		[signature]	Le 19/07/2017	
5° RUKUNDO François	NYAGISOZI			Le 19/07/2017	Borne
6° NIYONZIMA Olive	NYAGISOZI		[signature]	Le 19/07/2017	
7° TUMUSENGE Jeanne	NYAGISOZI		[signature]	Le 19/07/2017	
Umuyobozi w'Umudugudu HABIYAREMYE SPRIEN					
1.					

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1. MBONIGABA J.M. Vianney	KINYANA-KIGABIRO		[signature]	IE 19/7/2017	Borne
2. RUSANGANWA Sostene	KINYANA - KIGABIRO		[signature]	IE 19/7/2017	Borne
3. KAMANA Janvier	KINYANA - KIGABIRO		[signature]	IE 19/7/2017	Borne
4. MUNYANEZA Emmanuel	KINYANA - KIGABIRO		[signature]		
5. MUVIZERWA Jérémie	" "		→ Umuyobozi w'umudugudu		
6. NYIRASAFARI Vamelanda	" "		2		
7. NUMUKOBWA Madasina	" "				
8. NTEZIYAREMYE Innocent	" "				
9. NYIRABUKEYE Bonatina	" "				
10. MUKAZIKEYE Venonsia	" "				
11. IGIRUKWAYO J. Paul	" "				
12. NIYONSENGA Alphonse	" "				
13. RWAKANA Jelardi	" "				
14. NTIBIMENYA Thom	" "				
15. NYIRANGENDAHIMANA Flotune	" "				
16. HABANABAKIZE Thomas	" "				
17. UAYITESI Agama	" "				
18. ABIRABURA Bonaventure	" "				Borne
19. BAVUGE Martin	" "				
	" "				
20. NZEYIMANA Venuste	" "		G		
21. MUKANKUBANA	"				

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date
1. NIYOTWIZEYE Vincent	Ndera/Kagabo Rudashya Kacyinyaga		[signature]	Le 21/07/2017.
2. MUKATWARAMBWA Isabelle	Gasabo Ndera Rudashya Kacyinyaga		[signature]	"
3. MARARA EDIGALD	GASABO NDERA RUHANGARE		[signature]	"
4. Mukaruhigwa Consolee	Ruhogo		[signature]	"
5. Karasira Innocent	Ruhangare		[signature]	
6. Ayirwanda Eugene	Ruhangare		[signature]	
7. Nyiraneza Julienne	Ruhangare		[signature]	
8. Bazubagira Mariane	Ruhangare		[signature]	
9. Kabaliza J. de Dieu	Ruhangare		[signature]	
10. Kayijuka Claude	Ruhangare		[signature]	
11. Nsengimana Faustin	Ruhangare		[signature]	
12. GIASANA Donatien	Rudashya		[signature]	
13. Nyiramuhire Josée	Ruhangare		[signature]	
14. Mukandahiro Jeanne	Ruhangare		[signature]	
15. Mukakabaye Stephanie	Ruhangare		[signature]	
16. Batamuliza Speciose	Ruhangare		[signature]	
17.				

→ Born

→ Bo

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1 Bntamazi ferdinand	Chef de zone Mukuyu NUAU		[signature]	Le 20/07/2017	
2. NSENGIYUMVA BONIFACE	MUKUYU, JUNWE		[signature]	KIRFUYA	BORNE
			[signature]	—	BORNE
3. IYAMUREMYE JV.	—		53 [signature]		
4. KARANGWA Terecim	—		[signature]	—	BORN
5. NSENGIYUMVA J.D	—		[signature]		
6. NYIRAHABIMANA Char	—		[signature]		
6. NYIRINGIRA MAMNA	—		2 [signature]		

APPENDIX 3: PROFILES OF THE PARTICIPATING CONSULTANT

SONGA Silvin- holds a MSc in Environmental Science and Technology and BSc in Civil engineering. He has over 9 years professional experience in the field of environmental assessment and management and 15 years professional experience in civil works, construction related fields and public procurement. He has worked on various programmes as team leader of the Environmental Assessment, programmes in sectors such as; Irrigation programmes, green house agriculture, mining programmes, road and bridge construction programmes, building and house constructions, schools and hospitals, among others.

12. EIA License

RDB | RWANDA DEVELOPMENT BOARD

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) CERTIFICATE

N°: RDB/EIA/609/09/17

Issued Date: 28/09/2017

This is to certify that the Environmental Impact Statement (EIS) was received from **Energy Development Corporation Limited(EDCL)**

Project title: **Improvement of Substations and Distribution Lines Network in Kigali Phase III**

Project objective:

to increase acess to electricity in Rwanda and in particular Kigali City.

Location: **Gasabo** District , **Ndera, Jabana, Kinyinya, Rusororo** Sectors.

The EIS has been submitted in accordance with the Laws and Regulations relating to the requirements & procedures for Environmental Impact Assessment in Rwanda and has been reviewed and found to have sufficient and relevant mitigation measures to the identified likely impacts of the project on the environment.

It was therefore approved subject to fulfilment of the conditions attached to this certificate.

Clare AKAMANZI

Chief Executive Officer

Fred KAREMERA

Copies to: MININFRA, REMA, Gasabo District

RDB | RWANDA DEVELOPMENT BOARD

CONDITIONS OF APPROVAL

In addition to the implementation of mitigation measures outlined in the EIA report, this certificate of approval is granted under condition that the developer shall comply with the conditions given herein:

1. **General conditions**
   a. This certificate of approval is valid for a period of 3 years before the commencement of the project. Application for its renewal shall be examined by RDB. Otherwise, it is valid during the whole lifecycle of this specific project unless henceforth revoked or suspended;
   b. Any change in the project designs shall be notified to RDB for further environmental considerations, and adjustment of this certificate of approval;
   c. Ensure that the EMP is implemented as prescribed in the EIR and ensure that records are kept for future monitoring or environmental audits;
   d. Ensure that any other undesirable environmental impacts arising from implanting this project but no foreseen by the time of undertaking the EIA are mitigated;
   e. Obtain all necessary approvals from the local administration as well as other relevant institutions;
   f. Ensure that this certificate is clearly displayed and is available at all times at the project site during project development/construction;
   g. Fulfill other environmental conditions and requirements as may be prescribed from time to time by the environmental authority or any other lead agency;
   h. Carry out regular environmental audits and submit audit reports to the Authority.

2. **Specific conditions**

- Observe all relevant national, regional and international standards, policies, regulations and legislation that guide this specific project throughout its life cycle;
- Ensure appropriate compensation/expropriation to all the affected people in accordance with the prevailing regulations. Valuation of the properties should be updated and cutoff dates fixed accordingly. Works should start when this exercise is duly completed;
- Construction works likely to produce excessive vibrations and noise shall be carried out during day hours in order to avoid disturbance to the local people;
- All workers should have Personal Protective Equipment and put them all the time at work;
- Access to working area shall be restricted to the workers and permitted and guided visitors;
- Avoid emissions of dust emanating from earth works on site and increased traffic movement of vehicles;
- All machinery, trucks and equipment at the construction site should be in good condition so as to reduce the level of noise and exhaust emissions, & risk of accidents;
- Potable water, temporal sanitary toilets should be available on the construction site;
- Protect and Preserve cultural heritage and historical and memorial sites;

- ☞ Constantly liaise with relevant authorities and consult stakeholders including local communities in case of any new development or changes as regards to implementation of your project plan activities;
- ☞ Abide by all national social and environmental safeguard policies and standards and strive to maintain and constantly improve standards;
- ☞ Conduct periodic Environmental Audits and facilitate monitoring by relevant authorities;
- ☞ Have and/or actively support tree planting programs to replace those that will be cut on the right of way (ROW) and during the construction of access roads;
- ☞ Ensure safe disposal of all types of wastes (solid or liquid) in specified and approved sites after treatment as required;
- ☞ Take measures to ensure that soil and water are not contaminated by fuel and oil spillages/leakages due to the project related activities;
- ☞ Ensure any pits resulting from excavation activities are backfilled, and erosion control measures are applied wherever it is likely to be caused by project related activities;
- ☞ As a result of influx of job seekers and the social interaction between the construction workers and the surrounding communities, HIV/AIDS incidences are likely to increase. There should be awareness campaigns in and around the camp sites;
- ☞ The alignment of the ROW should be done in a way that avoids/reduces the number of electrical pylons in wetland areas and in any other fragile/protected ecosystem;
- ☞ Ensure that any other undesirable environmental impacts that may arise due to the implementation of this project but were not contemplated at the time of undertaking this Environmental Impact Assessment are mitigated;
- ☞ Obtain all other relevant permits for other connected projects/activities like access roads, camp sites, quarry exploitation, etc. This certificate does not replace other required approvals/permits;

➢ The Environmental Impact Report is thus approved subject to the fulfillment of the conditions described above together with all mitigation measures proposed in your Environmental Management and Monitoring Plans.

N.B. Note that in case of non-compliance with the conditions described above, RDB reserves the right to withdraw the certificate.

Signed by

Clare AKAMANZI
Chief Executive Officer
Rwanda Development Board

Yves NSHUTI
Ag. Managing Director
Energy Development Corporation Ltd

13. Letter related to acknowledgement (acceptance) of the project components by Kigari City

13. Letter related to acknowledgement (acceptance) of the project components by Kigari City.

YACHIYO ENGINEERING CO., LTD.
Consulting Engineers & Architects

Tel : +81-3-5822-2740
Fax : +81-3-5822-2791

Ref. JICA/YEC/PH3-01

19th June, 2017

Attention to: Eng. NSHUTI Yves
Director of Energy Planning
Energy Development Corporation Limited (EDCL),
Rwanda Energy Group, Kigali

Dear Sir,

Project title: Preparatory Survey on the Project for Improvement of Substations and Distribution Network (Phase 3)

Re: Request for Prior Confirmation from the City of Kigali regarding location of New Gasogi Substation and 15kV Distribution Line Routes for the Project

In accordance with the request from the Government of Rwanda, we, the JICA preparatory survey team, are presently conducting the study for the captioned project.

Since we commenced our study in Kigali on 28th May with EDCL, we have carried out our field work, technical discussions with counterpart members from EDCL/EUCL and analysis to confirm the validity of the project components. Throughout the survey/study, we have designed layout of substation within the proposed compound and have identified distribution line routes to minimize environmental, social and cost impacts.

In order to make our further study/analysis available and to avoid any redesign work or suspension in the implementation stage, we would like to request you to have a prior confirmation from the City of Kigali by 21st June, 2017 to acknowledge that the location of New Gasogi substation and the proposed 15kV line routes do not interfere with road reserve and city development plan (Master Plan) as well.

The draft layout plan of New Gasogi substation, existing 110kV transmission line to be reinforced and proposed 15kV line routes are attached for your review and action. Please remember that those design or routes will be subject to change depends on our further study and consultation with JICA.

Thank you in advance for your correspondence.

Yours sincerely,

阿部 真

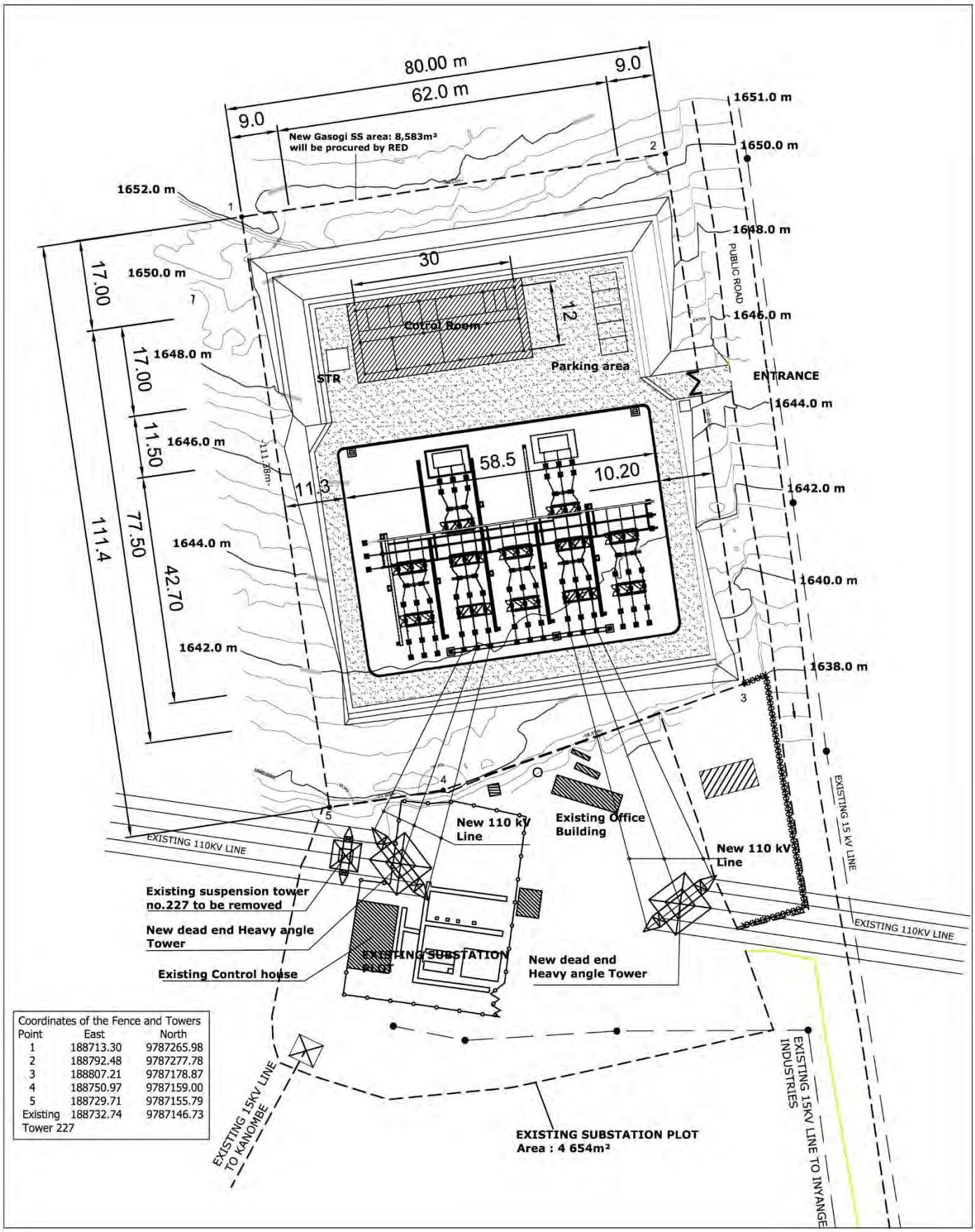
Makoto ABE
Chief Consultant
JICA Preparatory Survey Team/
Yachiyo Engineering Co., Ltd.

Attachment1: Preliminary Design of New Gasogi Substation
Attachment2: Existing 110kV Transmission Line from Jabana to Birembo Substation
Attachment3: Proposed 15kV Distribution Line from New Gasogi Substation

Copy to: Chief Representative, JICA Rwanda Office

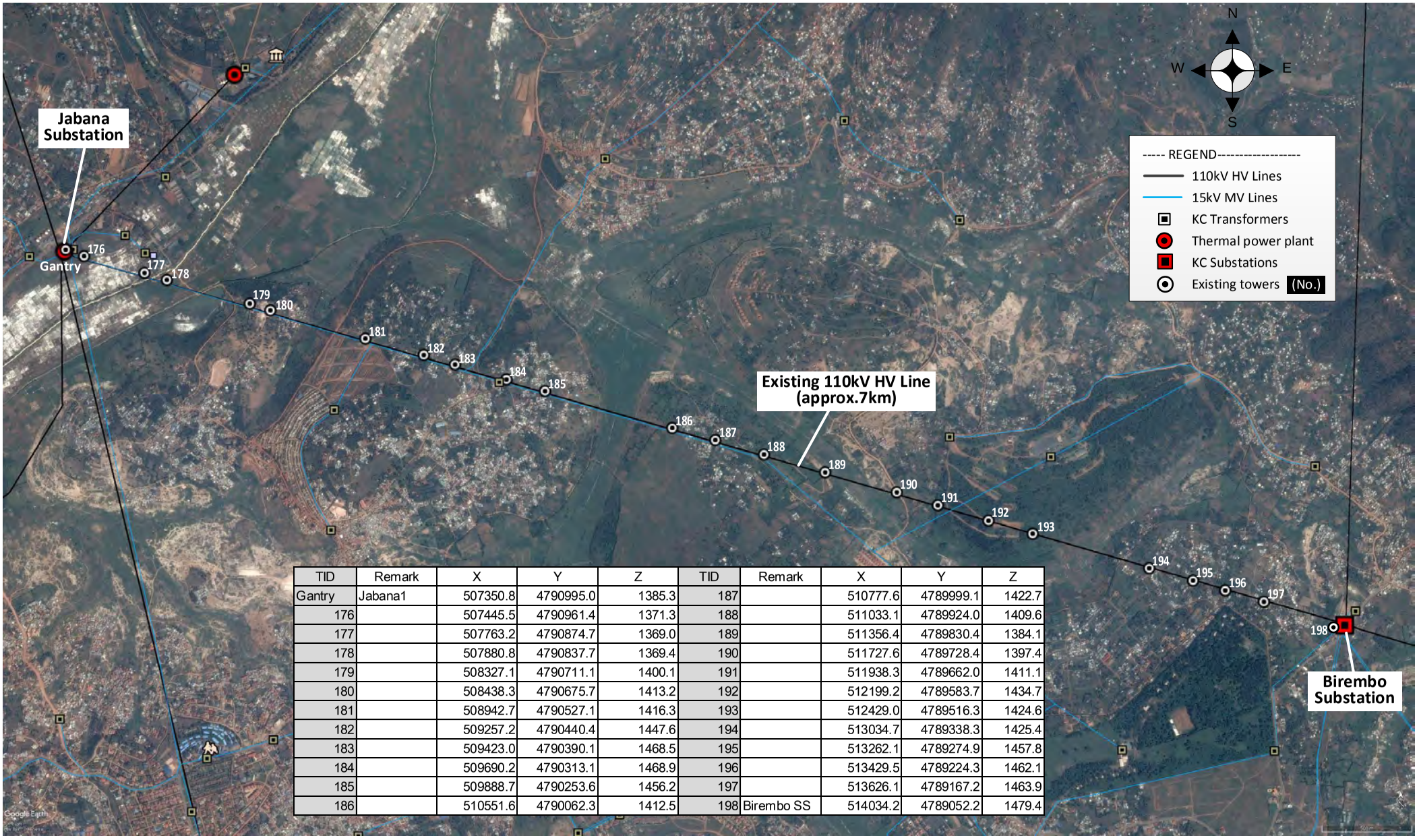
CS Tower, 5-20-8, Asakusabashi, Taito-ku, Tokyo, 111-8648, Japan

Attachment1: Preliminary Design for New Gasogi Substation



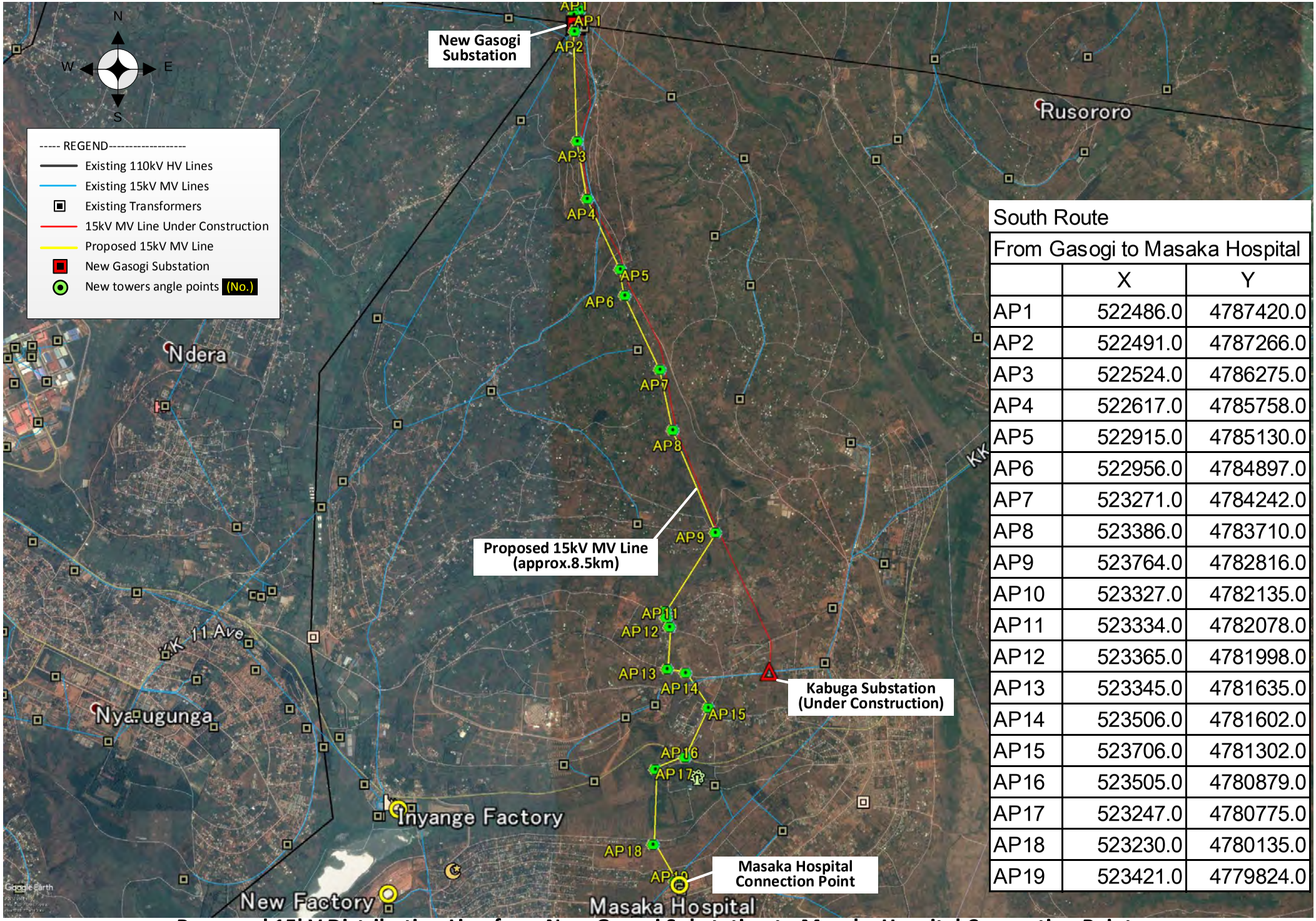
Coordinates of the Fence and Towers

Point	East	North
1	188713.30	9787265.98
2	188792.48	9787277.78
3	188807.21	9787178.87
4	188750.97	9787159.00
5	188729.71	9787155.79
Existing Tower 227	188732.74	9787146.73



TID	Remark	X	Y	Z	TID	Remark	X	Y	Z
Gantry	Jabana1	507350.8	4790995.0	1385.3	187		510777.6	4789999.1	1422.7
176		507445.5	4790961.4	1371.3	188		511033.1	4789924.0	1409.6
177		507763.2	4790874.7	1369.0	189		511356.4	4789830.4	1384.1
178		507880.8	4790837.7	1369.4	190		511727.6	4789728.4	1397.4
179		508327.1	4790711.1	1400.1	191		511938.3	4789662.0	1411.1
180		508438.3	4790675.7	1413.2	192		512199.2	4789583.7	1434.7
181		508942.7	4790527.1	1416.3	193		512429.0	4789516.3	1424.6
182		509257.2	4790440.4	1447.6	194		513034.7	4789338.3	1425.4
183		509423.0	4790390.1	1468.5	195		513262.1	4789274.9	1457.8
184		509690.2	4790313.1	1468.9	196		513429.5	4789224.3	1462.1
185		509888.7	4790253.6	1456.2	197		513626.1	4789167.2	1463.9
186		510551.6	4790062.3	1412.5	198	Birembo SS	514034.2	4789052.2	1479.4

Existing 110kV Transmission Line from Jabana to Birembo Substation

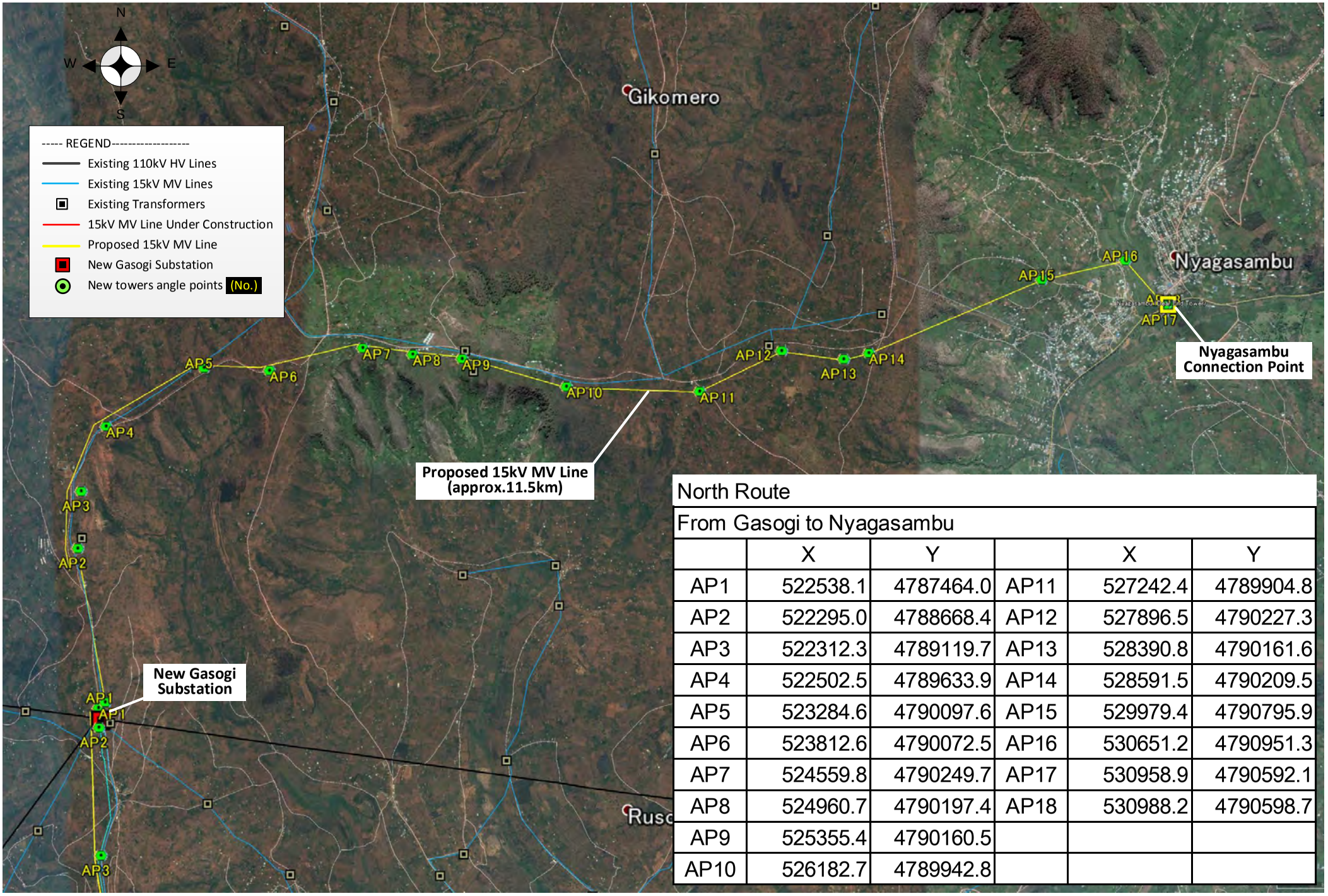


South Route

From Gasogi to Masaka Hospital		
	X	Y
AP1	522486.0	4787420.0
AP2	522491.0	4787266.0
AP3	522524.0	4786275.0
AP4	522617.0	4785758.0
AP5	522915.0	4785130.0
AP6	522956.0	4784897.0
AP7	523271.0	4784242.0
AP8	523386.0	4783710.0
AP9	523764.0	4782816.0
AP10	523327.0	4782135.0
AP11	523334.0	4782078.0
AP12	523365.0	4781998.0
AP13	523345.0	4781635.0
AP14	523506.0	4781602.0
AP15	523706.0	4781302.0
AP16	523505.0	4780879.0
AP17	523247.0	4780775.0
AP18	523230.0	4780135.0
AP19	523421.0	4779824.0

A13-4

Proposed 15kV Distribution Line from New Gasogi Substation to Masaka Hospital Connection Point



North Route

From Gasogi to Nyagasambu

	X	Y		X	Y
AP1	522538.1	4787464.0	AP11	527242.4	4789904.8
AP2	522295.0	4788668.4	AP12	527896.5	4790227.3
AP3	522312.3	4789119.7	AP13	528390.8	4790161.6
AP4	522502.5	4789633.9	AP14	528591.5	4790209.5
AP5	523284.6	4790097.6	AP15	529979.4	4790795.9
AP6	523812.6	4790072.5	AP16	530651.2	4790951.3
AP7	524559.8	4790249.7	AP17	530958.9	4790592.1
AP8	524960.7	4790197.4	AP18	530988.2	4790598.7
AP9	525355.4	4790160.5			
AP10	526182.7	4789942.8			

A13-5

Proposed 15kV Distribution Line from New Gasogi Substation to Nyagasambu Connection Point

EDCL
ENERGY DEVELOPMENT CORPORATION LIMITED

Kigali.....19 JUN 2017
N° 11.07.023/4990./17/MD-EDCL/EK/fk

The Lord Mayor
Kigali City,
P.O. Box 3527 Kigali – Rwanda,
E-mail: info@kigalicity.gov.rw.

Dear Sir,

RE: Request for confirmation of Substation location and Distribution Line Routes

Reference is made to the application of Grant Aid from Japan through JICA to finance the project of **"Improvement of Substations and Distribution Network Phase-3** presented by Rwanda Ministry of Foreign Affairs and Cooperation in 2016.

Reference is also made to the ongoing Preparatory Survey on which field work, design layout plan of New Gasogi Substation and Distribution line routes under JICA-III component have been identified in considering the Environmental, Social and Cost impacts minimization.

The purpose of this letter therefore, is to request your good office for confirmation the proposed location of new Substation and Distribution line routes to avoid any future interference with the City Master Plan before proceed with other development stages of the project.

An earliest response to our request will be very helpful to us towards finalizing the preparatory survey report and designs of the project components.

Yours Sincerely,

EDCL ENERGY DEVELOPMENT CORPORATION LTD

for **Emmanuel KAMANZI**
Managing Director

RECEIVED
KIGALI CITY
CONSTRUCTION
ONE STOP CENTER

Cc:

- Hon. Minister of Infrastructure
- Hon. State Minister in Charge of water and Energy
- Permanent Secretary/MININFRA
- Ag. Director General/REMA
- Chief Executive Officer/REG
- Managing Director/EUCL

KIGALI

10th Floor KCT, KN 2 ST, Nyarugenge District, P.O. Box 3855 Kigali, Rwanda
Tel.: + (250) (0) 787172265, email: info@edcl.reg.rw, website: www.edcl.reg.rw

14. Abbreviated Resettlement Action Plan

Draft Report

Abbreviated Resettlement Action Plan (ARAP)
For

The Preparatory survey on Improvement of substations and distribution network phase 3

Project Proponent:

RWANDA ENERGY GROUP Ltd
ENERGY DEVELOPMENT CORPORATION LIMITED (EDCL)
KN82 ST 3, Nyarugenge District, Kigali City,
P O Box 537 Kigali, RWANDA.

Submitted to:

RWANDA DEVELOPMENT BOARD (RDB)
Investment Implementation Division
Kigali, RWANDA.

Consultant:

Eco-Excellence Consultancy Ltd
Po Box 3418 Kigali, RWANDA
Office: Ubumwe House, Kimihurura
Phone: +250788356191
Email: mapetule1@gmail.com

October 2017

Contents

List of Tables

List of Figures

ACRONYMS

ARAP	Abbreviated Resettlement Action Plan
EDCL	Energy Development Corporation Limited
EDPRS:	Economic Development and Poverty Reduction Strategy
EUCL	Energy Utility Corporation Limited
ESS:	Environment and Social Safeguards
HIV:	Human Immune Deficiency Virus
JICA:	Japan International Cooperation Agency
PAPs:	Project Affected Persons
RAP:	Resettlement Action Plan
REMA:	Rwanda Environment Management Authority
RMU:	Ring Main Unit
RoW:	Right of Way
RPF:	Resettlement Policy Framework
Rwf:	Rwandan Franc
ToR:	Terms of Reference

EXECUTIVE SUMMARY

INTRODUCTION

The Government of Rwanda (GoR), in its effort to sustain economic growth, has increased and stabilized the power production and distribution, hence reducing power shortages. GoR also exercises a strong leadership role in donor coordination and has begun to work with donors on a clearer division of labour by identifying areas of individual donor comparative advantage. In connection with the mentioned strategy, the Government of Rwanda through Energy Development Corporation Limited (EDCL) has embarked on a country-wide electricity distribution to realize the primary EDPRS target.
In response to the request from the GoR, Japan International Cooperation Agency (JICA), in consultation with the Government of Japan, decided to **conduct a Preparatory survey on the project for improvement of Substations and Distribution Network Phase 3**.

In order for JICA to meet its internal standards requirements and as a risk management approach, it applies the JICA Guidelines for environmental and social considerations and World Bank safeguard policies, specifically OP 4.12 "Involuntary resettlement" and OP 4.01 "Environmental assessment", for projects that are likely to have an environmental and social impact.
In this regard an Abbreviated Resettlement Action Plan (ARAP) has been prepared to ensure that the procedure for expropriation and resettlement is undertaken in accordance with the above social safeguards.

THE PROJECT

The project for "improvement of substation and Distribution network phase 3" will comprise of the following components traversing the areas mentioned in the table below:

No.	Components	Distance covered	District	Sector	Cells	Village
1	New Gasogi substation	8,912m² (111.4m x 80m)	Gasabo	Ndera	Kibenga	Burunga
2	Single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point. (South Distribution line)	Approximately 8.5km	Gasabo	Ndera	Kibenga	Burunga
					Cyaruzinge	Gashure
						Gatare
					Rudashya	Ruhangare
						Munini
						Kacyinyaga
				Rusororo	Nyagahinga	Gisharara
						Kabutare
			Kicukiro	Masaka	Cyimo	Kiyovu
						Murambi
3	Single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point (North Distribution line)	Approximately 11.5km	Gasabo	Ndera	Kibenga	Burunga
					Mukuyu	Jurwe
				Gikomero	Murambi	Rugarama
					Munini	Rudakabukirwa
				Rusororo	Mbandazi	Karambo
					Kinyana	Nyagasozi
						Kigabiro

			Rwamagana	Fumbwe	Nyakagunga	Kirehe
						Akabeza
					Nyagasambu	Rambura
4	Single circuit 110Kv transmission line (TL) between Jabana and Birembo substations	Approximately 7km	Kicukiro	Jabana	Kabuye	Kabeza
			Gasabo	Kinyinya	Kagugu	Giheka
						Kagarama
						Dusenyi
					Murama	Ngaruyinka
					Gasharu	Kami
						Agatare

The acquisition of land for these elements will result in physical and / or economic resettlement of households. As such this Abbreviated Resettlement Action Plan (ARAP) has been prepared in line with national law, JICA Environmental and Social considerations 2010 and World Bank OP 4.12.

ARAP METHODOLOGY

The concept for the project to "improve the substation and distribution network phase 3" was comprehended to include; the project objectives, activities and boundaries of the area of intervention.

- Based on the identified project boundaries, the affected people were informed of the project, its objectives, activities, boundaries and the extent of their property that will be lost to the project. This was done through a stakeholder engagement process during the period of 3rd- 21st July and again 9th October – 3rd November 2017.
- An asset inventory and valuation for property and/or assets likely to be lost was prepared and completed for the North and south distribution line routes in the period of 9th October- 3rd November 2017.
- An announcement was sent out through Public notice at the respective local Sectors and Cells and by radio communication of the dates on which the outcome of the asset inventory and valuation would be disclosed to the PAPs for verification and agreement. Dates set were from the 30th October- 3rd November 2017. The completed asset inventory was shared with the Project Affected People (PAP) and verified. The Cut-off date was established on the 3rd November 2017. From the date of agreement no additional developments (e.g. new structures, trees etc) would added to the agreed compensation. This process identified and documented the people eligible for compensation at full replacement value for losses due to the Project and prevents ineligible people from claiming compensation after the asset inventory exercise has been completed.
- The asset inventory and property valuation report was shared with the respective Sector levels and District authorities for approval before it was submitted to EDCL to begin the preparation process of compensation.
- A Socio-economic survey of Project Affected Households (PAH) was undertaken along with the asset inventory to save time. Its purpose was to understand number of PAPs and their current livelihoods before the loss of property and land.
- An ARAP and/ or LRP was prepared informed by the survey, asset inventory and property valuation. It was then disclosed to PAPs to ensure all their concerns were covered and any missed out captured in this disclosure. Public disclosure through the national newspaper will be done.
- Once the ARAP is approved then its implementation by EDCL will follow. The approved Asset inventory and valuation report is reviewed by EDCL, once approved, then through its finance

department, it is submitted to the Ministry of Finance and Economic Planning (MINECOFIN). MINECOFIN would then effect compensation payment to the account numbers of the PAP for property lost to the project based on recommendations of the ARAP. This shall be done with a period not exceeding 120 days from the cut-off date.

- During the compensation period, any grievances shall be handled by the existing grievance mechanism local structure but in attendance of EDCL and members of the consultant's team (where required).
- Monitoring and evaluation of the ARAP shall be undertaken alongside implementation of the plans to monitor their successes and deviations.

Monitoring Framework

The monitoring plan shall comprise of three components:

- Performance monitoring; an internal management function allowing measurement of physical progress against milestones.
- Impact monitoring: to gauge the effectiveness of the ARAP and its implementation in meeting the needs of the affected people.
- Completion audit: to determine whether the measures outlined in this ARAP (and the supporting LRP) have been successful.

SOCIO-ECONOMIC BASELINE SURVEY

The baseline aimed to survey 100% of the 114 PAH of the North distribution line and the New Gasogi substation areas (73 HH) and South (41HH) distribution line routes. However, 71 (97.26%) of PAH were surveyed along the North (New Gasogi- Nyagasambu) and 34 (82.93%) HH along the South (New Gasogi- Masaka) routes of the Distribution lines that were physically present or had representatives between October and November 2017 by the time of the study.

Regarding HH heads by age patterns, along the North route 97.26% (69 HH) are in the age range of 21-80 years, 1.56% (1 HH) of HH heads is above 80 years and therefore considered elderly and no HH headed by individuals who are less than 20 years. As for the South route, 85.37% (37 HH) are in the age range of 21-80 years, No HH heads is above 80 years or less than 20 years.

Along the North route, about 15% (11 of the Heads of HH) interviewed had no education level whatsoever, while over 79% (57 of the heads of HH) in the affected area have at least completed the primary level of education with 6.85% (5HH having attained tertiary education).
While along the South route, about 12% (5 of the Heads of HH) interviewed had no education level whatsoever, while 70.73% (29 of the heads of HH) in the affected area have at least completed the primary level of education with 19.51% (8HH having attained tertiary education). This indicates a substantial level of literacy within the affected area population, essential for PAH in understanding their entitlements and relevance of compliance to requirements for quick compensation.

In terms of employment status, along the North route, 61.64% of the PAH are farmers, 19.18% self-employed, 5.48% have salaried employment and 4.11% unemployed. While along the south route, 41.46% of the PAH are farmers, 31.71% self-employed, 7.32% have salaried employment and 2.44% unemployed.
Having such a high dependency on farming normally would have been an indication of the extent to which land acquisition might have an impact on the PAPs, however, since as a livelihood restoration initiative, it is proposed that land under the ROW of the power line can continue to be cultivated with an exception of planting trees and perennial crops that could interfere with power line, the project is not likely to have a negative impact as would have been if cultivation was not accepted.

It was also important to know how many HH heads owned accounts in financial institutions (Banks, Savings and Credit Cooperatives (SACCOs) especially since all compensation payments would be done by bank transfer.
Along the North route, 80.82% (59HH) own accounts, 15.07% (11HH) do not own any form of accounts, while the South route, 80.49% (33HH) own accounts, 2.44% (1HH) do not own any form of accounts.
During the survey and asset inventory, those PAH who were found not own accounts were informed that compensation would only be done by bank/ financial institution transfer to account and therefore essential to own one

RESETTLEMENT IMPACTS

The magnitude of displacement associated with the Project, as determined by the asset inventory is outlined in the table below.

Magnitude of Displacement Caused by Land Acquisition

Displacement	Impact	Unit	Magnitude of Displacement					Total
			Gasabo			Kicukiro	Rwamagana	
			Ndera	Gikomero	Rusororo	Masaka	Fumbwe	
North route (New Gasogi- Nyagasambu Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	10	3	1	0	0	**14**
		PAP	44	12	1	0	0	**57**
Loss of Agricultural Land	Economic Displacement	PAH	22	9	11	0	3	**45**
		PAP	32	27	31	0	12	**102**
Loss of Crops/ Trees		PAH	13	7	28	0	2	**50**
		PAP	30	23	52	0	12	**117**
Land owned by district			0	0	1	0	4	**5**
South route (New Gasogi- Masaka Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	2	0	0	0	0	**2**
		PAP	6	0	0	0	0	**6**
Loss of Agricultural Land	Economic Displacement	PAH	20	0	6	1	0	**26**
		PAP	70	0	15	5	0	**90**
Loss of Crops/ Trees		PAH	23	0	5	1	0	**28**
		PAP	79	0	11	5	0	**95**
Land owned by district			1	0	0	0	0	**1**

The main impacts as a result of the Project are:

- Loss of houses resulting in physical displacement and loss of shelter.
- Loss of agricultural land resulting in loss of livelihoods as there is no land for crops and livestock the main sources of income.
- Loss of crops and trees resulting in loss of livelihoods and potential for food insecurity.
- Loss of waged employment for laborers on agricultural land although this is recognized to be minimal.

ELIGIBILITY AND ENTITLEMENTS

Based on the impacts outlined above an eligibility and entitlements matrix was developed which is summarized below.

Summary Eligibility and Entitlements Matrix

Type of Loss	Eligible Groups	Entitlements
Houses	Owner of the Structure	• Cash compensation through PAPs accounts in financial institutions at full replacement cost for entire structure and other fixed assets without depreciation and addition 5% disruption fee as by expropriation law. And • The right to salvage materials from the displaced house.
Other Structures (kraals, livestock sheds, stores etc)	Owner of the Structure	• Cash compensation through PAPs accounts in financial institutions at full replacement cost. • The right to salvage materials from the displaced house.
Land	Land Owner	• Cash compensation at current market value (including all transaction fees) for affected land plus an additional 5% disruption fee. Payment through PAPs accounts in financial institutions • Priority for employment opportunities associated with the construction and erection of the New Gasogi Substation and towers. • Awareness training on saving and access to credit schemes so as to manage acquired cash compensation.
Seasonal Crops	Crop Owners	• Seasonal crops may continue to be planted under the ROW even after erection of towers as long as they do not grow tall to interfere with the power lines.
Perennial Crops	Crop Owners	• Cash compensation based on prices of such crops based on the age, size, area coverage and type of crop. Compensation will be paid: o For owners of the land with lease land titles- payment will be made directly to their own accounts. o For users of the land not owning the land: compensation payment will be made against the land owner but only released to the land owner on written agreement authenticated by local authority that he/she shall compensate the actual crop/tree owner or proof he has already compensated them.
Trees	Tree Owner	• Cash compensation at replacement value based on type, age and productive value of affected trees. Compensation will be paid as

		follows: o For owners of the land: cash compensation to be paid directly into their accounts. o For users of the land: cash compensation will be made against the land owner but only released to the land owner on written agreement authenticated by local authority that he/she shall compensate the actual crop/ tree owner or proof he has already compensated them.
Waged Employment (Day Labourers & Traders)	Employees	• Employment opportunities during the construction of the New Gasogi Substation and erection of towers for labourers and skilled tradesmen. • Traders will move their 'businesses' to suitable areas.

LIVELIHOOD RESTORATION

The LRP is designed to have two stages, i.e. *short term measures* during the construction of the New Gasogi substation and erection of towers and *long term measures* to achieve a sustainable livelihood for PAH. It should be noted that these measures are in addition to providing all PAH with their cash compensation for lost assets.

Short Term Measures:

- *Wage Based Livelihood Restoration*: As a positive initiative in restoring the PAPs source of income probably lost from agricultural land or any other source, it is proposed that PAP are given priority to be employed as unskilled and skilled labour during the erection of the distribution and transmission lines and new substation. EDCL shall inspect the contractor to ensure PAPs are given first priority at the time of construction.
- *Ongoing Cultivation of Expropriate Land*: PAH can continue to cultivate land under the ROW with seasonal crops but not perennial crops that could interfere with the power line.

Long Term Livelihood Restoration Measures:

- *Wage Based Livelihood Restoration*: EUCL will require skilled and unskilled people to work during the maintenance of the erected towers, the new substation and mostly clearing ROW of trees, bushes and access roads to the towers. It is proposed that PAPs are given priority for paid temporary employment for both skilled and unskilled roles.
- *Ongoing Cultivation of Expropriate Land*: PAH can continue to cultivate land under the ROW with seasonal crops but not perennial crops that could interfere with the power line.

COST AND BUDGET

The total cost of compensation and estimated budget for resettlement and livelihood restoration implementation is shown below. This includes the cost of compensation and implementation of the ARAP including livelihood restoration and monitoring and evaluation activities.

No	Item	Cost (Rwf)
1	Compensation budget	141,271,129.2
2	ARAP & LRP Implementation budget	14,827,113
	Total	**156,098,242.2**

CHAPTER 1: INTRODUCTION

3.1. PROJECT BACKGROUND

The Government of Rwanda (GoR), in its effort to sustain economic growth, has increased and stabilized the power production and distribution, hence reducing power shortages. GoR also exercises a strong leadership role in donor coordination and has begun to work with donors on a clearer division of labour by identifying areas of individual donor comparative advantage. In connection with the mentioned strategy, the Government of Rwanda through Energy Development Corporation Limited (EDCL) has embarked on a country-wide electricity distribution to realize the primary EDPRS target.
A number of development partners so far committed to support the program including; World Bank IDA, World Bank, African Development Bank, BADEA, OFID, Saudi Funds, Netherlands, Japan, and others.
In response to the request from the GoR, Japan International Cooperation Agency (JICA), in consultation with the Government of Japan, decided to conduct a Preparatory survey on the project for improvement of Substations and Distribution Network Phase 3.

In order for JICA to meet its internal standards requirements and as a risk management approach, it applies the JICA Guidelines for environmental and social considerations and World Bank safeguard policies, specifically OP 4.12 "Involuntary resettlement" and OP 4.01 "Environmental assessment", for projects that are likely to have an environmental and social impact.
In this regard an Abbreviated Resettlement Action Plan (ARAP) has been prepared to ensure that the procedure for expropriation and resettlement is undertaken in accordance with the above social safeguards.

3.2. OVERVIEW OF THE PROJECT

The main objective of this project is to increase access to electricity in Kigali and parts of Rwamagana District by:

- Constructing a new substation at Gasogi.
- Constructing a single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point.
- Constructing a single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point.
- Reinforcement of the single circuit 110Kv transmission line (TL) between Jabana and Birembo substations.

The project will include the administrative districts indicated in Table 1 below:

Table 1: Project Location Overview

No.	Components	Distance covered	District	Sector	Cells	Village
1	New Gasogi substation	8,912m² (111.4m x 80m)	Gasabo	Ndera	Kibenga	Burunga
2	Single circuit 15kV distribution lines (DL) from the New Gasogi substation	Approximately 8.5km	Gasabo	Ndera	Kibenga	Burunga
					Cyaruzinge	Gashure
						Gatare
					Rudashya	Ruhangare

	to Masaka connection point. (South Distribution line)					Munini
						Kacyinyaga
				Rusororo	Nyagahinga	Gisharara
						Kabutare
			Kicukiro	Masaka	Cyimo	Kiyovu
						Murambi
3	Single circuit 15kV distribution lines from the New Gasogi substation to Nyagasambu connection point (North Distribution line)	Approximately 11.5km	Gasabo	Ndera	Kibenga	Burunga
					Mukuyu	Jurwe
				Gikomero	Murambi	Rugarama
					Munini	Rudakabukirwa
				Rusororo	Mbandazi	Karambo
					Kinyana	Nyagasozi
						Kigabiro
			Rwamagana	Fumbwe	Nyakagunga	Kirehe
						Akabeza
					Nyagasambu	Rambura
4	Single circuit 110Kv transmission line (TL) between Jabana and Birembo substations	Approximately 7km	Kicukiro	Jabana	Kabuye	Kabeza
			Gasabo	Kinyinya	Kagugu	Giheka
						Kagarama
						Dusenyi
					Murama	Ngaruyinka
					Gasharu	Kami
						Agatare

3.3. PROJECT COMPONENTS REQUIRING LAND ACQUISITION AND RESETTLEMENT

This project requires expropriation of the following:

- 8,912m^2 for the New Gasogi substation.
- Area coverage at positions of towers along the 8.5km Right of Way (ROW) corridor for the Single circuit 15kV distribution lines (DL) from the New Gasogi substation to Masaka connection point. (South Distribution line).
- Area coverage at positions of towers along the 11.5km Right of Way (ROW) corridor for the Single circuit 15kV distribution lines (DL) from the New Gasogi substation to Nyagasambu connection point (North Distribution line).
- Area coverage at positions of towers along the 7km Right of Way (ROW) corridor for the 110Kv transmission line (TL) between Jabana and Birembo substations.

This project involves both physical and economic displacement of households, land, crops and trees as shown in Table 2. Physical displacement involves the loss of shelter and assets due to land acquisition for the Distribution and transmission network, while economic displacement involves the loss of means of livelihood from land acquisition i.e. the loss of agricultural land on which crops and trees are cultivated.

Table 2: Magnitude of Displacement Caused by Land Acquisition

Displacement	Impact	Unit	Magnitude of Displacement					Total
			Gasabo			Kicukiro	Rwamagana	
			Ndera	Gikomero	Rusororo	Masaka	Fumbwe	
North route (New Gasogi- Nyagasambu Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	10	3	1	0	0	**14**
		PAP	44	12	1	0	0	**57**
Loss of Agricultural Land	Economic Displacement	PAH	22	9	11	0	3	**45**
		PAP	32	27	31	0	12	**102**
Loss of Crops/ Trees		PAH	13	7	28	0	2	**50**
		PAP	30	23	52	0	12	**117**
Land owned by district			0	0	1	0	4	**5**
South route (New Gasogi- Masaka Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	2	0	0	0	0	**2**
		PAP	6	0	0	0	0	**6**
Loss of Agricultural Land	Economic Displacement	PAH	20	0	6	1	0	**26**
		PAP	70	0	15	5	0	**90**
Loss of Crops/ Trees		PAH	23	0	5	1	0	**28**
		PAP	79	0	11	5	0	**95**
Land owned by district			1	0	0	0	0	**1**

3.4. METHODOLOGY OF THE LAND ACQUISITION PROCESS AND ARAP

- The concept for the project to "improve the substation and distribution network phase 3" was comprehended to include; the project objectives, activities and boundaries of the area of intervention.
- Based on the identified project boundaries, the affected people were informed of the project, its objectives, activities, boundaries and the extent of their property that will be lost to the project. This was done through a stakeholder engagement process during the period of 3rd- 21st July and again 9th October – 3rd November 2017.
- An asset inventory and valuation for property and/or assets likely to be lost was prepared and completed for the North and south distribution line routes in the period of 9th October- 3rd November 2017.
- An announcement was sent out through Public notice at the respective local Sectors and Cells and by radio communication of the dates on which the outcome of the asset inventory and valuation would be disclosed to the PAPs for verification and agreement. Dates set were from the 30th October- 3rd November 2017. The completed asset inventory was shared with the Project Affected People (PAP)

and verified. The Cut-off date was established on the 3rd November 2017. From the date of agreement no additional developments (e.g. new structures, trees etc) would added to the agreed compensation. This process identified and documented the people eligible for compensation at full replacement value for losses due to the Project and prevents ineligible people from claiming compensation after the asset inventory exercise has been completed.

- The asset inventory and property valuation report was shared with the respective Sector levels and District authorities for approval before it was submitted to EDCL to begin the preparation process of compensation.
- A Socio-economic survey of Project Affected Households (PAH) was undertaken along with the asset inventory to save time. Its purpose was to understand number of PAPs and their current livelihoods before the loss of property and land.
- An ARAP and/ or LRP was prepared informed by the survey, asset inventory and property valuation. It was then disclosed to PAPs to ensure all their concerns were covered and any missed out captured in this disclosure. Public disclosure through the national newspaper will be done.
- Once the ARAP was approved then its implementation by EDCL would follow. The approved Asset inventory and valuation report was reviewed by EDCL, once approved then through its finance department submitted to the Ministry of Finance and Economic Planning (MINECOFIN). MINECOFIN would then effect compensation payment to the account numbers of the PAP for property lost to the project based on recommendations of the ARAP. This shall be done with a period not exceeding 120 days from the cut-off date.
- During the compensation period, any grievances shall be handled by the existing grievance mechanism local structure but in attendance of EDCL and members of the consultant's team (where required).
- Monitoring and evaluation of the ARAP shall be undertaken alongside implementation of the plans to monitor their successes and deviations.

Some activities mentioned above and undertaken during preparation of the ARAP are discussed in a further detail below.

Public consultation/ Stakeholders engagement

One-on-one key informant interviews, cell and village-level discussions and Focis Group Discussions (FGDs) were undertaken to understand the extent of potential resettlement-related impacts of the Project's land acquisition process, as well as other relevant issues. The outcomes of these consultations were used to define the scope and strategy for the next stage of data collection. During the FGDs. Details of the public consultation meetings are discussed in *Chapter 13*. In each cell, the FGDs were held with: (i) local Government leaders; and (ii) the PAPs.

Asset Inventory and Property Valuation

This exercise required full support of local Government officials (i.e. district, sector, cell and village leaders) as well as land managers at district and sector levels. It also required mutual agreement of the PAPs in determining favorable compensation prices and also to ensure that the process of asset inventory and valuation is done smoothly without causing distress and insecurity in the areas of the proposed power line. Under the expropriation law, article 25 states that valuation of land and property shall be conducted in the presence of local administrative entities.
The inventory and valuation was done by a certified real property valuer as stipulated in the National expropriation law 2015.

PAPs were categorized in the following manner:

- ***House owners*** - these are the households (HHs) who were losing their houses to expropriation. Resettlement of houses shall occur for those right under the Right of Way (ROW) for the Distribution lines (DL) and for structures only at a minimum 5m vertical clearance from the lowest conductor for the Jabana- Birembo transmission line (TL)
- ***Land owners*** - these were household (HH) land owners of the portion the towers shall be erected and any remaining land deemed non-economical by virtue of the ROW. These HH included only those with legal land ownership documents.
- ***Crop and tree owners*** - these were HHs with perennial crops and trees with in the ROW likely to grow and interfere with the power line. Valuation was for annual crops since seasonal crops may be harvested prior to the land being taken. For land users (tenants not owning the land), compensation was written against the land owner. Compensation would be directed to the land owner and not the crop owner because payment is done by MINECOFIN, which only makes payments against land on which the crops exist. However, compensation would only be released to the land owner on written agreement with the local authority that he/she will compensate the actual crop/ tree owner. Records of land users (and associated owners) will be kept by the District so that these payments can be tracked to ensure all PAP receive due compensation. In the event of none payment of compensation to land users by land owners, land users will be able to raise grievances with the District.

In a number of cases, PAH overlapped in each of these categories. For example, a HH with a house, crops and trees on their land.

The detailed asset inventory and property valuation report links property to: individual owners with single identification IDs, their land plot numbers, phone numbers and financial institution account numbers.

Additional Stakeholder Engagement

Additional stakeholder engagement was undertaken with PAP to explain in greater detail the ARAP Process, activities they could undertake and to gather their feedback on the ARAP and its implementation. To save time Stakeholder engagement was done for both the ARAP and the ESIA. This is discussed in greater detail in Chapter 13.

CHAPTER 2: RESETTLMENT AS A RESULT OF THE PROJECT

JICA guidelines for environmental and social considerations 2010 and World Bank (WB) involuntary resettlement OP 4.12 requires that any acquisition of land that results in physical and / or economic displacement and resettlement of people should be avoided where possible. However, where such displacement and resettlement is unavoidable – that is – where alternative suitable project sites are not available or the cost of developing those sites is prohibitive – adverse resettlement impacts on affected individuals and communities should be minimized to the extent possible through sensitive project design, adjustments in the routing or siting of project facilities etc.

This section provides an overview of the Project that will result in displacement and resettlement, and how this displacement and resettlement is being minimized. Specifically, this section seeks to:

- Provide a brief Project description;
- Describe the scale and nature of the resettlement associated with the Project; and
- Outline alternatives considered during Project design to minimize resettlement.

2.1. *PROJECT* DESCRIPTION

The components of the proposed project comprised of:

Table 3 Project components

	Components	Description
1	Procurement of installation work	
	1.1 New Gasogi substation a) 110 kV/ 15 kV transformer b) 110Kv switch gear c) 15Kv switch gear d) Control and supervisory facilities	15MVA x 2 units 1 set 1 set 1 set
	1.2 Distribution line a) 15 kV distribution line (Single circuit) from New Gasogi substation to Masaka connection point b) 15 kV distribution line (Single circuit) from New Gasogi substation to Nyagasambu connection point	Approx. 8.5km Approx. 11.5km
	1.3 Reinforcement of Transmission line between Birembo and Jabana Substations 1) 110 kV transmission line (Single circuit) from Birembo and Jabana Substation	Approx. 7.0km
2	Procurement Work	
	2.1 Maintenance tools for the equipment to be procured	1 lot

	2.2 Spare parts for the equipment to be procured	1 lot
3	Construction work	
	3.1 Installation of Gantries, Towers, etc. 3.2 Construction of Control building of New Gasogi Substation 3.3 Civil works	1 lot 1 lot 1 building

The scope of the EIA study is limited to only section 1.1, 1.2 and 1.3.

A site layout of the proposed new Gasogi substation is shown below;

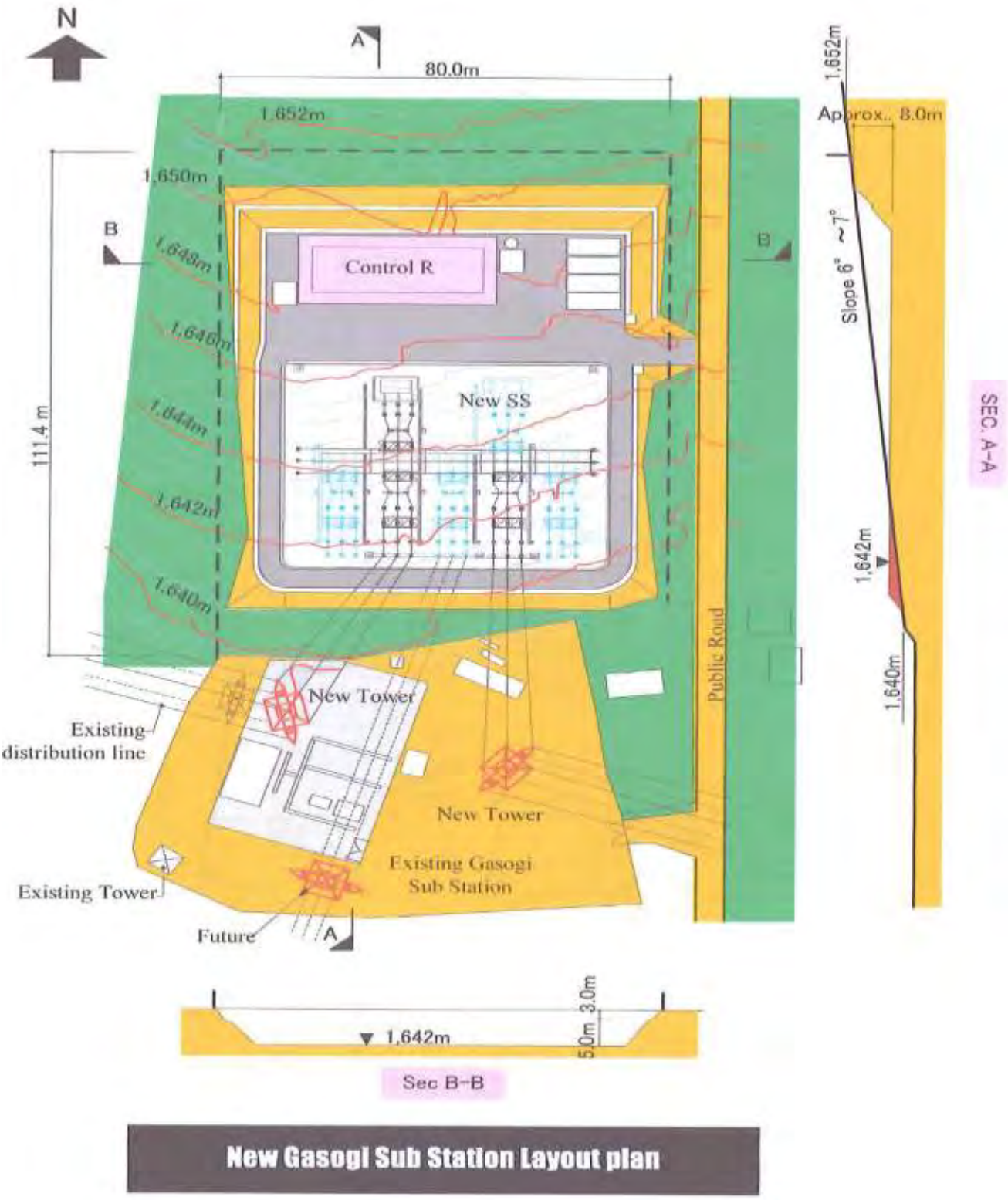
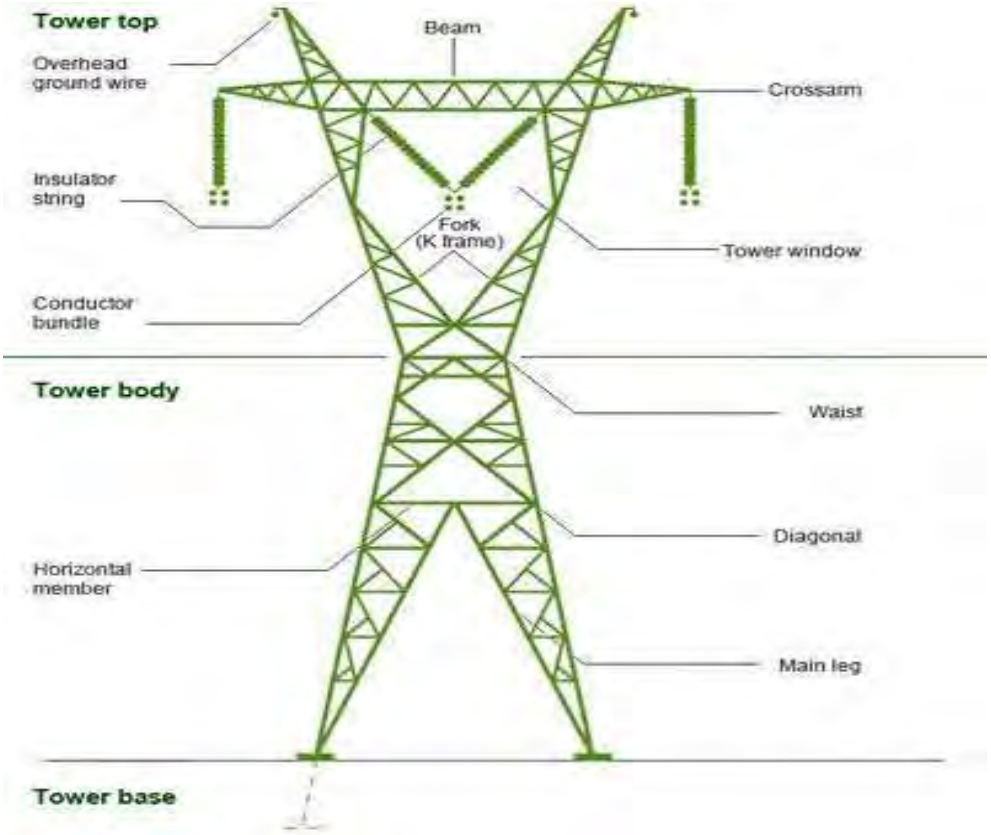


Figure 1 New Gasogi substation site layout plan

The project shall also involve tower erection and conductors for the distribution and transmission lines. An example of a tower type is shown in the figure below.



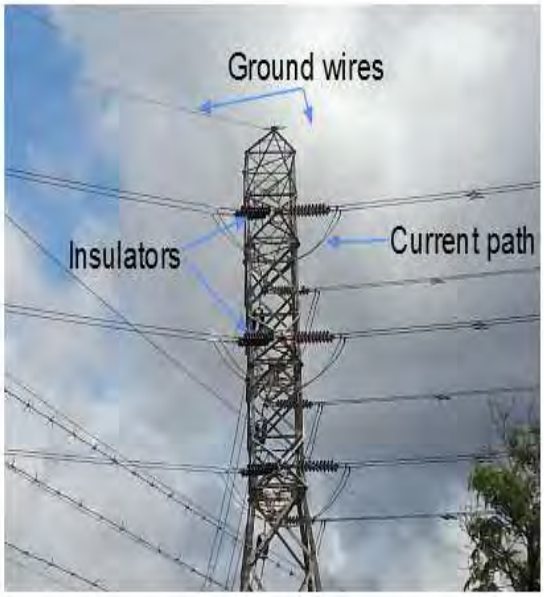


Figure 2 components of a tower

The project covered three (3) districts; Gasabo, Kicukiro and Rwamagana districts. Line of route of the distribution and power lines demarcated by the connecting Angle points are indicated by the following maps.

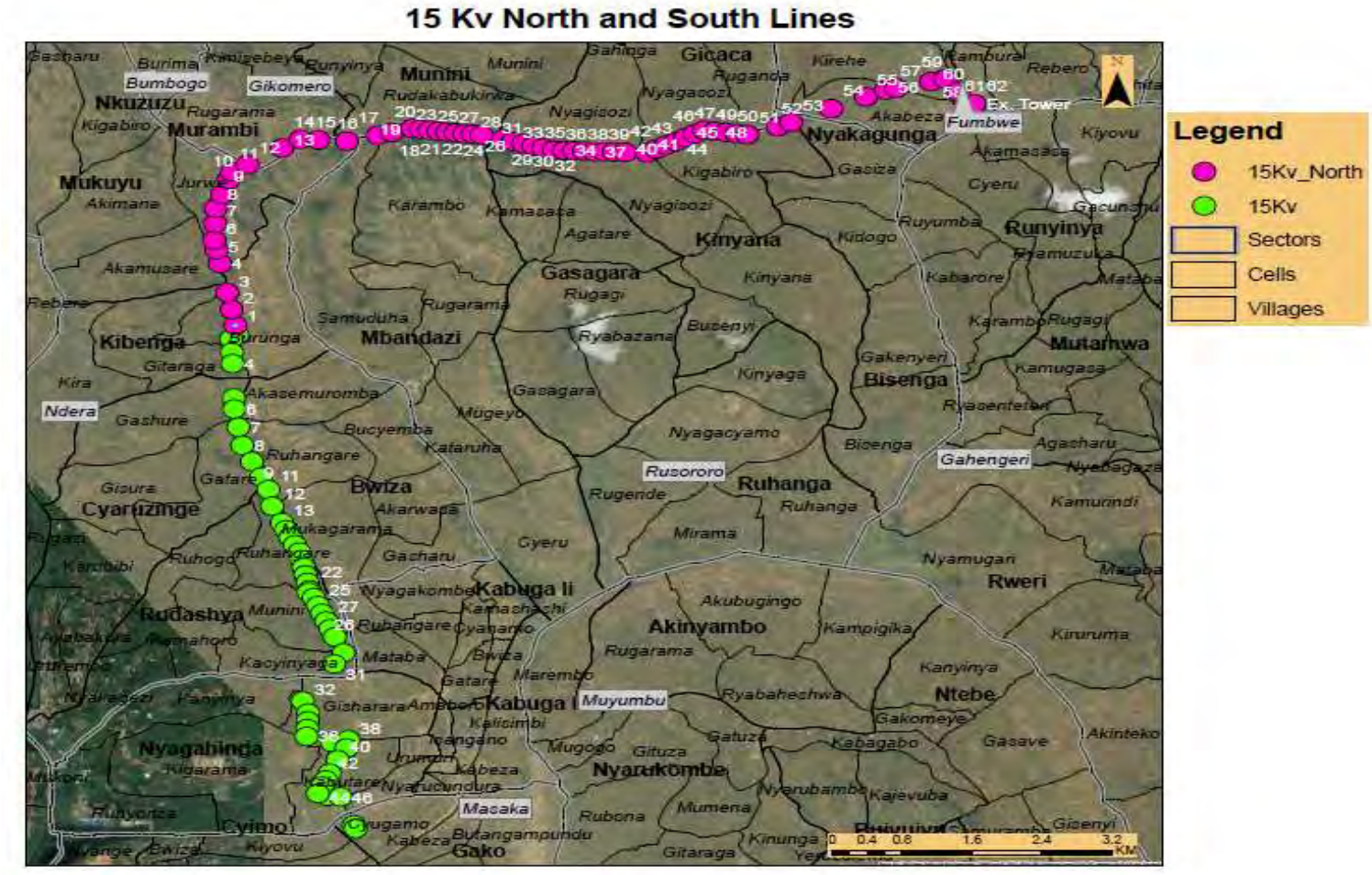


Figure 3 Distribution line from New Gasogi Substation to Nyagasambu (North route) and New Gasogi substation to Masaka Hospital connection point (South route)

Figure 4 Existing 110kV Transmission line from Jabana- Birembo substation

2.2. PROJECT INDUCED RESETTLEMENT

In order to establish a new Gasogi Substation, distribute power to Nyagasambu and Masaka connection points and rehabilitate the Jabana- Birembo Transmission lines, land would be acquired from communities along the ROW of these lines, resulting in physical and economic displacement.
For the structures, only residential houses were lost, no community structures (i.e. churches, community halls), commercial businesses, schools, health centres or local administration offices were displaced during the land acquisition.

The Table below highlights the magnitude of the impact, from the asset inventory, caused by the land acquisition.

Table 4: Magnitude of Displacement Caused by Land Acquisition

Displacement	Impact	Unit	Magnitude of Displacement					Total
			Gasabo			Kicukiro	Rwamagana	
			Ndera	Gikomero	Rusororo	Masaka	Fumbwe	
North route (New Gasogi- Nyagasambu Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	10	3	1	0	0	**14**
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		PAP	30	23	52	0	12	**117**
Land owned by district			0	0	1	0	4	**5**
South route (New Gasogi- Masaka Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	2	0	0	0	0	**2**
		PAP	6	0	0	0	0	**6**
Loss of Agricultural Land	Economic Displacement	PAH	20	0	6	1	0	**26**
		PAP	70	0	15	5	0	**90**
Loss of Crops/ Trees		PAH	23	0	5	1	0	**28**
		PAP	79	0	11	5	0	**95**
Land owned by district			1	0	0	0	0	**1**

2.3. ANALYSIS OF ALTERNATIVES FOR MINIMISATION OF RESETTLEMENT

An analysis of alternative line routes was undertaken by the surveying and design team (PITRAD) through survey and mapping. At the end of this process, the lines of route chosen for this project were based on the following:

- New Gasogi substation.
- North route- 15kV Distribution line from New Gasogi substation to Nyagasambu existing Tower.
- South route- 15kV Distribution line from New Gasogi substation to Masaka existing Tower.
- Jabana- Birembo 110 kV Transmission line.

Alternative of New Gasogi susbstation

Possible alternatives for the location of the sites for the construction of the New Gasogi substation were considered. After analysis, the selected site was retained on grounds that it was adjacent to the existing Gasogi substation which would simplify any transfer of technical equipment or connections. It would also be easier and cheaper to expropriate the land adjacent to the existing substation compared to any other area.

Alternative of Routes of the Distribution lines

The chosen line of routes proposed were the shortest, with portions along the road reserves and would require less displacement of Households compared to other routes. The south route phase III was proposed along the phase II in order to benefit from the ROW of the phase II that way reducing the cost incurred in expropriation.

Alternative of routes of the Transmission line

Replacing the existing transmission line from Jabana- Birembo was the cheapest and most optimal choice to achieve the rehabilitation of the transmission line with less resettlement cost.

No Project Alternative

A No Project (Do nothing option) alternative if chosen, would primarily mean that the status quo will be maintained and in a sense any impacts (adverse) that come with the project will not occur. However the positive benefits will be forgone in terms of providing more access to electricity to the Kigali project intervention area population which would have in turn spurred and contributed to economic growth.

In particular if the "do nothing option" was considered, some benefits would be missed out such as:

- Increased electricity supply to, Ndera, Rusororo, Gikomero, Masaka and Fumbwe Sector areas.
- Increased electricity supply to Masaka Hospital.
- Businesses would not grow for lack of sufficient electricity, employment from these businesses and other related electricity dependent activities would not be realized.
- During the construction phase there would be no temporary employment opportunities for local contractors.

The "no project" alternative was there not considered as a viable option.

CHAPTER 3: LEGAL FRAMEWORK

The land law of 2013 determines modalities of how land in Rwanda can be allocated, acquired, transferred, used and managed. It also establishes principles applied to rights recognized over land tenure in Rwanda.

This chapter underlines aspects relevant to the ARAP from the National Constitution, land law, expropriation law and relevant National regulations. It also discusses JICA guidelines for E&S considerations 2010, WB safeguard policy OP 4.12 requirements for the resettlement process to be complete and finally reveals a gap analysis of both national and international policies, recommending strategies of how such gaps can be closed.

3.1. RELEVANT LEGISLATION AND POLICIES IN RWANDA APPLYING TO THE PROJECT

3.1.1. NATIONAL LAWS AND REGULATIONS

LAND LAW IN RWANDA

The Organic Law No.43/2013 of 16/06/2013 governing land in Rwanda determines modalities for allocating, acquisition, transfer, use and management of land in Rwanda. Under this law and relevant to this study are the definitions given to:

- **Land tenure** as the system by which land is held, describing the rights, responsibilities and restrictions that are attached to the land holder.
- **Expropriation**: an act of taking away an individuals' land by the State due to public interest in circumstances and procedures provided by law and subject to fair and prior compensation.

With reference to Article 4 of this law on equal right to land, it is stated that all forms of discrimination, such as that based on sex or origin, in relation to access to land and the enjoyment of real rights shall be prohibited. Every person who is in possession of land, acquired either in accordance with custom, or granted by a competent authority, or by purchase, is the recognized proprietor under an emphyteutic lease in accordance with the provisions of this law.

An emphyteutic lease is a long term lease of land from the Government by the title holder, in this case a period of 20 years, 49 years or 99 years, as stated in the land title lease document. Most of the land ownership documents are emphyteutic leases from the Government for a specific period and are renewable.

Any Rwandan citizen is entitled to be granted freehold title to land reserved for residential, industrial, commercial, social, cultural or scientific services. Freehold rights will apply only to developed land where infrastructure is erected and its extent will be strictly limited to the area of land that is necessary to support the authorized developments on the land and their amenity. Certifying that the land has been allocated or leased will be evidenced by a certificate of land registration issued by the registrar of land titles. The land owner will enjoy full rights to exploit his/her land in accordance with the provisions of this law and other laws.

The State recognizes the right to freely own land and will protect the land owner from being dispossessed of the land whether totally or partially, except in case of expropriation due to public interest. All buildings, crops and other works found on the land are achieved by the land owner using his/her own money or are otherwise are presumed to be his / hers. However, this does not prohibit another person from

owning buildings, crops and any other works on another person's land in accordance with procedures provided for by this law, other laws or in agreement with the land owner.

The Organic Land Law also provides two types of formal land tenure: full ownership/freehold and long term leasehold. Following the recent privatization of State owned lands, very few land users currently hold either type of land tenure. Therefore, the Organic Land Law recognizes existing rights, whether written or unwritten, under both civil law and customary practices through new national land tenure arrangements. Efforts were made under the Law (Article 7) to formalize land ownership, especially land acquired through customary means. For instance, rural populations with customary land rights have completed registration of their land through decentralized land institutions such as the District Land Bureau, Sector Land Committees and Cell Land Committees (Ministerial Order N° 001/2006 of 26/09/2006 Determining the Structure of Land Registers, the Responsibilities and the Functioning of the District Land Bureau).

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 Land law N0. 08/2005 of 14/07/2005, Article 6). The law also recognizes the private ownership of the land except the marshlands which are owned by the Government. In order to confirm this private ownership, the Government has completed registration of all lands and provided lease title to the owners. It is from the land titles that this study is able to understand category of land use for each Project Affected Person (PAP)/Displaced Person and also determine who the rightful land owner is, in the process of the asset inventory.

NATIONAL LAW ON EXPROPRIATION IN PUBLIC INTEREST

Based on Law No. 32/2015, relating to expropriation in the public interest, Article 3, only the Government will carry out expropriation, only in the public interest and with prior and just compensation. No person will hinder the implementation of the program of expropriation on the pretext of self- centred justifications. It also informs us that a person to be expropriated will be informed of the beginning of the process of the land survey and the inventory of the properties thereon.

Fair compensation will be determined through agreement between the expropriator and the person to be expropriated. The compensation may be monetary or an alternative land and a building equivalent to the determination of just monetary compensation.

In regard to asset inventory and valuation, Article 22 of the law states that land values and property prices should be consistent with the prevailing market rates as established by the Institute of Real Property Valuers in Rwanda.

The criteria for determining fair compensation, as stated in Article 28, is that without prejudice to other laws, the value of the land and property to be expropriated in the public interest will be calculated on the basis of their size, nature and location and the prevailing market rates. The compensation for disruption caused by expropriation to be paid to the expropriated person shall be equivalent to five percent (5%) of the total value of his/her property expropriated.

Contesting of assessed value can be done seven days after the approval of the valuation report. Any person contesting the assessed value will, at his/her own expense, engage the services of a valuer or a valuation firm recognized by the Institute of Real Property

Valuers in Rwanda to carry out a counter-assessment of the value as implied in Article 33.

Article 35 states that fair 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 order for the expropriation to be authorized, the fair compensation must be paid to the expropriated person before he/she relocates.
Article 36 states that the approved fair compensation will be paid within a period not exceeding one hundred and twenty (120) days from the day of its approval by the District or City of Kigali Council or the relevant Ministry. If fair compensation is not paid within the period, expropriation will become null and void unless otherwise agreed upon between the expropriator and the person to be expropriated.
Subsequent to receiving fair compensation, the expropriated person will have a period not exceeding one hundred and twenty (120) days to relocate. The person to be expropriated will not be allowed to plant crops that require more than one hundred and twenty days of growth before they can be harvested.

Any expropriator that retracts his/her project for expropriation in the public interest after the valuation of the property or fails to pay fair compensation within the period provided under Article 37 of this Law will be bound to pay compensation of five per cent (5%) of the agreed fair compensation.

Since the project involves land acquisition, the expropriation law is applied where land, houses, crops and other property could be compensated.

Guidelines on Right of Way (ROW) for Power lines

Guidelines No. 01/GL/EL-EWS/RURA/2015 states that the Licensee shall obtain a ROW for a power line through an easement from the property owner or through purchasing the title ownership of the required land.

In the latter case, a landowner shall sell the strip or be expropriated of the land to the Licensee (licensed electric power) outright. RURA views the easement as a private agreement between two parties and would therefore not to be directly involved, unless asked by one of the parties to provide an independent and unbiased response to practices that contravene these guidelines by any of the parties.

Easement is an agreement between the Licensee and the Landowner which grants a permanent right to the Licensee to cross or use land to build, maintain, operate and protect the power lines, while permitting the landowner to retain the general ownership and control of the land.

Regarding the ROW dimensions minimum horizontal Right-of-Way width requirement for overhead lines are elaborated in the table below. However, these dimensions may differ from values given in the table below for existing power lines or during special circumstances. Furthermore, when the power line parallels other existing infrastructure ROW such as roads, railroads, a lesser width may be required as part of the ROW of the existing infrastructure can often be combined with the ROW needed for the power line.

The safety clearance distances to power lines shall comply with the following standards: (i) RS 474-1: 2011 for Power Installations exceeding 1kV a.c. – Part 1: Common rules; (ii). RS EAS 811-2: 2014 on Code of practice for safety of electrical installations; (iii) Any other relevant standards issued by the National Standards Bureau.

Expropriation of the ROW shall be conducted in accordance with the Law into force governing expropriation for public interest in Rwanda. The landowner shall subsequently hand over all the rights and responsibilities for the expropriated strip of land. Procedures for land acquisitions and land transfer shall comply with the domestic laws and regulations governing the matters.

Table 5 *Nationally acceptable Horizontal ROW for different voltage levels*

Voltage levels	**0.4kV**	**15kV< V<30kV**	**110kV**	**220kV**	**400kV**
Horizontal ROW (m)	3	12	25	30	50

Note: The power lines shall be centered in the Right-of-Ways given in the table above.

The ROW shall generally be clear of unauthorized structures that could interfere with a power line operation.

The guideline continues to state that relative to the features observed of any power line project area, some of the crucial acts forbidden under the ROW are to construct any building or structure or carry out cultivation, farming or any other activity within the ROW prior to the consent of the Licensee (i.e.REG).

However, derogation is in place stating that as long as minimum clearances from poles and conductors are maintained and with a prior written consent of the Licensee, the ROW can be used for certain activities such as yards, gardens, pastures and farming, recreational fields, streets, roads, driveways, parking lots, lakes, fences, drainage ditches, grading or any other activity that may not interfere with the line operation. Furthermore, temporary buildings or structures that are small and easily movable may be acceptable in the ROW with prior approval of the Licensee, provided that: (a) they are located away from the Licensee' works and access roads and not directly beneath overhead conductors; (b) they are not habitable.

An exception to the above mentioned requirements for the ROW and based on the discussion held between RURA and EDCL on 21st June 2017 (*refer to JICA field report, 2017*), it was agreed and stated that the following criteria of resettlement and land acquisition are applied for reinforcement of the existing 110kV transmission line between Birembo and Jabana substation.

Table 6 *Right of way for existing transmission line Jabana- Birembo*

No.	Items	Right of Way (ROW), Criteria for land acquisition and resettlement
1	Right of Ways	110kV transmission line: **25m width(12.5m+12.5m)**
2	Land acquisition	Lands are required **only where towers will be erected**.
3	Resettlement of structures lived or use by people such as houses, shops, etc.	A minimum vertical clearance from the lowest conductor to the top of structures is 5m. Structures within Right-of-way that do not meet the above minimum clearance, meaning the distance between the lowest conductor and the top of structures is less than 5m, are subject of resettlement.
4	Resettlement of trees	All trees within the above Right of way must be removed.
5	Resettlement of other objects	Other objects within the above Right of way not meeting the minimum clearance (5m) will be evaluated based on social impacts and safety.

This is interpreted as such; that during asset inventory and valuation of property for compensation only land on which towers are built, habitable buildings under the power lines that do not meet the minimum vertical clearance, trees and perennial crops with in the corridor of the ROW that grow long and associated facilities like access roads to construction points will be eligible for compensation.

ABUNZI POLICY FOR GRIEVANCE REDRESS

The Abunzi are part of the organisational structure that implements the grievance mechanism. The National 2010 Abunzi Organic law states that at both the cell and sector levels, the Abunzi committee shall be composed of twelve people known for their integrity, who reside respectively in the concerned cell and sector and who are recognised for their ability to reconcile differences. These mediators are elected by the Cell Council and the Sector Council respectively for a renewable term of five years. Any grievance is assessed by these mediators in the presence of the affected person or representative of the affected community and the defendant. Abunzi meet weekly at the cell or sector offices to review and resolve these grievances. No more than 14 days will pass before response is given on the grievance. Written resolution declarations are prepared by the Secretary of the Abunzi and signed by everyone in attendance and sent to the cell leader for implementation. Response to the complaint is issued in writing to the complainant from the cell leader's office. If the response is not satisfactory to those affected the complaint can be taken to the Sector level and then District level and finally to courts of law in this chronological order.

SOCIAL PROTECTION UNDER VISION 2020 UMURENGE PROGRAMME (VUP)

VUP was used to accurately identify vulnerable groups and was proposed as part of the LRP for special assistance to vulnerable and/or poor groups.
The VUP aims to eradicate extreme poverty by 2020. This aim will eventually be achieved through acceleration in poverty reduction by achieving these key objectives:

- Realising the productive capacities of people and offering solutions adapted to their needs.
- Improving community livelihood assets (e.g. ecosystem rehabilitation) and ensuring their sustainable use.
- Increasing the targeting of social protection to the most vulnerable.

The VUP is organized around three components to implement client-based solutions and put money straight into the pockets of hard working Rwandans who participate in the VUP:

- Public works using community-based participatory approaches (e.g. Ubudehe) and are intended to build productive community assets. Since private land ownership is widespread in Rwanda, public works can take place on either public or private land (e.g. terracing). However, the case must be made that the assets benefit the community at large. When benefits are clear the community will have the incentive, or a vested interest, to maintain the community assets, thereby ensuring sustainability.
- Credit packages to tackle extreme poverty as well as to foster entrepreneurship and off-farm employment opportunities. These packages are designed to make the best possible use of scarce public resources, involve the private financial sector and provide people with incentives to improve their own productive capacities.
- Direct support to improve access to social services or to provide for landless householders that do not qualify for public works or credit packages, Such unconditional support seeks to expand health and education coverage as well as to encourage the development of "appropriate" skills, handicrafts or social service activities.

These three program components are not necessarily mutually exclusive. For instance, public works can be complemented with credit packages. In addition, a distinction is made between a household and members of the household. This is crucial as it includes women and youth, which represent important productive capacities but may not be heads of households. Hence, eligibility to these programs intends to address the concerns of women and the youth populations.
The program components are implemented through a set of projects that are designed and coordinated at district sector "Umurenge" level and implemented at cell "Umudugudu" level. Both program components and projects are linked to technical specialists in sector ministries who also provide the strategic direction and priorities as well as specific technical standards and policies. Eligibility of beneficiaries from the VUP:

- Public works are intended for adult women and men. This includes pregnant women during her first six months of pregnancy, lactating women after 10 months of giving birth and female heads of households. It excludes sick or mentally challenged people unable to undertake even light work, pregnant women in their

final trimester of pregnancy and lactating women in the first 10 months after child birth.

- Credit packages are intended for adult women and men. This includes pregnant women, lactating women and female heads of households. It excludes sick or mentally challenged people unable to undertake even light work. Restrictions apply for the landless unable to work who cannot generate income to pay back the loan
- Direct supports are intended for those unable to participate in public works and those without productive capacity to qualify for credit packages. It includes those who do not have sufficient and reliable support from their sons or daughters or remittances from relatives away from the village. Such individuals may include disabled persons, child headed households, marginalized persons, elders, lactating mothers in the first 10 months after birth, pregnant women in their last trimester, genocide survivors, persons living with HIV/AIDS, street children, widow headed households, refugees and returnees.

The criteria applied in determining who would be classified in the poor/vulnerable group and therefore eligible for the VUP support described above were:

- Category 1 of Ubudehe Program- Abatindinyakujya (Those living in abject poverty): This category of the population owns no property, lives by begging and is wholly dependent on others.
- Category 2 of Ubudehe Program- Abatindi (Very poor): This category of the population has poor housing, lives on a poor diet, depends on others and does not own land or livestock.
- Household headed by a person with disability classified under the category I a or II of the Ubudehe Program.
- Household headed by children under 19 yrs classified under the category I a or II of the Ubudehe Program.
- Household headed by an elderly person over 80 years old classified under category I or II of the Ubudehe Program.

3.1.2.INTERNATIONAL SAFEGUARDS

JICA Guidelines for Environmental and social considerations (2010)

JICA, which is responsible for Official Development Assistance (ODA), plays a key role in contributing to sustainable development in developing countries. The inclusion of environmental and social costs in development costs and the social and institutional framework that makes such inclusion possible are crucial for sustainable development. Internalization and an institutional framework are requirements for measures regarding environmental and social considerations and JICA is required to have suitable consideration for environmental and social impacts.

The objectives of the guidelines are to encourage Project proponents to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. In doing so, JICA recognizes the following seven principles to be very important: (i) wide range of Environmental and social (E&S) impacts must be addressed, (ii) Measures for E&S considerations must be implemented from an early stage to a monitoring stage, (iii) JICA is responsible for accountability when implementing cooperation projects, (iv) JICA asks stakeholders for their participation,

(v) JICA itself discloses information on E&S considerations in collaboration with project proponents, (vi) JICA makes efforts to enhance the comprehensive capacity of organizations and operations in order for project proponents, (vii) JICA addresses request of acceleration for the prompt implementation of projects while undertaking E&S considerations.
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 Japan Ministry of Foreign Affairs (MOFA), (4) Technical cooperation for development planning, and (5) Technical cooperation projects.
The process of E&S consideration comprises of; (i) information disclosure, (ii) categorization of projects, (iii) impacts to be assessed, (iv) consultation with local stakeholders, (v) concern about social environment and human rights, (vi) Laws, regulations and standards of reference of host governments, (vii) advice of advisory committee for E&S considerations, (viii) decision making by JICA and (ix) ensuring appropriate implementation of and compliance with the guidelines.

Regarding categorization of projects, JICA classified projects into four categories.

- *Category A*- Such projects 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.

- *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.

Whereas one of the sensitive sectors identified for classification of a project as Category A is power transmission and distribution lines involving large-scale involuntary resettlement, large-scale logging, or submarine electrical cables, this particular project was observed to require large scale involuntary resettlement and its impacts are site specific, hence declassified to Category B but with recommendation of an EIA as instructed by Rwanda Development Board (RDB) (i.e. the National organ responsible for screening a project and determining whether or not an EIA is required and the extent of assessment).

JICA guidelines indicate impacts to be assessed with regard to E&S considerations to 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.

For critical impact such as involuntary resettlement, indigenous people, JICA guidelines desire that reference is made to World Bank (WB) safeguard policies. Regarding indigenous people, Rwanda does not have indigenous groups on grounds that it is a nation with a single/common culture, tribe, language and with a National constitution that recognises all Rwandans are born and remain equal in rights and freedom (*article 16 of Rwandan Constitution, 2015* and hence this safeguard is not applicable and not triggered.

The ARAP has gone further to consider the relevant WB safeguard triggered by land acquisition and resettlement from project activities.

RELEVANT WORLD BANK SAFEGUARD POLICIES

Involuntary resettlement OP 4.12

The key objectives of OP 4.12 are to:

- Avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
- Avoid forced eviction.
- Anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected.
- Improve or restore the livelihoods and standards of living of PAP.
- Improve living conditions among physically resettled people through the provision of adequate housing with security of tenure at resettlement sites.

OP 4.12 classifies PAP as persons: (i) who have formal legal rights to the land or assets they occupy or use; (ii) who do not have formal legal rights to land or assets, but have a claim to land that is recognized or recognizable under national law; or (iii) who have no recognizable legal right or claim to the land or assets they occupy or use. The census will establish the status of the PAP.

The scope of application of OP 4.12 applies to two types of displacement: (i) physical displacement and (ii) economic displacement resulting from the following types of land related transactions:

- Land rights acquired through expropriation.
- Land right acquired through negotiated settlements which could result in expropriation if negotiations failed.
- Project activities resulting in involuntary resettlement on land use or access to natural resources.
- Project activities requiring eviction of people occupying land without formal, traditional or recognizable usage rights.
- Restrictions on access to land or use of resources including communal and natural resources.

The general requirements of OP 4.12 are:

1. *Project Design* considers alternative designs to avoid or minimize physical or economic displacement as it balances its environmental, social and financial cost and benefits.
2. Where displacement is unavoidable, the displaced are *compensated at full replacement cost* and other assistance to improve or restore their livelihood. Full replacement defined as the market value of the asset plus transaction costs.
3. For land-based livelihoods, the first compensation option shall be land-based compensation. Where the expropriated land can only be taken after compensation is complete. Furthermore and where applicable, resettlement sites and moving allowances may be granted in addition to compensation. Opportunities to PAP will be availed for development benefits from project activities.
4. *Stakeholder engagement* of affected communities is essential in decision making process of resettlement and livelihood restoration. Relevant information regarding the compensation, livelihood restoration of the PAP shall be publically disclosed throughout the resettlement planning, implementation, monitoring and evaluation.
5. *Grievance mechanism* will be established at the development phase as a platform where concerns about compensation and relocation are raised by the PAP and such a concern is resolved by the agency acquiring the land or property.
6. *Resettlement and livelihood restoration planning and implementation*. A census will be carried out to collect appropriate socioeconomic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance and discourage ineligible persons, such as opportunistic settlers, from claiming benefits. In the absence of host government procedures, the client will establish a cut-off date for eligibility. Information regarding the cut-off date will be well documented and disseminated throughout the project area.

Displacement requirements are:

1. *Under Physical displacement* where it involves moving people to another location the client will (i) offer the displaced persons choices including adequate replacement housing with security of tenure or cash compensation and (ii) provide relocation assistance suited to the needs of each group of displaced persons. For new resettlement sites, improved living conditions must be seen, while relocating in preexisting communities and groups shall require their preferences. A Resettlement Action Plan shall be required to guide it.
    a. For persons with legal rights of land or assets and those who do not have legal rights but have recognizable claim on land, the client will offer the choice of replacement property of equal or higher value, security of tenure, equivalent or

better characteristics, and advantages of location or cash compensation where appropriate.

b. For persons who have no recognizable legal right or claim to land or assets they occupy or use, the client will offer them a choice of options for adequate housing with security of tenure so that they can resettle legally without having to face the risk of forced eviction or full replacement compensation where appropriate.

2. *Under Economic Displacement* resulting from land acquisition or restriction on land use, the displaced person will also be compensated at full replacement cost for lost assets or access.
   a. For affected commercial structures, compensation shall include the cost of reestablishing commercial activities elsewhere, for lost net income during the period of transition, and for the costs of the transfer and reinstallation of the plant, machinery, or other equipment.
   b. For persons with legal rights of land or assets and those who do not have legal rights but have recognizable claim on land, replacement property of equal or greater value will be provided, or, where appropriate, cash compensation at full replacement cost.
   c. For persons who have no recognizable legal right or claim to land or assets they occupy or use, will be compensated for lost assets other than land (such as crops and other improvements made to the land) at full replacement cost.

3.2. GAP ANALYSIS BETWEEN IFC PS 5 AND THE LAWS OF RWANDA

The following table compares differences between the laws/regulations of Rwanda related to expropriation and WB OP 4.12 Involuntary Resettlement. The announcement of the new expropriation law introduces a legal framework within which expropriation activities must be conducted, and above all, attempts to bring Rwandan Legislation more in line with international best practice requirements. Despite this, there are still some gaps between the National Rwandan legislation and the OP 4.12.

Table 7: Gap Analysis between OP 4.12 and Rwandan Law

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
1.	Avoidance or minimization of project impacts at Project Design	Recommends avoidance, and when avoidance is not possible, minimization of displacement by exploring alternative project designs.	No similar provisions are provided in the Rwandan National Law, however, it states that the affected persons shall be given fair and just compensation in Article 3 of the expropriation law	Gap is mostly on avoidance, where the National law states that expropriation of land for public interest is regarded as inevitable.	Alternatives analysis of project design options are discussed in Chapter 2.3, including the zero option analysis to avoid the project.
2.	Full replacement compensation	When displacement cannot be avoided, the client will offer full replacement cost compensation to PAPs for loss of assets Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. Provide relocation assistance suited to	Compensation is calculated considering the size, nature and location and considering the prevailing market prices. Compensation for disruption caused by expropriation to be paid to the expropriated person shall be equivalent to five percent (5%) of the total value of his/her property expropriated (*Article 28 of the Expropriation*	A gap exists between full replacement cost and market prices in the National Law. National prices are based on Market price and district gazette for crops and trees, while houses are based on current construction material prices at time of valuation. What the National Law does not specifically include in the full replacement cost are transaction fees and any taxes.	The existing gap of transaction fees in addition to the market price to ensure full replacement cost and relocation assistance is covered in the 5% of the total value of property expropriated as cost for any disruption caused. A Livelihood restoration plan (LRP) is proposed in this ARAP to close the gap.

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
		the needs of each group of displaced persons.	*Law*). Article 35 of the Expropriation Law provides for fair and just compensation and it stipulates that fair 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. There is no explicit support for the transition period and livelihood restoration mentioned in the local laws.	No Gap on preference or choice of compensation. No gap on relocation assistance since there is an addition 5% to the valued price to cover disruption caused. Gap exists as no guidance on restoration of PAP livelihood is given in the Rwandan regulations.	
3.	Livelihood restoration	When displacement cannot be avoided, the client will offer displaced communities and persons compensation for loss of assets at full	There are no explicit provisions on livelihood restoration.	The Rwandan legislation has no instructions on this matter. Gap exists.	LRP has been proposed in the ARAP to cover this gap.

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
		replacement cost and other assistance to help them improve or restore their standards of living or livelihoods.			
4.	Compensation timing	Compensation and other kinds of assistance must be provided prior to displacement.	The Expropriation Law, Article 35 stated the fair compensation must be paid to the expropriated person before he or she relocates. Article 36 specifies a time frame of 120 days from the day of approval by the District or Kigali city council or relevant ministry.	No gap. Compensation will be provided prior to relocation.	No gap hence no need to close gap.
5.	Abbreviated Resettlement Action Plan (ARAP) or RAP and Livelihood Restoration Plan (LRP)	For projects that entail physical displacement, resettlement action plan (RAP or ARAP) must be prepared and made available to the public.	A procedure of expropriation is explained that includes valuation of property lost, compensation and stages of appeals for expropriated people that are not satisfied by the outcome of the expropriation.	The Rwandan legislation is not clear on this matter of preparing a detailed RAP or LRP however, Government recognizes obligations by donors that require RAPs for such development projects.	To close this gap, an ARAP was prepared in accordance with the JICA E&S 2010 and WB OP 4.12 since both physical and economic displacement is experienced under this project.

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
		While those subject to economic displacement require a LRP			
6.	Public consultation/ Stakeholder engagement	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	Articles 10, 11 and 14 of the expropriation law 2015 refer to Consultative meetings with concerned populations living in the land affected, sensitizing them on the relevance of the project of expropriation in the public interest.	Whereas public dissemination is advised in the National Law, there are no specific guidelines for public participation of affected people in planning, implementation, and monitoring of RAP.	Consultations during the ESIA and RAP preparation were used as opportunities for the public to participate in RAP planning, implementation and monitoring. Furthermore a stakeholder engagement plan was proposed in this ARAP for implementation during the project.
7.	Grievance mechanism	Grievance mechanisms must be established for the affected people and their communities as	The Expropriation Law Article 33 provides an appeal procedure for individuals dissatisfied	No significant gap on grievance mechanism, however, the gap appears where the local law states that the	To cover this gap on expenses on appeals, an appropriate and accessible grievance mechanism is in place following the existing local grievance structure to avoid duplication, as

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
		early as possible in the development phase	with the value of their compensation. It however requires the contesting person to hire and pay for a professional valuer.	displaced person shall hire their own valuer at their own expense.	elaborated in Chapter 10
8.	Census, asset inventory, socio-economic survey and cut-off date	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers and others who wish to take advance of such benefits.	According to the Rwandan Expropriation Law, Article 21 the district shall approve the list of the persons to be expropriated which serves as a basis for drawing up an inventory of the property to be expropriated.	No gap in terms of conducting inventory. However, no socio-economic survey is obliged by government funded projects and the cut-off date is not clearly defined by the local law even though it appears to be the date the valuation report is completed and published.	To close the gap an ARAP includes; the socio-economic survey, census of the PAPs, an asset inventory and dates announced through public notices at each Sector and Cell offices and Radio communication for verification of the asset inventory and valuation outcomes on the 30th October- 3rd November 2017, from which a cut-off date was set for 3RD November.
9.	Eligibility	Eligibility of benefits includes, (i)the PAPs	Article 26 of the Expropriation Law	There is a gap. The Rwandan	Gap could not be closed, only those with land lease title deeds can be

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
		who have formal legal rights to land (including customary and traditional land rights recognized under law), (ii)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 (iii) the PAPs who have no recognizable legal right to the land they are occupying.	considers only those that have land titles as the only ones eligible for compensation. People unlawfully occupying land or having developed activities on land shall not be compensated.	legislation does not recognize those displaced people with no formal legal rights to land but have a claim to it or those who have no recognizable right or claim to the land they are occupying.	compensated. This is policy by Ministry of finance and economic planning which is the only organ that authorizes payment for compensation on expropriation. A land lease title deed is the only proof recognized as reference for asset lost. For those with property on land they are renting or care taking for the actual land owner, compensation was written against the land owner but would only be released to the land owner on written agreement authenticated by local authority that he/she shall compensate the actual crop/ tree owner.
10.	Vulnerable groups	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 clear provision on the vulnerable groups among those displaced	There is a gap. The Rwandan legislation does not contain provisions on this matter.	Based on the baseline survey of affected communities any HH that might get into Category I and II vulnerable groups of the National Ubudehe categorization as a result of the Project activities, will be included in the National Social protection that includes; direct financial support monthly and for some public works for payment.
11	Monitoring	The client will	Local legislation does	There is a gap. The	A monitoring and implementation

No	Issues	OP 4.12	Rwandan Law	Gap between OP 4.12 & Rwandan Law	Policies Applied to the Project to Close Gap
	and evaluation	establish procedures to monitor and evaluate the implementation of a Resettlement Action Plan or Livelihood Restoration Plan.	not have any monitoring and evaluation requirement.	Rwandan legislation does not contain provisions on this matter.	plan of the ARAP and LRP implementation has been. The success of the Project will require rigorous evaluation and corrective actions will need to be implemented where required.

CHAPTER 4: BASELINE

4.1 SOCIAL STRUCTURE AND ORGANISATION

Local governance structure in Rwanda comprises of 4 Provinces and Kigali city. i.e. north, south, east and western provinces. Each province and the Kigali city comprises of a number of districts. Each district comprises of sectors, each sector comprises of cells and each cell comprises of villages. The project to improve substations and distribution network Phase III traverses through three (3) Districts. i.e. Gasabo, Kicukiro and Rwamagana.

4.2 HOUSEHOLDS IN AFFECTED AREA

The baseline aimed to survey 100% of the 114 PAH of the North distribution line and the New Gasogi substation areas (73 HH) and South (41HH) distribution line routes. However, 71 (97.26%) of PAH were surveyed along the North (New Gasogi-Nyagasambu) and 34 (82.93%) HH along the South (New Gasogi- Masaka) routes of the Distribution lines that were physically present or had representatives between October and November 2017 by the time of the study.
Along the North route, 2HH of the PAHs were not present or had no representatives to provide information of the asset ownership. Along the South route 7 HH were not present or had no representatives to provide information of the asset ownership.
Among those interviewed during the survey with representation at their possessions, there were 2 HH heads that were not responsive to the survey along the North route.
Table 7 below indicates the distribution of the PAH by District, sector, cell and village.

Table 8: Surveyed Households

Districts	Sector	Cell	Village	HH Count	%
North route (New Gasogi- Nyagasambu Distribution line)					
Gasabo	GIKOMERO	KAMUNINI	RUDAKABUKIRA	1	1.37
	GIKOMERO	MURAMBI	RUGARAMA	11	15.07
	NDERA	KIBENGA	BURUNGA	7	9.59
	NDERA	MUKUYU	AKAMUSARE	1	1.37
	NDERA	MUKUYU	JURWE	14	19.18
	RUSORORO	KINYANA	KIGABIRO	12	16.44
	RUSORORO	KINYANA	NYAGISOZI	15	20.55
	RUSORORO	MBANDAZI	KARAMBO	8	10.96
Rwamagana	FUMBWE	NYAKAGUNGA	AKABEZA	1	1.37
	FUMBWE	NYAKAGUNGA	KIREHE	1	1.37
	FUMBWE	NYAKAGUNGA	NYAGASAMBU	2	2.74
	Total affected HH			***73***	***100.00***
South route (New Gasogi- Masaka Distribution line)					
Kicukiro	MASAKA	CYUGAMO	MURAMBI	1	2.44
Gasabo	NDERA	CYARUZINGI	GASHURE	1	2.44
	NDERA	CYARUZINGI	GATARE	5	12.20
	NDERA	KIBENGA	BURUNGA	7	17.07
	NDERA	RUDASHYA	RUHANGARE	18	43.90
	RUSORORO	NYAGAHINGA	GISHARARA	5	12.20
	RUSORORO	NYAGAHINGA	KABUTARE	4	9.76
	Total affected HH			***41***	***100.00***

Of the surveyed HH, along the North route 32.88% have female heads, while 67.12% have male heads and along the south route 46.34% have female heads, while 53.66% have male heads.

4.3 CROPS GROWN

At the time of the survey, crops grown ranged from seasonal to perennial crops. Common among the crops were; beans, bananas, maize, cassava and sweet potatoes. Perennial trees observed in the area were; avocado, pawpaw and mango trees. Planted forests of mostly eucalyptus covered portions along the ROW of the power line.
It may suffice that PAH grow these crops largely for HH subsistence, with surplus production sold to middlemen from Kigali city.

4.4 LAND OCCUPANCY

Of the 73 HH along the North route distribution line 89.04% are owners of the land while, 6.85% are either hiring or care taking the land. The rest were not found and had no representatives to avail any information regarding land ownership at the time of the survey.

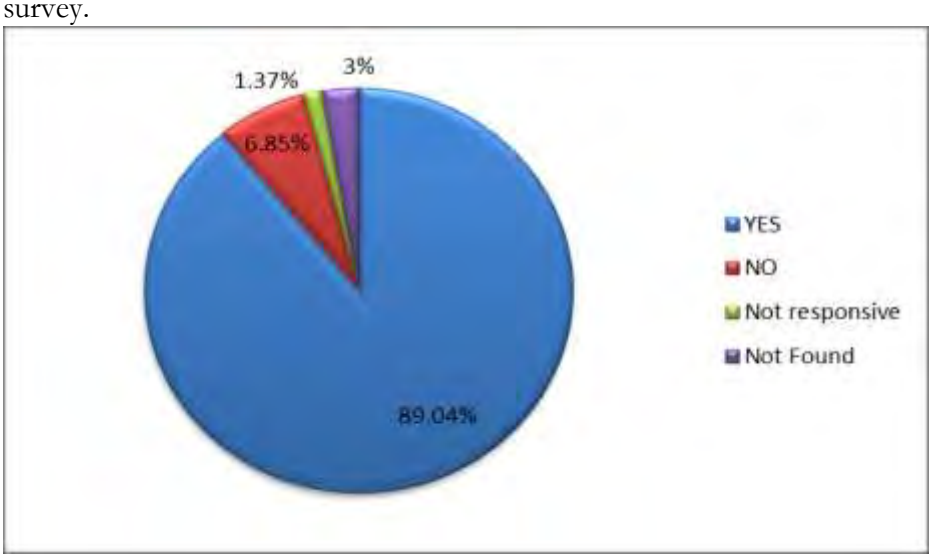


Figure 5: Land occupancy along the North distribution line route

While for the 41 HH along the South route distribution line 85.37% are owners of the land. The rest were not found and had no representatives to avail any information regarding land ownership at the time of survey.

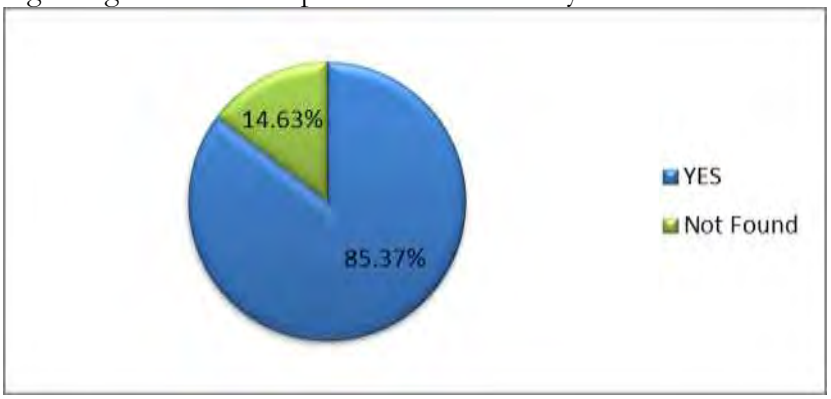


Figure 6: Land occupancy along the South Distribution line route

4.5 DEMOGRAPHY

The total PAH surveyed is distributed by age group as per Table 8 below. Regarding HH heads by age patterns, along the North route 97.26% (69 HH) are in the age range of 21-80 years, 1.56% (1 HH) of HH heads is above 80 years and therefore considered elderly and no HH headed by individuals who are less than 20 years. As for the South route, 85.37% (37 HH) are in the age range of 21-80 years, No HH heads is above 80 years or less than 20 years.

Table 9: Age Distribution for Household heads (HHH)

Age group	Number	Percentage
North route (New Gasogi- Nyagasambu Distribution line)		
0-20	0	0.00
21-30	11	15.07
31-40	20	27.40
41-50	13	17.81
51-60	15	20.55
61-70	7	9.59
71-80	2	2.74
81-90	1	1.37
90+	0	0.00
Not found	2	2.74
Not Responsive	2	2.74
Total population	**73**	100.00
South route (New Gasogi- Masaka Distribution line)		
0-20	0	0.00
21-30	4	9.76
31-40	11	26.83
41-50	8	19.51
51-60	6	14.63
61-70	2	4.88
71-80	3	7.32
81-90	0	0.00
90+	0	0.00
Not Found	7	17.07
Total population	**41**	100.00

Based on these figures, only those above 80years were considered as likely to be placed in the vulnerable group and liable to any livelihood restoration assistance if any.

4.6 EDUCATION STATUS

Along the North route, about 15% (11 of the Heads of HH) interviewed had no education level whatsoever, while over 79% (57 of the heads of HH) in the affected area have at least completed the primary level of education with 6.85% (5HH having attained tertiary education), indicating a substantial level of literacy within the affected area population as shown in the table below.

While along the South route, about 12% (5 of the Heads of HH) interviewed had no education level whatsoever, while 70.73% (29 of the heads of HH) in the affected area have at least completed the primary level of education with 19.51% (8HH having attained tertiary education), also indicating a substantial level of literacy within the affected area population as shown in the table below.
Such levels of literacy are essential for PAH in understanding their entitlements, references made during the valuation of their assets and compliance to requirements for quick compensation such as; accurate documentation of land lease titles, financial institution accounts, among the things required.

Table 10: Education status of PAHs

Education Level	Number	Percentage
North route (New Gasogi- Nyagasambu Distribution line)		
No School	11	15.07
Primary	38	52.05
Secondary	15	20.55
Tertiary	5	6.85
Not found	2	2.74
Not responsive	2	2.74
Total population	**73**	100.00
South route (New Gasogi- Masaka Distribution line)		
No School	5	12.20
Primary	14	34.15
Secondary	7	17.07
Tertiary	8	19.51
Not found	7	17.07
Total population	**41**	100.00

4.7 EMPLOYMENT STATUS

Along the North route, 61.64% of the PAH are farmers, 19.18% self-employed, 5.48% have salaried employment and 4.11% unemployed.

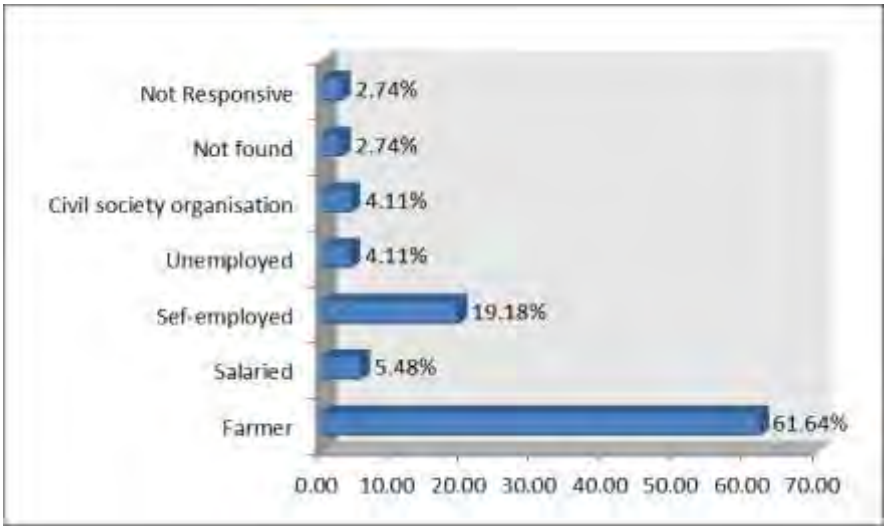


Figure 7: Primary Occupation of PAH along the North Distribution line

While along the south route, 41.46% of the PAH are farmers, 31.71% self-employed, 7.32% have salaried employment and 2.44% unemployed.

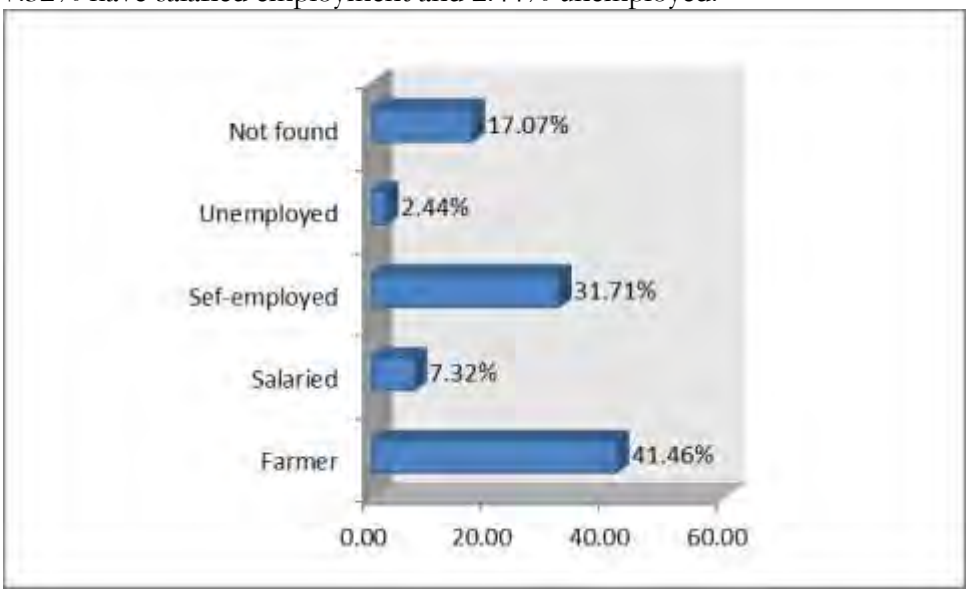


Figure 8: Primary occupation of PAH along the South Distribution line

Having such a high percentage of HH dependent on farming normally would have been an indication of the extent to which land acquisition might have an impact on the PAPs, however, since it is proposed that as a livelihood restoration initiative that land under the ROW of the power line can continue to be cultivated with an exception of planting trees and perennial crops that could interfere with power line, the project is not likely to have a negative impact as would have been if cultivation was not accepted.

4.8 INCOME SOURCES

Along the North route, the majority of the population derive their household incomes from agriculture (73.97%). The second most common source of income for the households is from self-employment (12.33%). Public service (6.85%) is the least income source for the PAHs.

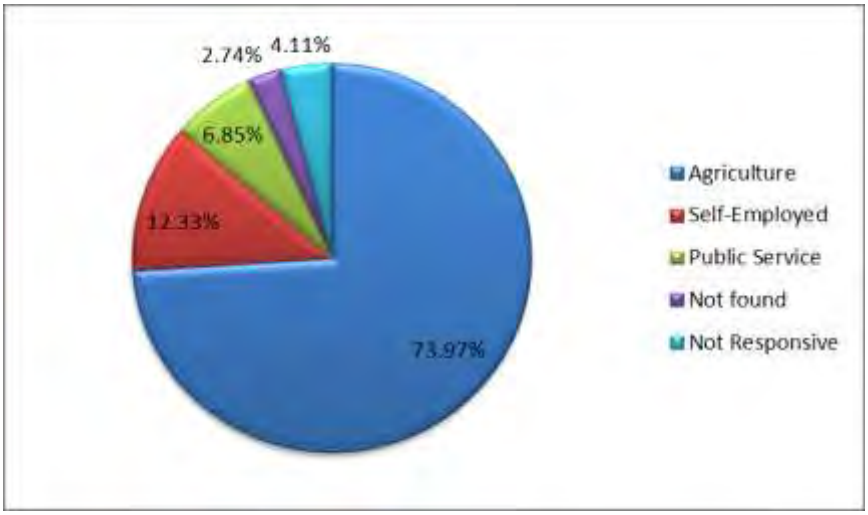


Figure 9: Households Sources of Income along the North route

Though different from the north, the south route also has the majority of the population derive their household incomes from agriculture (56.10%). The second most common source of income for the households is from self-employment (19.51%). Public service (7.32%) is the least income source for the PAHs.

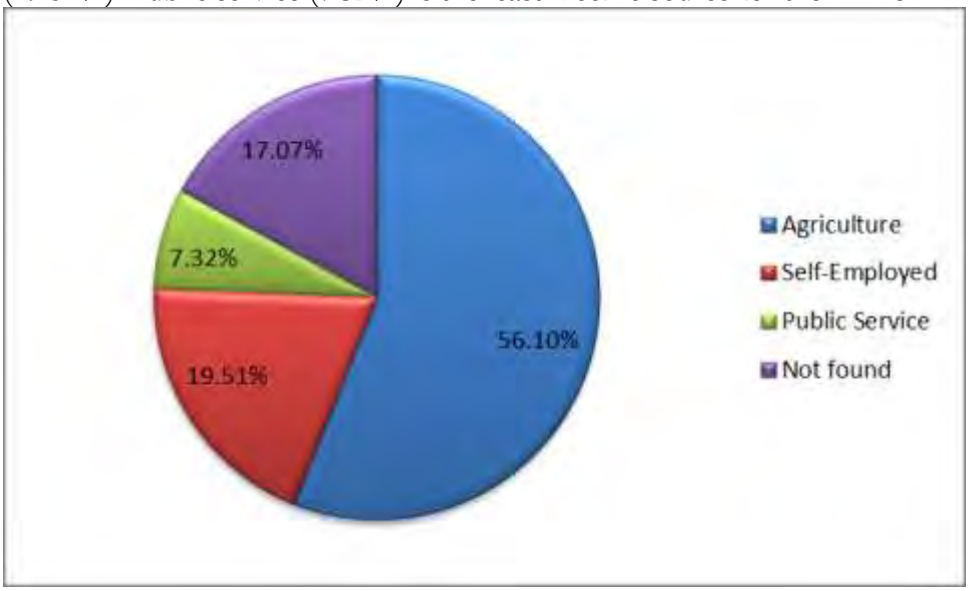


Figure 10: Households sources of Income along the South route

With the project acquiring portions of land from PAH largely dependent on agriculture as their income source, it seems right to avail alternative sources of income to PAPs during the construction and operation of the project as a livelihood restoration initiative. e.g. job opportunities during construction like casual labour, masonry, carpentry. This could act as a transfer of skills and eventually a transition from agricultural dependency to self-employment from acquired skills.

4.9 EXPENDITURE LEVELS

The figure below from the survey demonstrates that along the North route, the HH expenditure levels in monetary range per month. 63% (46HH) spend a range of

30,000-100,000Rwf/month, 28.77% (21HH) expend over 100,000Rwf/month, while 2.74% (2HH) spend less than 30,000Rwf/month.

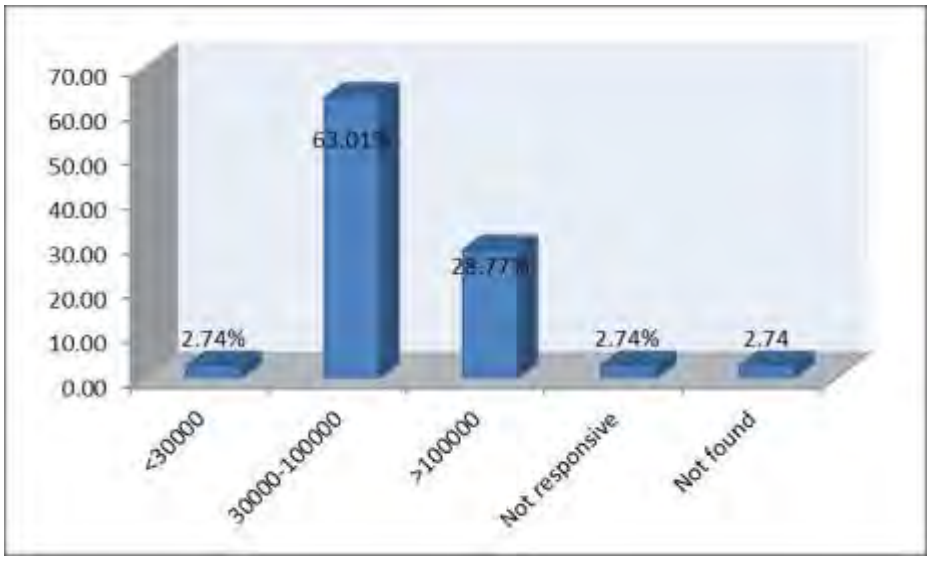


Figure 11: Extent of HH Expenditure along the North route

Along the south route, HH expenditure levels in monetary range per month. 48.78% (20HH) spend a range of 30,000-100,000Rwf/month, 31.71% (13HH) expend over 100,000Rwf/month, while 2.44% (1HH) spend less than 30,000Rwf/month.

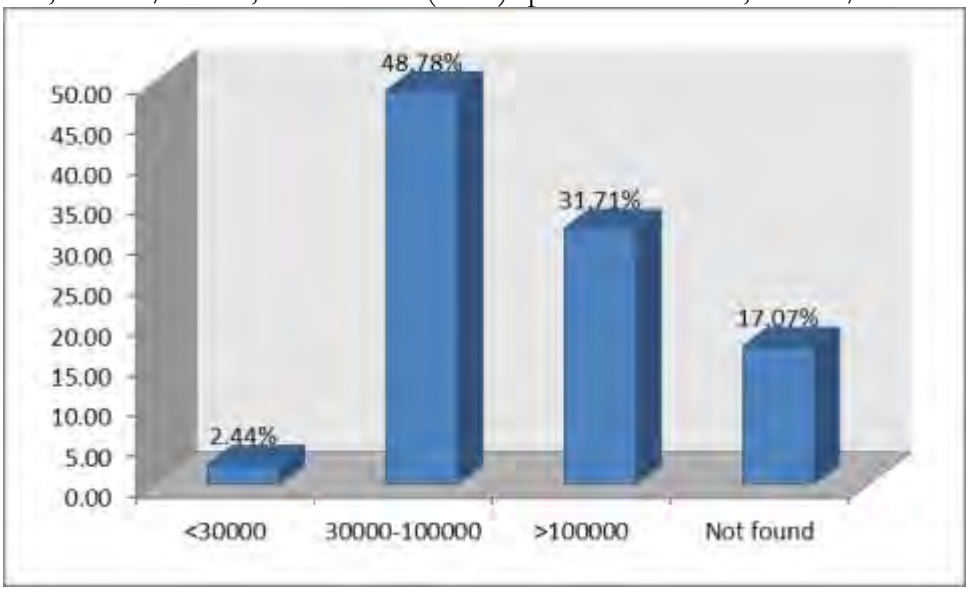


Figure 12: Extent of HH Expenditure along the South route

4.10 FINANCIAL INSTITUTION ACCOUNT STATUS

It was important to know how many HH heads owned accounts in financial institutions (Banks, Savings and Credit Cooperatives (SACCOs) especially since all compensation payments would be done by bank transfer.
Along the North route, 80.82% (59HH) own accounts, 15.07% (11HH) do not own any form of accounts.

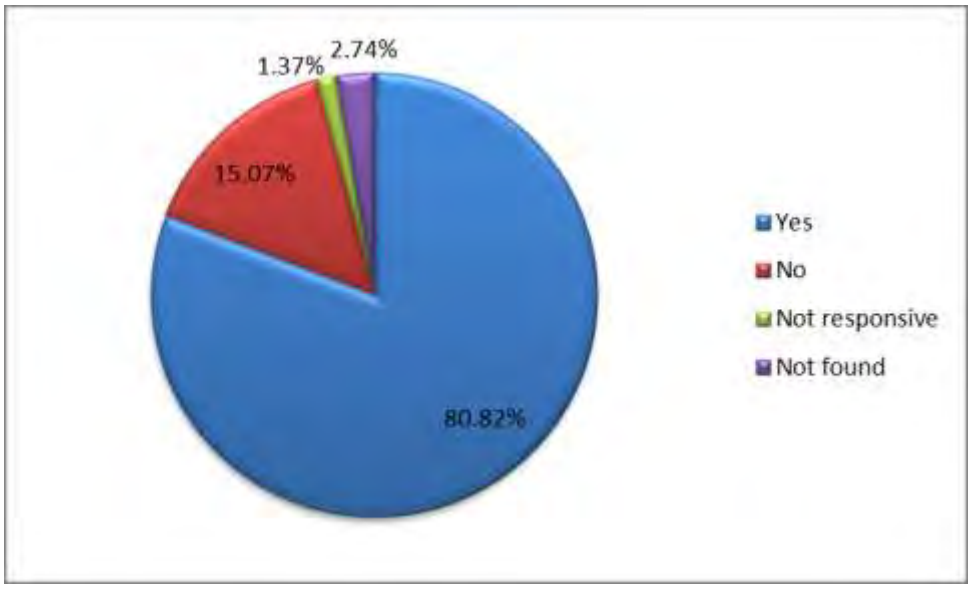


Figure 13: HH along the North route with accounts in financial institutions

Along the South route, 80.49% (33HH) own accounts, 2.44% (1HH) do not own any form of accounts.

During the survey and asset inventory, those PAH who were found not own accounts were informed that compensation would only be done by bank/ financial institution transfer to account and therefore essential to own one.

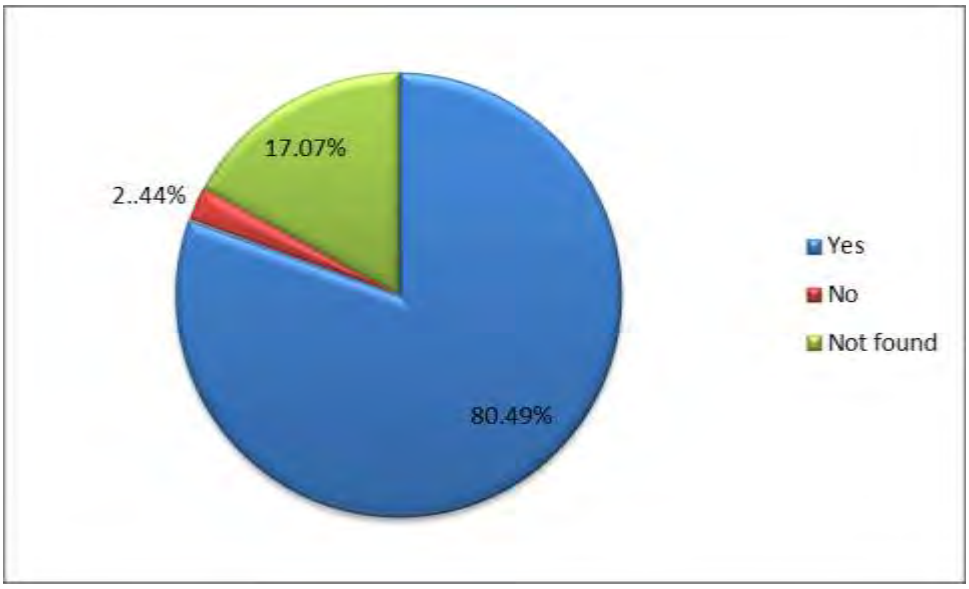


Figure 14: HH along the South route with accounts in financial institutions

CHAPTER 5: RESETTLEMENT IMPACTS

This chapter draws on information presented in Chapter 4: Baseline, as well as information gathered through stakeholder engagement, the census and asset inventory to determine the resettlement impacts.

Under this section, details of the displacement impacts are elaborated, appropriate compensation and relevant measures for restoration of livelihoods proposed, in accordance with the JICA E&S 2010, WB OP4.12 and National regulations.

5.1. KEY RESETTLEMENT IMPACTS

The magnitude of displacement associated with the Project is outlined in the table below. The main impacts as a result of the Project are loss of houses, agricultural land and crops and trees.

Table 11: Magnitude of Displacement Caused by Land Acquisition

Displacement	Impact	Unit	Magnitude of Displacement					Total
			Gasabo			Kicukiro	Rwamagana	
			Ndera	Gikomero	Rusororo	Masaka	Fumbwe	
North route (New Gasogi- Nyagasambu Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	10	3	1	0	0	**14**
		PAP	44	12	1	0	0	**57**
Loss of Agricultural Land	Economic Displacement	PAH	22	9	11	0	3	**45**
		PAP	32	27	31	0	12	**102**
Loss of Crops/ Trees		PAH	13	7	28	0	2	**50**
		PAP	30	23	52	0	12	**117**
Land owned by district			0	0	1	0	4	**5**
South route (New Gasogi- Masaka Distribution line)								
Loss of Residential Houses	Physical Displacement	PAH	2	0	0	0	0	**2**
		PAP	6	0	0	0	0	**6**
Loss of Agricultural Land	Economic Displacement	PAH	20	0	6	1	0	**26**
		PAP	70	0	15	5	0	**90**
Loss of Crops/ Trees		PAH	23	0	5	1	0	**28**
		PAP	79	0	11	5	0	**95**
Land owned by district			1	0	0	0	0	**1**

LOSS OF HOUSING

Impact
For both the North and south distribution line, the Project will result in the physical displacement of 16 PAH equivalent to 63PAPs rightly under the power lines and their ROW. Affected houses are constructed of earth bricks or mud and stick walls; roofed with iron sheets or clay baked roof tiles. Any associated structures such as toilets or storage sheds are also part of what will be lost.

Impacts arising from loss of housing include:

- Loss of shelter and the requirement to relocate.
- Loss or breakage of social networks within affected communities.
- Disturbance of relocating from old houses to new houses. i.e. packing, transporting and unpacking of house items.
- Inconvenience associated with unfamiliarity of the new location.

Mitigation and Interventions

- Those that are physically displaced will be compensated for their loss of housing with cash compensation at replacement value for their property since the alternative of house for house is currently not possible.
- An additional 5% disruption cost will be added to the valued cost of the structure to cover any inconvenience caused by the exercise of displacement.
- Furthermore, PAH will have the right to salvage materials from their existing homes.

LOSS OF AGRICULTURAL LAND

Impact
As outlined in the baseline the majority of households rely on subsistence agriculture as their main form of livelihood. In addition, small livestock farming is undertaken. The land in the project area is registered as agricultural land and residential usage. From the asset inventory, 192 PAP will lose their land.

Loss of access to this land, in the absence of any mitigation, would result in the loss access to land for livelihood activities resulting in a potential for impoverishment and food insecurity.

Mitigation and Interventions

The WB OP 4.12 prioritizes the provision of replacement land when resettling people who are reliant on subsistence agriculture or livestock rearing. However, replacement land is not available. As such cash compensation for land is being provided based on the following principles:

- *Cash Compensation*: Compensation rates for land were based on comparison of current market value of land in the different areas along the power line route. The certified property valuer compared prices of recent land transactions in coming with the unit rate of land. An additional 5% as disruption cost shall applied to the

valued cost, as required by the National expropriation law 2015. The valuation was shared with PAP so that they could understand the source of the compensation rates and agree to them.

- *Timing of Compensation*: Compensation payments would be made utmost 120days from approval of the valuation expropriation report by the District and before any acquisition of land takes place.

With reference to the Rwanda expropriation law 2015, those who do not agree with the value, have the right to appeal to the grievance mechanism elaborated in chapter 3.
For the absentee PAP, as per common practice in Rwanda, compensation amounts at full replacement cost shall be transferred to Sector level "Escrow account" from which, once absentee land owners make themselves known, they can collect their compensation. This is a practice that has been used for example in an AFDB project "Interconnection Uganda- Rwanda- DRC" transmission lines.

LOSS OF TREES AND CROPS

Impact
As the area is mainly categorised agricultural land, the acquisition of land will also result in loss of standing crops and trees. From the asset inventory, the number of PAPs that will lose trees and crops is 212. This includes PAP that have crops on land they legally own, have a recognizable claim to or on land they do not own but have either been renting or caretaking.
Based on the baseline survey the majority of the crops grown are seasonal crops that have a growth period of 3-6months such as; beans, maize and sweet potatoes. However there are also perennial crops and trees that are harvested throughout the year such as; bananas, avocado trees, pawpaw trees, mango trees and planted eucalyptus tree forests.

Mitigation and Interventions

- Compensation at full replacement cost will be provided for the loss of all other (perennial) crops and trees, as per the District Gazette on crop and tree prices.
- PAH will continue to be able to cultivate short season crops even under the ROW but not perennial crops and will therefore be able to harvest all such standing crops even after the power lines are erected.

LOSS OF ACCESS TO WAGED EMPLOYMENT

Impact
There are a limited number of people that undertake waged employment, mainly as day labourers on land plots that will be acquired. The loss of agricultural land will reduce the number of people that would hire such day labourers. However, the work is sporadic and it is therefore not possible to determine the extent of the losses.
In addition, there are a number of traders and skilled workers who operate in the area, many of who are based out of their homes. It is assumed that such individuals will simply relocate their businesses, noting that no business premises have been affected by the resettlement activities.

Mitigation and Interventions
The following mitigation and interventions will be implemented:

- Employment opportunities during the construction of the New Gasogi substation and the power line will be made available for labourers and skilled tradesmen.

DISRUPTION TO SOCIAL NETWORKS AND ACCESS TO SERVICES

Impact
Some PAH have expressed concern over disruption to their existing social networks and access to any services they use in the existing area and other land plots that they may have in these locations.
Such disruption can lead to feelings of isolation and loss of informal support from neighbours and friends.

Mitigation and Intervention- Unfortunately mitigation or intervention can be proposed at this time to offset this impact. The area is peri-urban to urban and experiences relocation mainly from land transactions with the richer buying land of the poorer land owners hence common practice to relocate.

5.2. SCOPED OUT IMPACTS

As a result of this project, business structures / premises, social amenities and infrastructure were not expropriated or affected. Access to these facilities will continue to be enjoyed by the communities. Access to wetlands or water resources was also not affected.
No cultural heritage, specifically graves, has been identified within the project area. However, a Chance Finds Procedure has been outlined in the ESIA and can be applied during project implementation.
Commercial land, squatters and street vendors were also not identified in the affected area.
These impacts were therefore scoped out of this ARAP.

CHAPTER 6: ELIGIBILITY AND ENTITLEMENTS

6.1. ELIGIBILITY

With reference to the local expropriation law, persons eligible for compensation when displaced are those with recognized land lease title certification of ownership or recognized claim to the land or activities that were carried out on the land including; crops, forests, any buildings or any other activity aimed at efficient use of land or its productivity.
WB OP 4.12 has a broader definition of entitlement in that it recognizes persons eligible for compensation as those who: (i) have formal legal rights to the land or assets they occupy or use; (ii) do not have formal legal rights to land or assets, but have a claim to land that is recognized or recognizable under national law; or (iii) have no recognizable legal right or claim to the land or assets they occupy or use.
Both recognize the right to compensation for land and property owned at the time of the cut-off date.

The difference between national legislation and the WB OP 4.12 relates to recognizing those that have no recognizable legal right or claim to the land or assets they occupy or use.
In the case of this ARAP, in alignment with WB OP 4.12, those who have no recognizable legal right or claim to the land or assets they occupy or use, will be considered for compensation for the property/ assets they own but not the land itself.

ELIGIBLE GROUPS

PAH identified during the census and baseline survey that are eligible for compensation as a result of land acquisition and involuntary resettlement are:

Land Owner: This refers to PAH that possess land lease titles certified by the National Land Commission or those with recognizable claim of the land.

House Owner: This refers to PAH that own houses in the expropriation area.

Crop/Tree Owner: This refers to PAH that cultivate crops or trees on land within the expropriated area. Crop/tree owners could be; (i) those that also own the land, (ii) those that are renting the land for cultivation, (iii) those care taking for the land owner.

VULNERABLE GROUPS

In order to determine vulnerable groups, reference was made to the Socio-economic Baseline (SEB) study for the PAH. Based on the survey, only 1 household heads along the North route was over 80 years who would have been considered in the vulnerable group, however, will not be physically displaced (no house resettlement) and therefore not require any form of relocation assistance. None of those PAHs that will have houses resettled are of age above 80 years or less than 20 years, the oldest PAH among those losing houses is 71 years.

6.2. ENTITLEMENTS MATRIX

The entitlements matrix proposes eligibility and payments for the losses triggered by the project (e.g. land, housing, trees, crops, etc). The following entitlements matrix was developed based on analysis of the impacts of the project, criteria for eligibility and agreements made by government in terms of compensation and other support.

Table 12: Entitlement Matrix

Type of Loss	Eligible Groups	Impact	Entitlements	Responsible
Houses	Owner of the Structure	Loss of residential dwelling	• Cash compensation through PAPs accounts in financial institutions at full replacement cost for entire structure and other fixed assets without depreciation and addition 5% disruption fee as by expropriation law. And • The right to salvage materials from the displaced house.	EDCL/ MINECOFIN
Other Structures (kraals, livestock sheds, stores etc)	Owner of the Structure	Loss of structure	• Cash compensation through PAPs accounts in financial institutions at full replacement cost. • The right to salvage materials from the displaced house.	EDCL/ MINECOFIN
Land	Land Owner	Displacement of people from land used for agriculture or housing. Loss of livelihoods	• Cash compensation at current market value (including all transaction fees) for affected land plus an additional 5% disruption fee. Payment through PAPs accounts in financial institutions • Priority for employment opportunities associated with the construction and erection of the New Gasogi Substation and towers. • Awareness training on saving and access to credit schemes so as to manage acquired cash compensation.	EDCL/ MINECOFIN
Seasonal Crops	Crop Owners	Loss of crops used for subsistence Loss of livelihoods	• Seasonal crops may continue to be planted under the ROW even after erection of towers as long as they do not grow tall to interfere with the power lines.	EDCL/ EUCL
Perennial Crops	Crop Owners	Loss of perennial crops used for	• Cash compensation based on prices of such crops based on the age, size, area coverage and type of crop. Compensation will be paid:	EDCL/ MINECOFIN / Sector

Type of Loss	Eligible Groups	Impact	Entitlements	Responsible
		subsistence Loss of livelihoods	○ For owners of the land with lease land titles- payment will be made directly to their own accounts. ○ For users of the land not owning the land: compensation payment will be made against the land owner but only released to the land owner on written agreement authenticated by local authority that he/she shall compensate the actual crop/tree owner or proof he has already compensated them.	
Trees	Tree Owner	Loss of trees used for subsistence, shade, etc. Loss of livelihoods	• Cash compensation at replacement value based on type, age and productive value of affected trees. Compensation will be paid as follows: ○ For owners of the land: cash compensation to be paid directly into their accounts. ○ For users of the land: cash compensation will be made against the land owner but only released to the land owner on written agreement authenticated by local authority that he/she shall compensate the actual crop/ tree owner or proof he has already compensated them.	EDCL/ MINECOFIN / Sector
Waged Employment (Day Labourers & Traders)	Employees	Loss of livelihoods	• Employment opportunities during the construction of the New Gasogi Substation and erection of towers for labourers and skilled tradesmen. • Traders will move their 'businesses' to suitable areas.	EDCL / Districts/ Sectors

6.3. VERIFICATION AND DISCLOSURE OF ENTITLEMENTS

Asset inventory, census and socio-economic survey were done concurrently in the weeks of 9th -27th October 2017. Entitlement and all information from the asset inventory was disclosed to PAPs in Cell public meetings. Asset/Property valuation forms were shown to each PAP for verification, once they agreed to them then they signed or thumb pressed in ink against their names as a sign of agreement.

A cut-off date was established on 3rd November (after verification of asset inventory and valuation by PAHs) from which date none of the PAPs would add any asset and no encroachers were be allowed. No additional assets would be claimed by the PAPs for compensation beyond what was on these asset agreement forms. Cut-off date was were communicated through notices at each Cell office and through radio broad cast

These Asset valuation agreement forms signed by PAPs formed the valuation or expropriation report. Each of the agreement forms was then signed off by the cell leader, then shared with Sector authorities who countersigned as a sign of approval and authorization of legal process and sent to the District for approval by the council and final signature before it was then received by EDCL to commence on compensation payment process.

CHAPTER 7: VALUATION METHOD

7.1. METHOD OF VALUATION

Asset inventory and valuation process was a field operation that involved a certified property valuer and local authorities, explaining the manner in which the inventory and valuation was done for the affected communities.

- Portions of land lost to ROW or towers were measured by tape measure to determine the size. This was done in the presence of the PAP.
- Houses were also measured by tape measure. Type and quantity of construction materials used on the houses were determined, as was the state of the structure. This was completed in the presence of the PAP. Still photos were taken with the rightful owner against his/ her house.
- Crops were determined based on area of coverage, in other cases number of standing crops and age.
- Trees were determined based on number of trees, age and type of tree.
- All this data was entered into individual valuation field sheets for each plot of land and for each PAP. Each of these sheets would be verified by the PAP, who would sign against the sheet. These sheets would then be signed off by the Cell and Sector authorities before they are sent to the District land commission for endorsement and submission to EDCL for payment processing.

VALUATION OF LAND

Land to land compensation could have been the best option, however, as there was not enough land adequate in size in the vicinity of the displaced land, it was agreed with the PAP to have cash compensation for affected property instead of land to land compensation.

To determine a fair market value price for the land, the certified valuer compared prices referred from prices of land recently transacted in the same sector and cells. The unit prices determined per square metre (m^2) of land, which includes taxes and transaction fees, were used for each of the cells as indicated in the table below.

Table 13: Land prices used

No.	District	Sector	Cells	Village	Price (Rwf)/m^2 of land
2	Gasabo	Ndera	Kibenga	Burunga	3000
			Mukuyu	Jurwe	3000
			Cyaruzinge	Gashure	4000
				Gatare	4000
			Rudashya	Ruhangare	6000
				Munini	
				Kacyinyaga	
		Gikomero	Murambi	Rugarama	2000
			Munini	Rudakabukirwa	2000
		Rusororo	Mbandazi	Karambo	3000
			Kinyana	Nyagasozi	2000
				Kigabiro	2000
			Nyagahinga	Gisharara	10,000

				Kabutare	20,000
	Kicukiro	Masaka	Cyimo	Kiyovu	15,000
				Murambi	15,000
	Rwamagana	Fumbwe	Nyakagunga	Kirehe	4,500
				Akabeza	4,500
			Nyagasambu	Rambura	5,000

VALUATION OF HOUSES

Pricing was based on costing of material and labour per m^2 for the foundation, wall elevations, roofing, finishes and number of items such as doors, windows and other installations. The details of each house were included in the full replacement cost/compensation agreement that was agreed and signed by the PAP by signature or thumb stamp, signed by cell, by the sector authorities as approved. For PAP that owned a house to be relocated, a picture was also taken of him/her standing against the house and a reference mark left on the house as proof that once compensated would be relocated.

VALUATION OF CROPS AND TREES

During the asset inventory and valuation of trees and crops likely to be lost to project activities, unit prices applied to most of the crops and trees came from the following table. For trees age was important in determining the unit price, while for other crops it was the area that guided the unit price.

Table 14: Rate of Valuation of Crops and Trees

Crop Type	Area affected (m^2)
Napier grass "Ubwatsi bw'inka"	3119
Peas "Amashaza"	881
Cassava leaves "Isombe"	26
Sweet potatoes "Ibijumba"	951
Maize "Ibigori"	1971
Beans "Ibishyimbo"	2243.8
Sorghum "Amasaka"	390
Ground nuts "Ubunyobwa"	700
Imiravumba	86
Passparum	789
Flowers "Indabo"	168
Tomatoes "Inyanya"	284.7
Total surface area	***11,609.5***

Tree Type	No of trees affected
Mangoes	54

Avocado	151
Cassava “Imyumbati”	1020
Yams “Amateke”	992
Banana	782
“Imiyenzi”	2445
Tree tomato “Ibinyomoro”	4
Pine apple “Ananas”	26
Macadamia “Makadamiya”	167
Eucalyptus trees “Inturusu”	12317
Cedrela	19
Passion fruit “Amacunga”	5
Greveria “Gereveriya”	94
Guava “Amapera”	22
“Imihati”	299
“Imitagara”	12
“Kasiya”	102
“Filawo”	3
“Umunyinya”	2
Paw paw “Ipapayi”	6
“Umusave”	20
“Cypres”	2367
Bamboo “Umugano”	2
Jacaranda	12
“Ibibonobono”	8
Erythrina abyssinica “Umuco”	2
Total number of trees	**20,622**

The Expropriation/valuation report will be verified by the consultant to ensure that all relevant documents have been signed by the relevant parties i.e. PAPs, cell, Sector and district authorities and certified by the valuer. The report will then be sent to EDCL which after verification, will commence compensation process. It will be sent to Ministry of Finance and Economic Planning (MINECOFIN) for payment.

The full replacement compensation packages will be made directly by the Ministry of Finance and Economic Planning (MINECOFIN) to the PAPs’ bank accounts or Savings and Credit Cooperation (SACCOs) accounts. PAPs without bank accounts are encouraged to open bank accounts before payments can be made.

CHAPTER 8: LIVELIHOOD RESTORATION

8.1 INTRODUCTION

Resettlement affects the income-earning capacity of PAP, and compensation alone does not guarantee the restoration or improvement of their living standards. WB OP 4.12 requires initiatives to be implemented that lead to an improved standard of living for the PAP.

In developing the Livelihood Restoration Plan (LRP) key considerations were given to the following:
1. Restoration of sources of income and living standards- through land based and wage based measures.
2. Income restoration based on income generating activities other than just a one-time cash compensation.
3. Participatory dialogue between PAP, the EDCL and local authorities.

HOUSEHOLDS CONSIDERED IN THE LRP

The LRP covers the following PAH interviewed in the census and socio-economic survey (i.e. 114HH), categorised in the following manner:

- **House Owners** - of the 16PAHs an equivalent of 63PAPs.
- **PAP that owned land and/or crops-**
    - PAP that owned land – 192
    - PAP that owned perennial crops and trees - 212

Those HH that only owned land and once compensated would leave the area, in absence, would not be expected to benefit from the LRP.

The design of the LRP was guided by data obtained from the socio-economic survey to understand the current livelihoods of affected communities, determine the categories of livelihoods that would need to be restored and the LRP's focus in maintaining or improving the livelihoods of PAH.

8.2 LIVELIHOOD RESTORATION PLAN (LRP)

The LRP is designed to have two stages, i.e.

- *Short term* measures during the construction of the New Gasogi substation and tower erection, to support the transition of PAH and
- *Long term* measures to achieve a sustainable livelihood for PAH. It should be noted that these measures are in addition to providing all PAH with their cash compensation for lost assets.

SHORT TERM LIVELIHOOD RESTORATION MEASURES

The short term measures are directed to livelihood resources or activities for generating incomes during the initial phase of implementation thereby providing immediate assistance and ensuring continued access to livelihoods.

Wage Based Livelihood Restoration

As a positive initiative in restoring the PAPs source of income probably lost from agricultural land or any other source, it is proposed that PAP are given priority to be employed as unskilled and skilled labour during the erection of the distribution and transmission lines and new substation. An example, unskilled casual labourers on the current market could earn 2,500Rwf/day as opposed to 800-1000Rwf/day earned for a day's hire on agricultural land. Skilled labourers such as masons, carpenters and welders could also benefit from these opportunities.
EDCL shall inspect the contractor to ensure PAPs are given first priority at the time of construction.

LONG TERM LIVELIHOOD RESTORATION MEASURES

The long term plan will be implemented post displacement-project construction and shall continue through the project implementation and its life cycle.

Wage Based Livelihood Restoration

EUCL will require skilled and unskilled people to work during the maintenance of the erected towers, the new substation and mostly clearing ROW of trees, bushes and access roads to the towers. It is proposed that PAPs are given priority for paid temporary employment for both skilled and unskilled roles.

The indicative LRP implementation schedule is shared below:

Livelihood Restoration Plan schedule

S/n	Activities	2018				2019			
	Wage based Restoration plan	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1	Employment during construction on sites, project implementation and project life								
	Vulnerable group livelihood restoration plan								
2	Inclusion of Vulnerable groups in the Direct financial support from VUP government Programme								
3	Medical insurance support								

CHAPTER 9: INSTITUTIONAL ARRANGEMENTS

9.1 OVERVIEW

Institutional arrangement is essential in clearly defining the responsibilities of the institutions involved in implementing the entire ARAP and LRP. The institutional responsibilities will involve: (i) determining those who are entitled to compensation; (ii) determining how asset valuation and compensation will be implemented; (iii) implementing the livelihood restoration programs (iv) undertaking stakeholder engagement throughout the implementation of the ARAP; (v) disseminating information regarding the resettlement process; (vi) budget management; and (vii) coordination of all agencies that are implementing the resettlement.

Other than clearly defining responsibilities, the institutional arrangements will build a ARAP implementation network between EDCL (the resettlement project implementer), the PAPs and local government authorities. The affected area currently has no legally registered NGOs with the competence to support this resettlement process and therefore no NGOs will be part of the institutional arrangements.

This chapter describes:
The arrangements in place that form the resettlement institutional framework and their importance to the implementation of the resettlement and LRPs.

- The roles and responsibilities of these Institutions.
- Capacity building requirements for these Institutions to effectively undertake their tasks.

9.2. INSTITUTIONAL ROLES AND RESPONSIBILITIES

Rwanda Energy Group (REG) - Is the institution in Rwanda responsible for development of energy and delivery to the public. In this particular project the type of energy is electricity. Under it, operate two autonomous companies, i.e. EDCL and EUCL. EDCL in charge of all infrastructure development of these energy sources, while EUCL plans, manages this utility and recovers funds from the services provided to the public. EDCL is responsible regarding approval and implementation of the RAP

Energy Development Corporation Ltd (EDCL) - Is responsible for overseeing the designs of the project, reviewing the RAP and valuation of property likely to be affected by the project before submitting the complete report of full replacement compensation to MINECOFIN. EDCL will also participate in the tendering process of a potential contractor and supervise the construction works of this project. It is responsible for grievance redress throughout the project from planning to the commissioning of construction works.
Once the works are complete, the power lines are then transferred to EUCL for operation and management.

Energy Development Corporation Ltd (EUCL)-Is responsible for operation and maintenance of the project after construction works have been commissioned, including informing communities not to build structures or plant trees that may come within the 5m clearance from the lowest power line.

Local government- Sector and Cell authorities shall be responsible on verifying the valued property of PAPs and this will be verified by signature and stamp from Executive Secretaries of Sector and Cells against each PAPs valued compensation agreement. They will also inform the PAPs by list on notice board of the completion of bank transaction of their full replacement compensation. The Village, Cell and Sector levels shall be the core of resolution of the grievance redress. Only when the grievance redress has reached the Sector level shall the District land commission be involved.

Ministry of Finance and Economic planning (MINECOFIN) - Shall be responsible for disbursing the full replacement compensation to verified PAPs as per list and bank accounts submitted by EDCL.

CHAPTER 10: GRIEVANCE REDRESS MECHANISM

Full replacement cost for compensation is supervised by the by the resettlement and compensation committee. This committee comprises of; members from EDCL and Sector authorities. Their duty is to verify whether all assets valued and all PAH have been fully compensated at the full replacement cost agreed by both the PAH and EDCL. In the event that the PAH rejects the value given by this compensation committee or in the case that a PAH is not paid at full replacement cost, then this is the point at which the grievance redress mechanism commences.
Other grievances may occur along the course of the project, such as:

- Dust, noise, loss of land or crops from storm water or excavated soil piles and encroachment during construction.
- Disputes over ownership of expropriated land and the compensation process.
- Issues associated with maintenance works of the power lines ROW and access routes to the towers after erection of towers with EUCL operating the lines.

A grievance mechanism is therefore essential for affected communities to have timely redress of any grievances so as to achieve satisfaction in the implementation of the resettlement and project implementation.

10.1. GRIEVANCE REDRESS FRAMEWORK

The grievance and redress mechanism is conducted through amicable negotiations in order to resolve any raised disputes. To avoid duplication and confusion, the grievance and redress mechanism follows the current dispute resolution hierarchy at local government level. The following procedure is applied:

- *Stage 1*- PAP will raise the issue with Village leaders "locally called Umudugudu" for a solution to be reached. If the resolution at this stage does not satisfy the PAP, it is raised to the next stage.
- *Stage 2*- The issue is raised at the Cell level "locally called Akagali". At this stage are Cell mediators "locally called Abunzi" that sort out matter below a threshold of 5Million Rwanda Francs. Here the grievance is assessed by these mediators in the presence of the PAP and written resolution declared. Should it not be satisfying to the PAP, then the PAP will raise it with the next stage.
- *Stage 3*- at the Sector level; where a team from the Sector and District land commission seat to resolve the issues between the PAP and developer (EDCL). Incase grievance reached thisstage, it is at this level that from previous projects, effective resolutions are passed to the satisfaction of both parties. However, should this fail, the matter is raised by the grieving PAP to the Courts of law.

According to Article 26 of the Expropriation Law N0 18/2007 of 19/04/2007, filing a case in the courts of law does not stop the expropriation process from continuing in terms of transfer of land rights. Article 26 provides the complaints procedures for individuals dissatisfied with the value of their compensation. It stipulates that dissatisfied persons have a period of 30 days after the project approval decision has been taken to appeal (Article 19).
It should be noted that grievance redress is a process undertaken at no cost and anyone can appeal, except at the stage of the courts of law, where a fee is incurred.

EDCL will follow up the aggrieved PAPs at each level to ensure that the grievances are resolved. Each sector should identify one PAP to work with EDCL and the local leaders to ensure that the grievances are attended to in time. This is in addition to the existing Compensation Committee.

To ensure that the affected parties are fully aware and to reduce possible backlog of complaints, it should be noted in advance that most PAPs take time to decide to complain exceeding the 30 day period required to file their complaints. As per international standards, grievances logged outside this timeframe may still be valid and legitimate. Customarily, the government expropriation authorities ensure that all affected people are fully informed, and will issue warnings about the consequences of failure to lodge their complaints in time. Within this customary procedure, affected people were informed by the consultant during the public consultation and were found to be fully aware of the grievance and redress procedures before their assets are compensated.

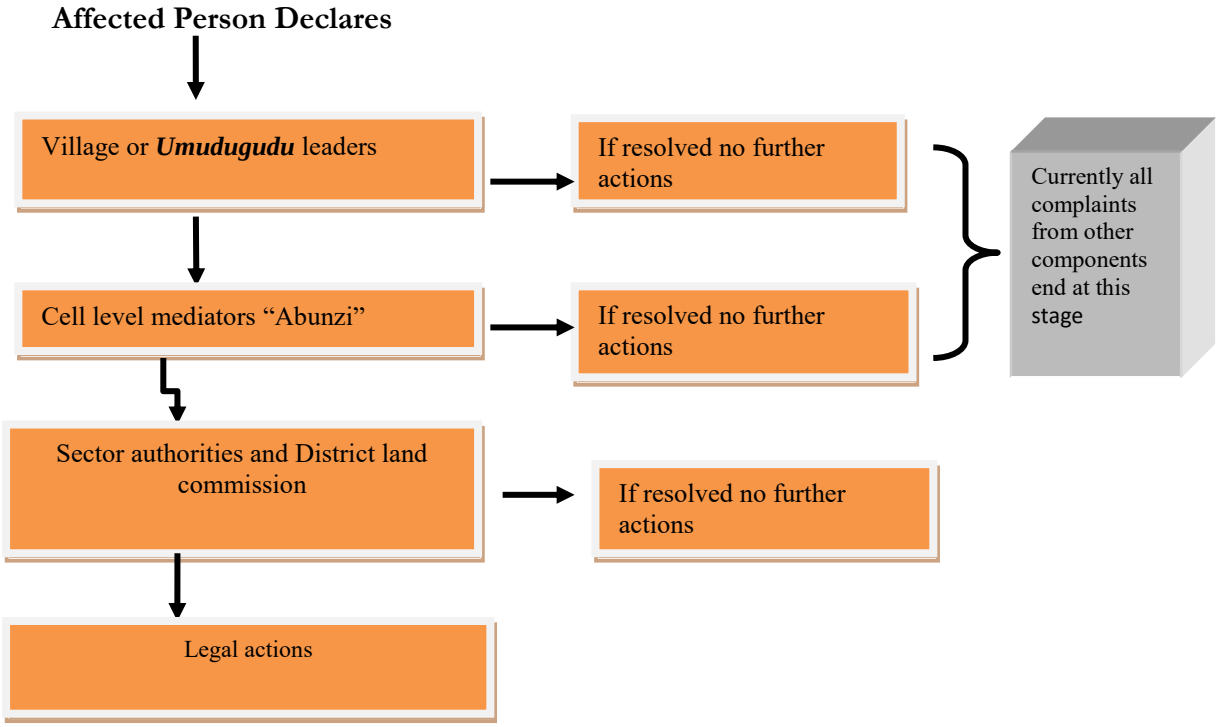


Figure 15: Organigram of Grievance Redress Mechanism

CHAPTER 11: MONITORING AND IMPLEMENTATION PLAN

11.1. OVERVIEW

The WB OP 4.12 require that projects monitor and report on the effectiveness of ARAP implementation, including the physical progress of resettlement and rehabilitation activities, the disbursement of compensation, the effectiveness of public consultation and participation activities, and the sustainability of livelihood restoration and development efforts among affected communities.

The objective of monitoring is to provide the Project with feedback on ARAP implementation and to identify problems and successes as early as possible to allow timely adjustment of implementation arrangements.

This ARAP provides a description of the monitoring that will be undertaken through the implementation of the ARAP and explains:

- The framework of methods that will be applied in the monitoring plan focusing on three areas; performance monitoring, impact monitoring and completion audit.
- Institutional responsibilities in the monitoring process; and
- Monitoring implementation schedule.

11.2. MONITORING FRAMEWORK

PERFORMANCE MONITORING

Performance monitoring is an internal management function allowing the organization responsible for resettlement to measure physical progress against milestones. It shall therefore be integrated in the overall project management to synchronize it with the project implementation activities.

Performance milestones that will be monitored in this Project are as follows:

- Consultation meetings were held and will continue to be held with PAPs during ARAP development and implementation in line with the requirements of the Stakeholder Engagement Plan (see Chapter 13).
- Effectiveness of Grievance redress procedures following the existing dispute resolution structure of the local government in place.
- Establishment of functioning institutional frameworks aligned with the relevant phase of the resettlement process.
- Completion of census, assets inventories, ESIA assessments, and socioeconomic study.
- Identification and categorizing of PAPs as per asset type affected. .i.e. land, houses, crops, trees, etc.
- Disbursement of compensation payments.
- Agreement on livelihood restoration schemes with affected communities.
- Monitoring and evaluation reports submitted.

IMPACT MONITORING

Impact monitoring will gauge the effectiveness of the ARAP and its implementation in meeting the needs of the affected people. The purpose of impact monitoring is: (i) to provide the agency responsible for ARAP implementation (i.e. EDCL) with an assessment of the effects of resettlement on the affected communities; (ii) to verify internal performance monitoring; and (iii) to identify adjustments in the implementation of the ARAP and LRP as required.

The effects of an ARAP will be tracked against the baseline conditions of the population before resettlement.

As part of developing the monitoring plan, EDCL will apply the indicators mentioned in the baseline survey and any relevant ones at the time, for measuring the impact of physical and economic relocation on the health and welfare of the remaining affected population and the effectiveness of impact mitigation measures, including livelihood restoration and development initiatives.

Example parameters that will help to monitor any changes include;

- Ownership of household goods. e.g. phones, radios and foam mattresses
- changes in quality and quantity of agricultural production;
- changes in employment rates;
- changes in the number of working household members versus the total number of household members (ie. dependency ratios);
- changes in household income levels;
- changes in household expenditure patterns;
- changes in access to social infrastructure and services;
- changes in asset ownership / quality / size;
- small business numbers, ownership by men vs. women; and
- proportion of children in each household attending primary school; and

It should be noted that the above mentioned livelihood and standard of living parameters are examples only and the monitoring plan will need to carefully review the baseline and proposed entitlements to develop a full set of indicators.

In addition to the quantitative indicators from the baseline survey, impact monitoring will be supplemented by the use of qualitative indicators to assess the satisfaction of affected people with resettlement initiatives and, thus the adequacy of those initiatives. The most effective qualitative monitoring methodology is direct consultation with the PAPs through regular meetings, focus group discussions, or similar forums established by the project sponsor for public participation as part of the consultation framework.

COMPLETION AUDIT

The key objective of the completion audit is to determine whether the measures outlined in this ARAP (and the supporting LRP) have been successful. The audit should verify that all physical inputs committed in the ARAP have been delivered and all services provided. In addition, the audit should evaluate whether the mitigation actions prescribed in the ARAP have had the desired effect. The socioeconomic status

of the PAP should be measured against the baseline conditions of the PAP before displacement.

This audit may be undertaken after 2 years to determine if all ARAP inputs including the livelihood restoration schemes have been completed. Assuming the completion audit shows a successful outcome, its realization shall be bring closure to EDCL's liability for resettlement, compensation and livelihood restoration. Should areas of concern be raised by the Closure Audit, EDCL will put in place corrective actions prior to repeating the relevant aspects of the Closure Audit.

11.3. SCHEDULE

Implementation and monitoring of the ARAP and livelihood restoration shall follow indicators and timing indicated in the ARAP and LRP implementation schedule in Table below.

Table 15: ARAP Implementation schedule

	Activities	Responsible Agencies	Oct-17				Nov-17				Dec-17				Jan-18				Feb-18				Mar-18				Apr-18				May-18			
1	***Preparation for implementation***																																	
	Asset inventory and valuation of property	Local consultant																																
	Establishment and announcement of cut-off dates for different sectors through stakeholder engagement.	Local consultant																																
	PAP signature of valued asset agreement forms and completion of the valuation/expropriation report	Local consultant																																
	Authorization and signature of Expropriation report by respective government agencies (i.e. Gasabo, Kicukiro and Masaka Districts and Sectors of Gikomero, Ndera, Rusororo, masaka and fumbwe)	EDCL/ Sector leaders																																
	Submission of Valuation/Expropriation report to EDCL for review and commencement of compensation process	Local consultant																																
	Continue stakeholder enagagement with PAPs through Sector and Cell authorities on progress of project and compensation	EDCL/ Sector leaders																																
	Processing of compensation funds	EDCL/ MINECOFIN																																
2	***Implementation***																																	
	Payment of compensation to PAPs through bank transfer to their individual accounts. Disemination of information all PAPs through Cell authorities of compensation payment.	EDCL/MINECOFIN																																
	Monitoring and evaluation	EDCL																																
	Grievance Redress with procedure of recording and processing of grievances	EDCL/ Sector authorities/ local consultant																																
3	***Contingency***																																	
	Contingency funds for increased costs	EDCL																																
	Documentation of Compensation process and Resettlement Planned changes	EDCL																																

CHAPTER 12: COST AND BUDGET

12.1. COMPENSATION COSTS

The total compensation budget for the property likely to be affected by the "Improvement of substation and Distribution network Phase III" Project will be **141,271,129.2Rwf.** It includes the cost of compensation for crops, trees, land and residential houses. EDCL will be responsible for the compensation costs displayed in this ARAP.

Table 16: Compensation Costs

Items of Compensation Activities	**Cost (Rwf)**
North route (New Gasogi- Nyagasambu Distribution line)	
Land	50,272,105.25
Crops and trees	6,052,842
Houses	40,971,268.99
South route (New Gasogi- Masaka Distribution line)	
Land	37,049,109.5
Crops and trees	4,987,293
Houses	1,938,510.46
Total Compensation Budget	**141,271,129.2**

12.2. IMPLEMENTATION BUDGET

The budget has been estimated for the resettlement implementation process based on the activities described in the implementation schedule in *Chapter 11*.

Table 17: ARAP Implementation Budget

	Activities	Responsible Agencies	Unit	Quantity	Cost (Rwf)
1	***Preparation for implementation***				
	Continue stakeholder enagagement with PAPs through Sector and Cell authorities on progress of project and compensation	EUCL/ Sector leaders	Trips	5	150,000
2	***Initiating Implementation***				
	Dissemination of information to PAPs of compensation payment.	EUCL/ Sector leaders	Trips	5	150,000
	Grievance Redress meetings with procedure of recording and processing of grievances	EUCL/ Sector authorities	Trips	10	300,000
3	***Contingency***				
	Contingency funds for increased costs	EUCL	Lumpsum	1	14,127,113
	Documentation of Compensation process and Resettlement Planned changes	EUCL	Lumpsum	1	100,000
	Total				**14,827,113**

12.3. TOTAL BUDGET

The total cost of compensation and estimated budget for ARAP implementation is shown below.

Table 18: Total Budget for compensation and ARAP implementation

No	Item	Cost (Rwf)
1	Compensation budget	141,271,129.2
2	ARAP & LRP Implementation budget	14,827,113
	Total	**156,098,242.2**

CHAPTER 13: STAKEHOLDER ENGAGEMENT PLAN (SEP)

This section discusses the stakeholder consultation that was undertaken for the Project during preparation of the ARAP and also presents the Stakeholders Engagement Plan (SEP).

13.1. RAP STAKEHOLDER CONSULTATION

Stakeholder consultation for the project incorporated:

- Stakeholder identification during ARAP preparation.
- A stakeholder consultation schedule during ARAP preparation.
- Issues raised and responses given from the stakeholder consultation.
- A grievance mechanism (see *Chapter 10* for details – no further information is presented in this chapter).
- Photographs of stakeholder consultation.
- Stakeholder engagement Plan proposed during ARAP implementation

NATIONAL LEGISLATION FOR STAKEHOLDER ENGAGEMENT

Law relating to expropriation in public interest, No. 32/2015, *in article 10*, requires that the concerned population (PAPs) was sensitized about the project and its importance. It also requires committees in charge of monitoring projects of expropriation to conduct a consultative meeting with the population living where the land is located concerning the relevance of the project of expropriation in the public interest.
Further to this since the ARAP was carried out by the same consultant doing the ESIA and consultations were concurrently done for the same PAPs, guidelines on EIA were also referred on public consultation to beef up the relevance of stakeholder engagement.
National Environmental Impact Assessment (EIA) guidelines state that during an environmental impact study, EIA experts will seek the views of persons who may be affected by the project. This will be done particularly during the scoping process and at any other crucial stages considered necessary by the Rwanda Environment Management Authority (REMA). Consulting the public during an impact study is important in identifying issues and impacts considered important by local communities. Identifying and addressing pertinent issues early will avoid difficulties during subsequent public review of the EIA report.

WB REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT

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 ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and ongoing reporting to the affected communities. The nature, frequency and level of effort of stakeholder engagement may vary considerably and will

be commensurate with the project's risks and adverse impacts and the project's phase of development.

STAKEHOLDER IDENTIFICATION DURING ARAP PREPARATION

Stakeholder engagement began by identifying the stakeholders that would be affected or influenced by project activities. These stakeholders were placed in four categories for purposes of public consultation (not in chronological order):

(1) Project Affected Households (PAHs).
(2) Local government officials at sector, cell and village level.
(3) Representatives of EDCL on behalf of REG.

No registered or operating NGOs were identified in the project area and so are not included in the stakeholder categories.

As indicated in *table 1*, *sub-chapter 1.2*, PAH comprised of persons from:

- Gasabo District- Ndera and Gikomero Sectors and their Cells in the ROW of the power lines;
- Kicukiro Distict- Masaka sector and one of its cells in the ROW of the power lines;
- Rwamagana District- Fumbwe sector and its cells in the ROW of the power lines.

Consultation was also undertaken with local government officials representing the sectors, cells and villages of the affected communities mentioned above and EDCL focal people.

METHODS APPLIED

In the interest of project implementation, public consultation for the ESIA and ARAP were undertaken concurrently by the same consultant. During the public consultation, the consultant applied different participatory methods:

- For PAH- methods applied were; public meetings, Focus Group Discussions (FGD), one-to-one discussions.
- For local government officials and representatives of EDCL- Informed Consultation and Participation (ICP) that involved interviews and one-to-one discussions.

The consulted stakeholders were informed of the proposed project and by using a guiding questionnaire, the consultant was able to guide discussions and obtain relevant information on the likely impacts of the project activities. Stakeholders were asked to raise their concerns on the proposed project. An issue raised by one individual or a group of people was cross-checked by discussing it with other individuals or groups. It is from these concerns that the common issues were determined and summarized hereafter.

DISCLOSURE OF INFORMATION

All meetings began with the consultant introducing his team to the attendees, where they are coming from and purpose of their visit. Similar procedure was followed during the public consultation meetings and individual consultations with the local authorities and local residents.

For meetings held with the sector authorities, EDCL issued a letter to the relevant Districts informing them of the proposed project and the exercise of expropriation. With reference to this letter, the consultant requested meetings directly with the each Executive Secretary (sector leader) either by telephone or by written request. Meetings were then scheduled and organized by the sector leader at his availability.

The sector leader would then request that the cell leaders are available for a meeting with the consultant and in turn cell leaders would facilitate organizing a meeting at village level with PAPs. The cell leaders facilitated meeting with the displaced communities. In all the meetings held with sector leaders, cell leaders and PAPs, information disclosed to stakeholders included:

- The purpose of the Project.
- Components of the Project and the ROW of the Project affected area.
- Overall schedule/duration of project development.
- The likely impacts by the Project. i.e. the benefits and likely negative impacts.
- Process of land acquisition and resettlement.
- Eligibility and entitlement to compensation.
- Development initiatives proposed for the livelihood restoration of the displaced persons.
- Proposed stakeholders engagement process.
- Proposed grievance and redress mechanism for any concerns.

The scheduled stakeholder meetings and gatherings are presented in the table below:

Table 19: Summary of Stakeholder Engagement Schedule during ARAP preparation

Date and Time	Place	Methods	Type of participants	Number of participants	Purpose of meeting.
19th and 23rd June 2017	Kigali	ICP	EDCL	3	*To understand;* the project objectives, executing agency, their part in the project (institutional framework), institutional capacity to manage the project, *To record and understand*: likely benefits and impacts of the project and proposed mitigation measures.
21st June 2017	Kigali	ICP	RURA	7	To understand guidelines on ROW of power lines and most importantly guidelines pertaining existing power lines that require rehabilitation.
3rd- 7th July 2017	Gasabo, Rwamagana, Kicukiro Districts	ICP	Sector Executive secretaries for; Ndera, Rusororo, Gikomero, Fumbwe and Masaka	5	*To explain*; Project objectives, Components of the project, project area of development, benefits gained from the project and the purpose of the consultation. Explain the process that will be followed during resettlement and inform them of what preparations to make for smooth asset inventory, valuation and compensation of affected assets. *To record and understand*; local perception of the project, likely benefits, the likely impacts by the Project and proposals on mitigation measures to negative impacts.
5th – 12th July 2017	Ndera, Rusororo, Gikomero, Fumbwe and Masaka sectors	ICP	Cell Executive secretaries for; Kibenga, Cyaruzinge, Rudashya, Mukuyu	11	

Date and Time	Place	Methods	Type of participants	Number of participants	Purpose of meeting.
			and Gikomero in Ndera Sector. Nyagahinga, Mbandazi and Kinyana cell in Rusororo sector. Cyimo in Masaka sector. Nyakagunga and Nyagasambu in Fumbwe sector		
10th – 21st July 2017	Project intervention Cells	Public meetings, FGD	Cell leaders, village leaders and communities in project affected areas.	52	
9th- 13th October 2017	Ndera, Gikomero, Rusororo and Fumbwe sectors	One on one consultations with PAPs	PAHs	114	Asset inventory, census and socio-economic study of PAHs and valuation of assets. Also sensitizing PAPs of what documents to prepare for the process of resettlement and compensation to smooth
16th- 20th October 2017	Ndera, Rusoro and Masaka Sectors	One on one consultations with PAPs	PAHs	114	
30th October- 3rd November	Ndera, Gikomero, Rusororo, Fumbwe and	FGD and one on one consultations	PAHs	114	Verification of the asset inventory and valuation of assets, establishment of cut-off dates and

Date and Time	Place	Methods	Type of participants	Number of participants	Purpose of meeting.
2017	Masaka Sectors				signature of compensation agreements of affected assets by the PAPs.
6th- 24th November 2017	Ndera, Gikomero, Rusororo, Fumbwe and Masaka Sectors	ICP	Local authorities at village, cell, sector and District levels	71	Authorisation by signature that the resettlement process was authentic and justified for compensation by EDCL.

Table 20: Key Issues Raised and Responses from Stakeholder Engagement during ARAP preparation

Issues	Responses
• Locals expected to lose land, structures, crops and trees to the power line project and wanted to know whether they would be fairly compensated. • Questions were raised on eligibility for compensation. i.e. which structures, land, crops and trees that would be compensated. • Questions were raised on whether Job opportunities were available for locals during construction phase. • Questioning whether the power lines would serve their communities. • Worry of exposure to electro-magnetic for those under the power line. • Worry of human electrocution.	• An ARAP was being prepared to guide the resettlement process and PAPs would be compensated for assets lost at fair market price with an additional 5% disruption cost. Cash Compensation payment would be done by EDCL. Asset inventory and Valuation would be done by an independent registered Valuer and prices of land, structures, crops and trees would be referred from commissioned prices set by the Institute of Real Property Valuers (IRPV) in Rwanda. Compensation would be paid in 120 days from signature of agreement by the PAPs as long as all supporting land lease title documents are in order. • In reference to the RURA 2015 guidelines, all structures under ROW of power line would be displaced. • Land displaced will be that land on which the towers shall be erected and any other portion of the plot of land left that is not of any economic use after tower has been lost. • An affirmative program was suggested that gives locals in the area, employment priority during construction. • Communities were informed that purpose of the power lines was to increase the amount of power in the Sectors of Ndera, Rusororo, Gikomero, Fumbwe and Masaka. • To answer the question of exposure to electro-magnetic fields and electrocution, it was explained that a clearance of more than 5m above the lowest conductor was maintained for all structures

Issues	Responses
	within which no electrocution can occur. It was also explained that these fields only revolve around the conductor and not beyond. Sharp spokes shall be placed at lower members of the tower to prevent unauthorised people from climbing.

Figure 16: Photo Log f or the Stakeholders Engagement

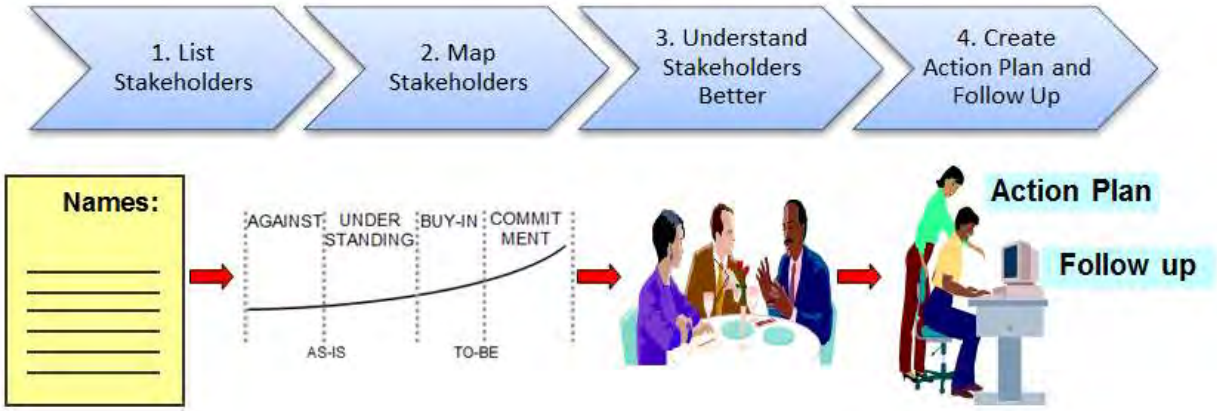





13.2. STAKEHOLDER ENGAGEMENT PLAN DURING ARAP IMPLEMENTATION

Stakeholders are individuals who are impacted by the change (positive or negative), those who can influence the change outcome and/or whose involvement is key to its success. The stakeholder engagement plan proposed follows and shall follow a four step approach.

Four-Step Approach to the Stakeholder Engagement Plan

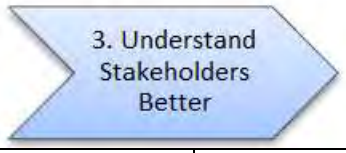


List of Key Stakeholders identified:

- PAPs;
- Local Government – Gasabo, Kicukiro and Rwamagana District and relevant sectors, cells and villages;
- Central Government institutions- Rwanda Development Board(RDB), MINECOFIN
- Autonomous Institutions- EDCL, EUCL and RURA.

PAP -Accepting **Accept**: Those seen as willing to go along with the change. **List comprises of**: Households comfortable with their asset valuation and compensation.	**Ambassadors/Champions** **Committed:** Stakeholders seen to be actively supportive of the project. They provide tangible resources and is visibly involved. **List comprises of:** EDCL, Local and central Government institutions mentioned above.
PAP - Resistance **Resistant:** Those seen to be against the change. Providing reasons against the project.	

	Not willing to give up their land. May or may not do what is needed. **List comprises of**: PAPs with other projects planned on their land along the ROW.	



Stakeholder	Map Position	Source of Emotion/ concern	Cause of Resistance	Actions Needed	Support Needed
Project Affected People (PAP)	PAH Support	Improve their livelihood	None	Payments for their assets and LRP initiatives	EDCL, MINECOFIN, Districts and sectors
Project Affected People (PAP)	PAH – Resistance	Loss of access to houses, land and existing networks	Change in livelihoods and circumstances, Affected planned projects on their land and Fear for the future	Payments for their assets and LRP initiatives. Stakeholder engagement to address concerns and established grievance mechanism to address concerns.	EDCL, District and Sectors, MINECOFIN
Local Government- Gasabo, Kicukiro and Rwamagana Districts and relevant sectors and cells	Champion	Changing economic-social life of its people	None	Participate and collaborate with stakeholders to achieve set objectives. Ensure grievances are resolved.	All stakeholders involved
Autonomous institutions. i.e. EDCL, EUCL	Champion	Leading agreement negotiations and provide after care service	None	Implementation of the agreement during construction and during operation. Ensure grievances are resolved.	EDCL and EUCL
Central Government Institutions. i.e. MINECOFIN	Champion	Wrong or insufficient information for payment	None	Payment of compensation for PAPs	MINECOFIN

B- Stakeholder Engagement Plan

Stakeholder	Where are we now?	Where do we want to be on these stakeholders?	Concerns, Issues, Resistance	Planned Engagement Actions	Timeline
PAP	PAH - Support	Champion	-Compensation payments. -opportunities of employment for PAPs during construction and operation of project.	-Reports on lists of the PAPs whose compensation payment has come through and those whose has bounced. Give early reason why, request PAPs to rectify documents and then request for repayment. -Allow for agricultural land use under the ROW of the power line. -Provide PAPs with job opportunities during construction and operation of project. - Increase electricity connectivity in the areas of the route of power line for ownership of the project.	-Monthly reports on compensation progress submitted to cell and sector levels. -Monthly meeting by grievance committee at cell levels. -Quarterly review of employment stat.us of PAPs during project construction and operation.
PAP	PAH – Resistance	Champion	-Compensation payments. -loss of houses, land and livelihood. - planned projects	- Expedited compensation for assets lost. -Ensure PAPs job availability during construction and operation.	-Bi- weekly meeting at cell and sector level with PAPs on alternatives to specific PAPs with alternative projects. -Monthly reports on compensation

Stakeholder	Where are we now?	Where do we want to be on these stakeholders?	Concerns, Issues, Resistance	Planned Engagement Actions	Timeline
			on their land affected -uncertainty of new employment. -fear of future of uncertainty.	-Consult and agree on alternatives to their planned projects or line route.	progress submitted to cell and sector levels. -Monthly meeting by grievance committee at cell levels. -Quarterly review of employment stat.us of PAPs during project construction and operation.
Local Government- Gasabo, Kicukiro and Rwamagana Districts and relevant sectors and cells.	Champion	Champion	-People resistant to being resettled due to above concerns. -Proposed Livelihood restoration of the PAP.	- Expedited compensation for assets lost - Ensure PAPs job availability during construction and operation. - Consult and agree on alternatives to their planned projects or line route. -Mobilize and sensitise resistant people.	-Bi- weekly meeting at cell and sector level with PAPs on alternatives to specific PAPs with alternative projects. -Monthly reports on compensation progress submitted to cell and sector levels. -Monthly meeting by grievance committee at cell levels. -Quarterly review of employment stat.us of PAPs during project construction and operation.
Autonomous institutions. i.e. EDCL, EUCL	Champion	Champion	- wrong or insufficient information for payment execution - PAPs resistance for reason stated above	- Meticulous verification of expropriation report to avoid missing information. - expedite compensation process. - Consult and agree on alternatives to their planned projects or line route.	-Monthly meeting at cell and sector level with PAPs on alternatives to specific PAPs with alternative projects. -Monthly reports on compensation progress submitted to cell and sector levels. -Monthly meeting by grievance committee at cell levels. -Quarterly review of employment

Stakeholder	Where are we now?	Where do we want to be on these stakeholders?	Concerns, Issues, Resistance	Planned Engagement Actions	Timeline
					stat.us of PAPs during project construction and operation.
MINECOFIN	Champion	Champion	-Wrong account number.	-Bring confirmation of bank account number. -Correct previous account number and repay returned payment.	Whenever the required document is received.

CHAPTER 14: REFERENCES

- EDPRS II, 2013. Economic Development and Poverty Reduction Strategy 2013-2018.
- Government of Rwanda, 2003. Constitution of the Republic of Rwanda.
- Government of Rwanda, 2013 .Organic law N° 43/2013 Law governing land in Rwanda.
- Government of Rwanda, 2007. Law No. 18/2007 of 19/04/2007 relating to expropriation in the Public interest.
- IFC, 2012. IFC Performance Standards on Environmental and Social Sustainability.
- IFC, 2002. IFC Handbook for preparing a Resettlement Action Plan.
- *JICA, 2010*. Japan International Cooperation Agency (JICA) Guidelines for environmental and social considerations.
- *JICA, 2015*. Field report for Preparatory survey on Improvement of substations and distribution network phase 2 in the Republic of Rwanda.
- World Bank, 2004. Involuntary Resettlement Source book

APPENDICES

APPENDIX 1: MINUTES OF PUBLIC CONSULTATTION MEETINGS

Akarere ka Gasabo

Kuwa 15/07/2017

Umurenge wa Rusororo

Akagali ka Kinyana

Umudugudu: Kigasiro

Impamvu: Gusobanurira abaturage ibyerekeye Umushinga w'amashanyarazi uzaturuka Gasogi ugana Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu atanga ikaze ku bashyitsi aribo: Songa Silvin, Olivier Rukemampunzi na Hakizimana J. Paul

Songa yafashe ijambo atangira kubasobanurira ibyerekeye imigendekere y'umushinga, ibyerekeye amambo n'ibyo kubarirwa ibintu byabo bishobora kwangizwa n'umushinga. [illegible]

Impungenge z'abaturage, uwa mbere yatangiye abaza ibyangombwa azitwaza ubwo agiye ayo kubarirwa; undi yatanze ikibazo cye abaza niba uwo muriro nabo uzabageraho agezwa niba ari ugushinga amapoto gusa awutambutsa; Undi yabajije niba akwangizishyurwa ari ahateye imambo gusa cyangwa niba n'ibindi bintu bizangizwa bizishyurwa, undi yabajije ibyerekeye imambo kuberako zitandukanye kuri icyiciti n'izindi za ~~[illegible]~~ Sima

Umuyobozi w'Umudugudu: Mwizerwa Germain [signature]

Umushyitsi: SONGA Silvin [signature]

Akarere ka Gasabo

Kuwa 15/07/2017

Umurenge wa Rusororo

Akagali ka Kinyana

Umudugudu: Kigasiro

Impamvu: Gusobanurira abaturage ibyerekeye Umushinga w'amashanyarazi Uzaturuka Gasogi ugana Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu atanga ikaze kubashyitsi aribo: Songa Silvin, olivier Rukemampunzi na Amuhanzimana J. paul

songa yafashe ijambo atangira kubasobanurira ibyerekeye imigendekere y'umushinga ibyerekeye imambo n'ibyo kubarirwa ibintu byabo bishobora kwangizwa n'umushinga.

Impungenge z'abaturage, uwa mbere yatangiye abaza ibyangombwa azitwaza ubugiye ago kubarirwa; undi yatanze ikibazo cye abaza niba uwo muriro nabo uzabageraho ayongwa niba ari ugushinga amapoto gusa awutambutsa; undi yabajije niba akwazi ashyirwa ari ahateye imambo gusa cyangwa niba nibindi bintu bizangizwa bizishyurwa, undi yabajije ibyerekeye imambo zizabaho zitandukanye kuri ayiti n'izindi za Sima

Umuyobozi w'Umudugudu: Mwizerwa Germain

Umushyitsi: SONGA Silvin

Akarere ka Gasabo
Umurenge wa Ndera
Akagali ka Mukuyu
Umudugudu wa Jurwe

Kuwa 20/07/2017

Impamvu: Gusobanurira abaturage ibyerekeye
Umushinga w'amashanyarazi uzaturuka Gasogi
ujya Nyagasambu

Inama yatangijwe n'umuyobozi w'umudugudu
atanga ubusobanuro bw'inama ku byerekeye umushinga anadusobanurira
n'ibyabanje byo gupima, asoza aha ikaze abashyitsi aribo
Songa, J. Paul na Olivier.
Songa yafashe ijambo atangira asobanurira abaturage
ibyerekeye umushinga, anababwira ko umushinga ushobora
kugira ibyo wangiza mu mitungo y'abaturage.
Yababwiye ko hari amapoto azashingwa mu butaka bw'
abaturage cyangwa se ku mazu y'abantu, ariyo mpamvu
bazabarirwa hangirengo babishyure ibyabo bizaba byangiritse.
Abaturage bafashe ijambo bagaragaza impungenge zabo,
abaza niba igihe bapoceje inzu niba bazahabwa amafaranga
cyangwa bakajya ahandi utura, undi yabajije niba ahantu
hatagiye ipoto naho bazaba bonira, banasabye ko bakorerwa
ubuvugizi mu byerekeye kubarirwa no kwishyurwa, bafite ikibazo
cy'ibyangombwa by'ubutaka byerekana ubuluzi kandi bakeneye kuhatura.
Barasaba ubuvugizi niba bakwishyurwa aho insinga zizanyura hose

Umuyobozi w'umudugudu: BAKUNZI ferdinand
Umushyitsi: SONGA Silvin:

Kuwa 21/07/2017

Akarere ka Gasabo

Umurenge wa Ndera

Akagali ka Rudashya

Umudugudu wa Ruhangare & Kakinyanga

Impamvu: Gusobanurira abaturage ibyerekeye umushinga w'amashanyarazi uzava i Gasogi ugana i Nyagasambu

Inama yatangijwe n'umuyobozi ushinzwe imibereho myiza y'abaturage mu kagari ka Rudashya aho twaje abashyitsi aribo; Songa, J.paul na Olivier

Songa yafashe ijambo atangira abwira abaturage ikigenza abashyitsi abasobanurira ibyerekeye umushinga w'amashanyarazi uzaturuka Gasogi ugana Nyagasambu; yabasobanuriye ko hari amapoto azashingwa mu masambu yabo; abasobanurira ko ayo mapoto hari ibyo azangiza ariyo mpamvu bagomba kubarirwa kugirango bazishyurwe ibyangijwe

Hakurikiye impungenge zabaturage, uwambere yabajije ikibazo giteye gitya ko hari abantu bashinze amapoto mu mirima yabo kandi ntibishyurwe, avuga ko hashize imyaka ibiri bibaye; abenshi bafite ikibazo kuri phase ya 1 babariwe ariko ntibishyuwe; ikindi kibazo micyabanto bapuze ubutaka ariko batarakora mutation afite ntibazo kandi kubarako insinga zizanyura hejuru y'inzu ariko ntabwo bamubariye inzu yiwe.

Umuyobozi ushinzwe imibereho myiza y'abaturage: GASANA Donatien 21/07/2017

Umushyitsi SONGA

APPENDIX 2: LIST OF PUBLIC OR PARTICIPANTS CONSULTED

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1. Nyiramahoro Odette	Akagari: Kimisagara Umudugudu: Nyagisozi			le 19/07/2017	Borne
2. Rutonesha Athanase	Umudugudu/Nyagisozi			Le 19/07/2017	
3= Kayitesi Charlotte	Nyagisozi			Le 19/07/2017	
4= Mukakarisa Jacqueline	Nyagisozi			Le 19/07/2017	
5= Rukundo François	Nyagisozi			Le 19/07/2017	Borne
6= Niyonzima Olivier	Nyagisozi			Le 19/07/2017	
7= Tumusenge Jeanne	Nyagisozi			Le 19/07/2017	
Umuyobozi w'Umudugudu HABIYAREMYE Spirer					
1.					

PUBLIC CONSULTATION LIST FOR THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1. HABONIMANA J.M. Vianney	KINYANA - KIGUGIRO			16/9/2017	Borne
2. RUSANGANWA Sostene	KINYANA - KIGABIRO			16/9/2017	Borne
3. KAMANA James	KINYANA - KIGABIRO			16/9/2017	Borne
4. MUNYANEZA Emmanuel	KINYANA - KIGABIRO				
5. MUZERWA Jérémie	"	"		Umuyobozi w'Umudugudu	
6. NYIRASAFARI Veneranda	"	"			
7. NUMUKOBWA Madonna	"	"	2		
8. NTEZIYAREMYE Innocent	"	"			
9. NYIRABUKEYE Bonaventure	"	"			
10. MUKAZIKEYE Vénantie	"	"			
11. IGIRUKWAYO J. Paul	"	"			
12. NIYONSENGA Alphonse	"	"			
13. RWAKANA Jolandi	"	"			
14. NTIBIMENYA Jhon	"	"			
15. NYIRANGENDAHIMANA Florence	"	"			
16. HABANABAKIZE Thomas	"	"			
17. UWITEGE Aroma	"	"			
18. ABIRABURA Bonaventure	"	"			Borne
19. BAVUGE Marie	"	"			
20. NZEYIMANA Venuste	"	"	2		
21. MUKANKUBANA	"				

PUBLIC CONSULTATION LIST FOR
THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION
NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date
1. NIYOTWIZEYE Vincent	Ndera/Kagyinya Gasabo Rudashya			le 21/07/2017.
2. MUKATWARANGWA Isabelle	Gasabo Ndera Rudashya Kagyinyaga			"
3. MAKARA EDIGALD	GASABO NDERA RUHANGARE			"
4. Mukarukaizwa Consolée	Ruhogo			"
5. Karasira Innocent	Ruhangare			
6. Ayirwanda Eugène	Ruhangare			
7. Nyiraneza Juliene	Ruhangare			
8. Bazubagira Marianne	Ruhangare			
9. Kabalisi J. de Dieu	Ruhangare			
10. Kayijuka Claude	Ruhangare			
11. Nsengimana Faustin	Ruhangare			
12 GASANA Donatien	Rudashya			
13. Nyiramuhire Josée	Ruhangare			
14. Mukandalisi Jeanne	Ruhangare			→ Born
15. Mukakabaye Stéphanie	Ruhangare			
16 Batamuliza Spécial	Ruhangare			→ Bo
17.				

PUBLIC CONSULTATION LIST FOR
THE PROJECT FOR IMPROVEMENT OF SUBSTATIONS AND DISTRIBUTION
NETWORK PHASE 3 IN RWANDA

Izina/Names	Aho ubarizwa/ Institution	Contact/ telephone	Signature	Date	
1 Butera nzi ferdinand	Chef de zone [illegible] Mudu		[signature]	Le 20/07/2017	
2. NSENGIYUMVA Bonitace	MUKUYU, JUNWE		[signature]	KIRFUYA	BORNE
			[signature]	——	BORNE
3. IYAMUREMYE JV.	——		53 [signature]		
4. KARANGWA Tenecien	——		[signature]		
5. NSENGIYUMVA J.D	——		[signature]	——	BORNE
6. NYIRAHABIMANA Char	——		1 [signature]		
6. NYIRINGIRA MAMINA	——		2 [signature]		

ENERGY DEVELOPMENT CORPORATION LIMITED

Date: 22 FEB 2018

Ref: N° 11.023/6750/18/MD-EDCL/FG/Pny

ECO-Excellence

I Consultancy I LTD I

Tel. 0788356191

Email: mapetule1@gmail.com

Dear Sir,

Subject: Approval of the final Abbreviated Resettlement Action Plan (ARAP) reports-

JICA PHASE III

Reference is made to ongoing study for the Improvement of substations and distribution network, phase III comprising of 15KV Distribution lines (New Gasogi substation-Nyagasambu and New Gasogi substation-Masaka hospital) and 110KV Transmission line (Jabana Substation –Birembo substation) project.

Reference is also made to your letter ref. no EEC/09/018 dated on 9th February 2018 submitting the final ARAP reports of the project above.

We hereby, acknowledge receipt of your revised ARAP reports for 110KV Transmission Line (Jabana-Birembo substations) and 15KV Distribution line (New Gasogi substation –Nyagasambu and New Gasogi substation-Masaka hospital) and we found that all our comments were taken into consideration.

We, are therefore glad to inform you that the documents are approved.

Best regards,

ENERGY DEVELOPMENT CORPORATION Ltd
EDCL
ENERGY DEVELOPMENT CORPORATION LIMITED
EDCL

Felix GAKUBA

Managing Director

CC: -Chief Executive Officer of REG

-ERM JAPAN Ltd