The Republic of the Union of Myanmar
Ministry of Electricity and Energy

Preparatory Survey
on
National Power Transmission Network
Development Project Phase III

Final Report
Pre-release Version

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Japan International Cooperation Agency (JICA)

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Contents

Abbreviation List

AC	Alternative Current
ACSR	Aluminum Conductors Steel Reinforced
ADB	Asian Development Bank
AIS	Air Insulated Switchgear
ANSI	American National Standards Institute
APs	Affected persons
AQ	Air Quality
ARAP	Abbreviated Resettlement Action Plan
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
BOQ	Bill of quantities
BOT	Build-operate-transfer
BS	British Standards
BTNMT	Bộ Tài nguyên và Môi trường
˚C	degree Celsius
CB	Circuit Breaker
CBEs	Commercial and Business Enterprises
CFMC	Central Farmland Management Committee
CHS	Community Health and Safety
CIF	Cost, Insurance and Freight
CLS	Closure Stage
COD	Chemical Oxygen Demand
CS	Construction Stage
CT	Current Transformer
CVT	Capacitor Voltage Transformer
dB	decibel
DC	Direct Current
DDMMYY	Date, Month, Year
DEPP	Department of Electric Power Planning
DFMC	District Farm Land Management Committee
DGSME	Department of Geological Survey and Mineral
DHPI	Department of Hydropower Implementation
DM	Department of Mines
DMS	Detailed Measurement Survey
DPTSC	Department of Power Transmission and System Control
DS	Disconnecting Switch
DUHD	Department of Urban & Housing Development
DZGD	Dry Zone Greening Department
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EDS	Every Day Stress
EHS	General Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIAP	Environmental Impact Assessment Procedure
EIRR	Economic Interest Rate of Return

EMF	Electromagnetic fields
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
ENAA	Engineering Advancement Association of Japan
EPA	Environmental Protection Agency
EPGE	Electric Power Generation Enterprise
ES	Earthing Switch
ESE	Electric Supply Enterprise
FD	Forest Department
FIDIC	International Federation of Consulting Engineers
FIRR	Financial Interest Rate of Return
FMC	Farmland Management Committee
FS	Feasibility Study
GAD	General Administration Department
GCB	Gas Circuit Breaker
GDP	Gross Domestic Product
GFC	Grievance Focal Person
GIB	Gas-insulated busbars
GIS	Gas-insulated switchgear
GL	Guidelines
GPa	giga pascal
GPS	Global Positioning System
GRMC	Grievance Management Committee
GRS	Grievance Redress System
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HH	Household
HIV	Human Immunodeficiency Virus
HLT	Hlaingtayar
HV	High Voltage
Hz	Hertz
IACS	International annealed copper standard
ICB	International Competetive Bidding
ID	Identification
IEC	International Electrotechnical Commission
IEE	Initial Environmental Examination
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
IPP	Indepent Power Producer
JEC	Japanese Electrotechnical Committee
JEM	Japan Electrical Manufacturers Association
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standards
JPY	Japanese yen
JV	joint venture
kN	kilo newton
kV	kilo volt

kVA	kilo volt-ampere
kWh	kilo watt-hour
LA	Land Acquisition
LAeq	Equivalent continuous A-weighted sound pressure Level
LL	Low Loss
LNG	Liquid Natural Gas
Ltd	Limited
Mbit	mega bit
MCB	Myanmar Central Belt
MCM	mega circular mil
Mdy	Mandalay
ME	Mining Enterprise
MEPE	Myanma Electric Power Enterprise
MESC	Mandalay Electricity Supply Corporation
MGE	Myanmar Gems Enterprise
MJTD	Myanmar Japan Thilawa Development Ltd.
MKI	Myanmar KOEI
MMK	Myanmar KYAT
MO	Ministry Office
MOC	Ministry of Construction
MOECAF	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electricity and Energy
MOGE	Myanmar Oil and Gas Enterprise
MOM	Minute of Meeting
MONREC	Ministry of Natural Resources and Environmental Conservation
MOU	Minutes of Understanding
MP	Master Plan
MPE	Myanmar Pearl Enterprise
MPN	Most Probable Number
MPPE	Myanmar Petroleum Product Enterpris
MUSD	million US dollar
MVA	mega volt-ampere
MVar	mega Var
MW	mega watt
MYA	Myanmar Central Belt
NCC	National Control Center
NEDA	Thai Neighboring Countries Economic Development Cooperation Agency
NEDO	New Energy and Industrial Technology Development Organization
NEP	National Electrification Plan
NEQG	National Environmental Quality (Emission) Guidelines
NGO	non-governmental organizations
NPT	Naypyidaw
NV	Noise and Vibration
NW	northwest
ODA	Official Development Assistance
ODF	optical distribution frame
OGPD	Oil and Gas Planning Department
OH	Overhead

OHS	Occupational Health and Safety
OHTL	Overhead Transmission Line
OLTC	On Load Tap Changer
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
OP	Optocal fibre composite overhead ground wire
OPGW	Optocal fibre composite overhead ground wire
OS	Operation Stage
P2	MY-P2 Project
P8	MY-P8 Project
P14	MY-P14 Project
PAHs	Project Affected Households
PAP	Project Affected Persons
PAUs	Project Affected Units
PCB	polychlorinated biphenyl
PCM	Public Consultation Meetings
PFP	POLYCON FRP Pipe
pH	power of hydrogen
PIB	Project Implementation Branch
PLC	Power Line Carrier
PM	Particulate matter
PM10	Particulate matter (a diameter of 10 micrometers or less)
PM2.5	Particulate matter (a diameter of 2.5 micrometers or less)
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PSD	Power System Department
PTP	Power Transmission Project
PTPO	Power Transmission Project Office
PYG	Pharyargyi
QCVN	Quy chuẩn kỹ thuật
RAP	Resettlement Action Plan
ROW	Right of Way
SA	Surge Arrester
SAS	Substation Automation System
SBD	Standard Bidding Documents
SCADA	Supervisory Control And Data Acquisition
SDMTE	Survey Department & Myanmar Timber Enterprise
SEZ	Special Economic Zone
SF6	sulfur hexafluoride
SGRT	Site Grievance Redress Team
SIL	Surge Impedance Load
SIWV	Switching Impulse Withstand Voltage
SLRD	Settlement and Land Record Department
SQ	square
SS	substation
ST	steam turbine
STM	Synchronous Transfer Mode
TDC	Township Development Committee

TEPCO	Tokyo Electric Power Company
TFMC	Township Farmland Management Committee
TJ	terra Jule
TL	Transmission Line
TLRD	Township Land Records Department
TN	Total Nitrogen
TOR	Terms of Reference
TP	Total Phosphorus
TSS	Total Suspended Solids
TW	Trapezoid shaped wire
UFES	University of Forestry and Environmental Science
UG	Underground
UGTL	Underground Transmission Line
UMO	Union Minister Office
UNFCCC	United Nations Framework Convention on Climate Change
UREC	Union Resources & Engineering Co.,Ltd.
US	United States
USD	United States dollar
UTS	Ultimate Tensile Strength
VAT	Value Added Tax
VFV	Vacant, Fallow and Virgin Land
VT	Votage Transformer
W	Watt
WB	World Bank
WQ	Water Quality
XLPE	cross-liked polyethylene cable
YCDC	Yangon City Developmemnt Committee
YESC	Yangon Electricity Supply Corporation

1. Background and Appropriateness of the Project

1.1. Outline of the Survey

The power supply is unstable in Yangon, the largest power demand center in Myanmar, due to its insufficient power supply network system. It is estimated that the loads of transmission lines exceed the limits of their capacities in some sections, and that the aging transmission lines and substation facilities are at a high risk of failure. In order to improve the situation, JICA has been gradually supporting the development of the 500 kV backbone transmission system in the "National Power Transmission Network Development Project". Stabilization of the power supply through improvement of the backbone systems in Yangon, where power demand is expected to increase, is essential for the economic development of Myanmar, even after the installation of backbone transmission lines via these projects. The necessary surveys will be conducted in order to carry out the project and help improve the situation, as part of Japan's loan assistance projects.

The table below shows an outline of the expected project, and its scope is shown in the figure below.

Project name	National Power Transmission Network Development Project (Phase III)
Purpose of the Project	In the Yangon area, the power supply capacity will be improved by installing and strengthening backbone transmission lines and substation facilities, thereby contributing to the economic development of Myanmar and an improvement of people's lives.
Project Outline	・Installation of 500 kV/230 kV Substation Facilities ・Strengthening 230 kV/33 kV/11 kV Substation Facilities (Candidate sites are expected to be Pharyargyii substation (500 kV/230 kV), East Dagon Substation (500 kV/230 kV), and Hlawga Substation (230 kV/33 kV/11 kV)) ・500 kV Transmission Lines ・230 kV Transmission Lines (Construction sites are expected to be between Pharyargyii and East Dagon (500 kV overhead lines), and between East Dagon and Hlawga (230 kV overhead lines with partial underground lines))
Relevant organizations/ Implementation organizations	The expected implementation organization for this Project is the Department of Power Transmission and System Control (DPTSC), Ministry of Electricity and Energy (MOEE): Project implementation, operation and maintenance, power system planning for the transmission lines and substations above 132 kV.
	Department of Electric Power Planning (DEPP), Ministry of Electricity and Energy (MOEE): Taking a leading role in project investigation and appraisal of the feasibility of the project, formulating the Master Plan, coordinating the respective expansion plans for power generation, transmission and distribution in Myanmar, planning for bilateral cooperation with International Organizations, etc.

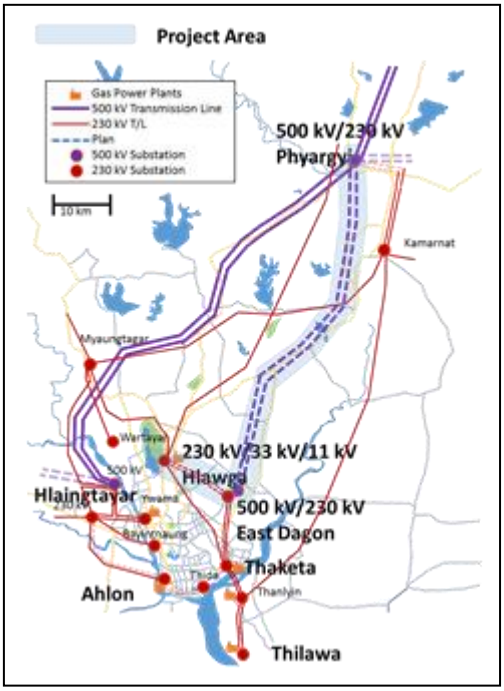


Figure 1.1-1 Project Outline and Area

This project is to construct a 500 kV transmission line and substation, and 230 kV transmission lines to supply power received from power sources in the north or southeast of Myanmar to the system to the east of Yangon City.

In this survey, an outline design and feasibility study (F/S) for the project will be conducted, and the project costs, project implementation structure, operation and maintenance management system, environmental and social considerations etc. will be examined. The purpose of this project is to conduct the surveys necessary for an examination to consider the implementation of a Japanese loan assistance project.

The study was conducted with the following points in mind.

・At the time of the Phase I and II FS surveys, there were no design examples for the 500 kV

transmission lines, and it was difficult to set and explain their design conditions. For this reason, for the first 230 kV underground line, the contents of the explanation and the materials were thoroughly examined, and discussions were held with DTPSC to avoid redoing work.

・Geological surveys conducted by a subcontractor are important for transmission line route selection and cost calculations, and it is necessary for the executing company to be able to cooperate with DTPSC at all times. In this project, we incorporated such conditions into the specifications and selected the most appropriate subcontractor.

・Construction related to the 500 kV transmission line, with support from Serbia, has been completed for the tower, and the wires are being connected. The construction is expected to be completed shortly.

・Compatibility with MP

According to the JICA Master Plan, three 500 kV substations will be required around Yangon by 2030. In addition to Payaji and Rheinthaya, which are under construction, boosting the Loga substation to a 500 kV substation is illustrated. However, DPTSC indicated that it was difficult to extend the 500 kV transmission line to the Loga substation in terms of the surrounding environment. Therefore, in this study, the 500 kV substation around East Dagon is planned to be installed as the third 500 kV substation, and the 230 kV transmission line is to be constructed from the new 500 kV substation at Loga and East Dagon substation.

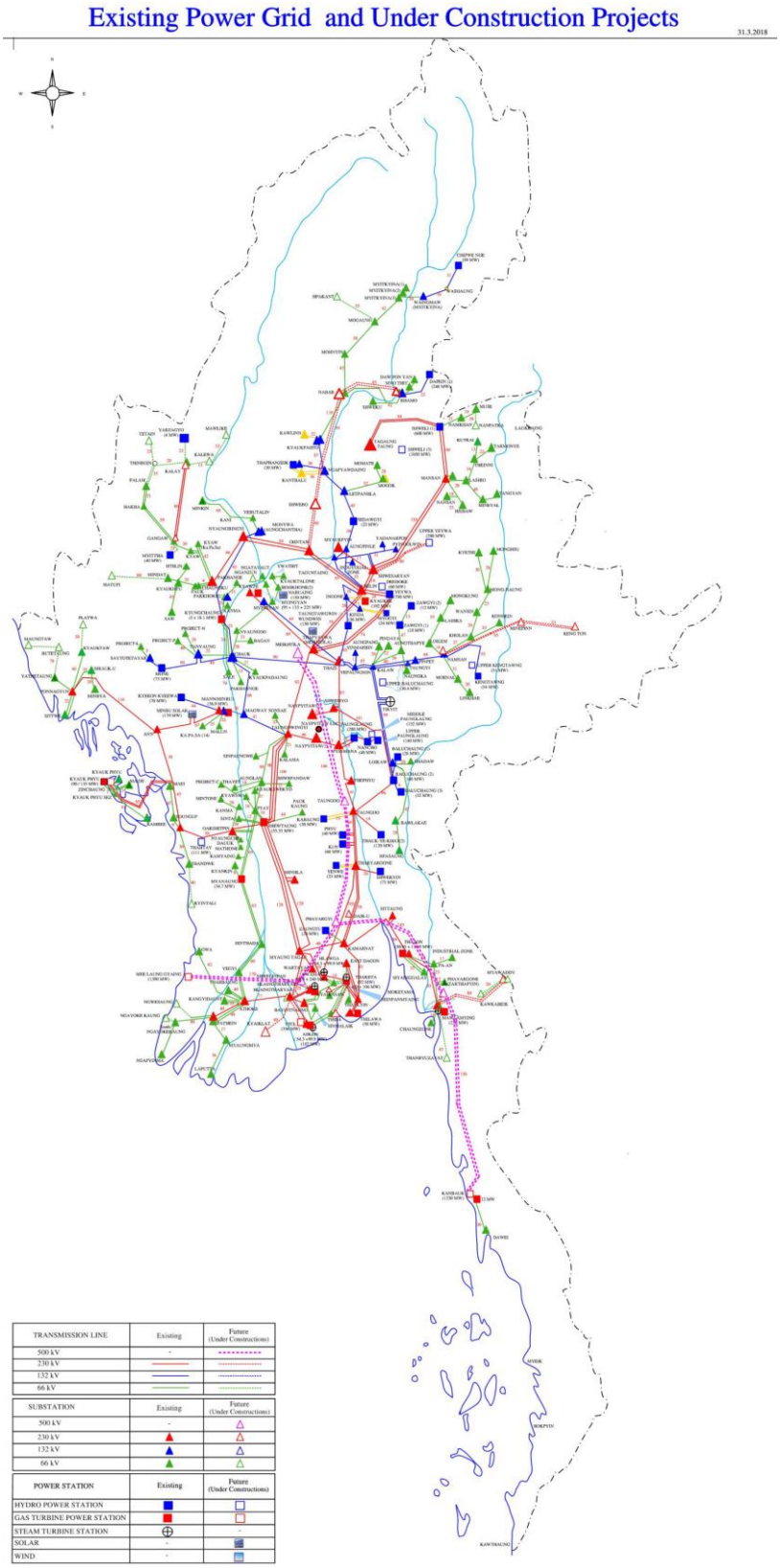


Figure 1.1-2 Power Grid in Myanmar (November 2018)

Source: Data from DPTSC

1.2. Power Demand Records

As per the data released by the MOEE at the ADB meeting[1] in November 2019, the actual peak demand in Myanmar is shown in the table below: 2,497 MW in 2015 and 3,798 MW in 2019.

Table 1.2-1 Maximum Power Demand Records in Myanmar

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Peak Load (MW)	1,129	1,371	1,588	1,790	1,969	2,102	2,497	2,802	3,189	3,586	3,798

Source: Data from MOEE

According to the Project for Capacity Development of Power Sector Development Planning (December 2017), the total maximum power demand in Myanmar in 2015 was 2,437 MW, and the maximum power demand in Yangon was 1,096 MW in 2015, accounting for 45% of the total for Myanmar.

The maximum power demand in 2019 increased by about 50% compared to 2015. Increasing at this rate, Myanmar's peak power demand in 2020 is expected to exceed 4,000 MW. Power demand in Yangon is expected to be around 2,000 MW by 2020.

Table 1.2-2 shows the maximum load of the 66 kV and 33 kV systems in Hlawga, Ahlone, Thaketa and Ywama in Yangon City from 2018 to 2019. The total maximum load of these four substations was about 1,150 MW. Since the load for each substation records the maximum load on the 66 kV and 33 kV distribution lines during a particular month or day, there is a difference between the total maximum load and the overall maximum load. There is isochronous separation. Therefore, the maximum value of the load for the entire four substations is smaller than this value. Generators are installed at the four substations.

In addition to the above four substations, the 230 kV substations in Yangon include 230 kV/66 kV Bayintnaung, 230 kV/66 kV East Dagon, 230 kV/33 kV Hlaingtharyar, 230 kV/33 kV Kamarnat, 230 kV/33 kV Myaungdagar, 230 kV/ 33 kV Thanlyin, 230 kV/33 kV Wartayar, and 230 kV Thilawa.

According to MOEE, the peak power demand in Yangon City was around 1,500 MW in 2019.

[1] RPTCC (Regional Power Trade Coordination Committee) 26, Hanoi, 27/11/2019

Table 1.2-2 Maximum Load Records for 66 kV and 33 kV Systems at Four Substations in Yangon city - Hlawga, Ahlone, Thaketa and Ywama - from 2018 to 2019

Hlawga		MW		MW	**Thaketa**	5/2019	MW		MW
	Hlaing Thar Yar (2)	26.4	GT-1	27.0		Thida (1)	52.0	GT-1	13.0
	Ywama Ba	25.0	GT-2	28.0		Thida (2)	54.0	GT-3	11.0
33 kV	Ywama Bb	25.2	MCP-1	23.6		Seinpanmyaing (1)	34.0	UETP GT	75.6
Bus A	Coca Cola	4.0				Seinpanmyaing (2)	34.0		
	Mayangone Aa	16.0			66 kV Bus	Dagon(S)	25.0	Max Power	50.9
	Mayangone Ab	15.2				Pathein Nyunt	34.0		
	Hlaing Thar Yar (1)	22.7				Kyaitkasan	50.0	UETP ST	37.2
	Myawady	0.3	STG	22.0		Dagon(E)	26.0		
	Hlaegu	22.6	MCP	27.3		Pathein Nyunt	32.0		
	Shwepyithar	20.0				MOGE	27.0		
	Ahtayu	5.9			33 kV	Myaintawtha	22.0		
	Pale	16.5				Dagon(S)	26.0		
33 kV	14th Mile	13.3				Dagon(N)	19.0		
Bus B	????	9.6					**435.0**		**187.7**
	Swe Lin Ban	9.6			**Ahlone**	Sep3rd/2019	MW		MW
	Pale(1)	28.5				Thida (1)	24.0	GT-2	48.0
	Kyetphyukan	8.2				Thida (2)	24.0	STG	25.0
	Station	0.1			66 kV Bus-	Ba Yint Noung (Stanc	0.0		
	Pale(2)	21.7			A	MRTV-3	40.1		
66 kV	Ywama Steel Mill	-				STG	0.0		
		290.8		**127.9**		Spare Feeder	0.0		
Ywama	5/2019	MW		MW		Myanma Railway	22.5	GT-1 (Stand by)	47.0
66 kV	Bayintnaung	49.0	John Brown GT-1	34.3		Mawtin	22.1		
	Seinpanmyaing	51.2	John Brown GT-2	34.3		Sin Ma Like	27.3		
	Hlawga-Ywama Ba	11.9	YPS-3	4.6	66 kV Bus-	MEC	0.2		
	Hlawga-Ywama Bb	16.7			B	Hone Hine	11.4		
	RIR-2	8.6				Hospital Complex (1)	2.1		
	Myangone	10.0				Hospital Complex (2)	14.5		
33 kV	Phan Chat	2.3			33 kV Bus	Hone Hine (1)	60.0		100.0
	RIR(1+3)	5.6			(66 kV	Hone Hine (2)			
	Danyingone	14.3			Bus-A)	17.79+16.77 including GT-1,2,3(33.3 MWx3) and its load			
	RIR(4)	4.5					**248.1**		**220.0**
	10 MVA Station Transfor	0.9			**Total**		**1,151.3**		**608.7**
	YPS-3	2.3							
		177.4		**73.2**					

The date in the table is approximately the time when the maximum load occurred and the time when the data was recorded. However, the recording time at Hlawga is unknown. Ahlone's Hone Hine is an estimate.

1.3. Power Demand Forecast for Yangon

In the Project for Capacity Development of Power Sector Development Planning (December 2017), the maximum power demand forecast is assumed for each scenario from a macro analysis based on the GDP growth rate. The maximum power demand in Myanmar in 2020 is estimated at 4,876 MW in the base case, which is slightly excessive in 2019.

Table 1.3-1 Forecast of Maximum Total Power Demand by Region in Myanmar (December 2017 Forecast)

Case	2020	2030
High Case	5,165 MW	14,834 MW
Base Case	4,876 MW	12,611 MW

Source: The Project for Capacity Development of Power Sector Development Planning, December 2017

Table 1.3-2 Forecast of Maximum Total Power Demand by Region in Myanmar (December 2017 Forecast)

Case	2020	2030
High Case	2,322 MW	6,669 MW
Base Case	2,192 MW	5,670 MW

(Source: The Project for Capacity Development of Power Sector Development Planning, December 2017)

In the report for the JICA Data Collection Survey on Urban Area Distribution Network Development, Sep. 2018 (JICA Distribution Network Improvement Plan), the estimated maximum power demand for Yangon City by YESC was as follows. The values for later years are larger than the above forecasts.

Table 1.3-3 Assumed Maximum Power Demand in Yangon City by YESC

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Demand (MW)	1,339.1	1620.6	1930.3	2269.4	2630.7	3015.7	3546.5	4170.6	4904.7	5767.9	6783

Source: JICA Data Collection Survey on Urban Area Distribution Network Development, Final Report, Sep. 2018

In this study, based on the above-mentioned power demand results and assumptions, the following method was used to estimate the maximum demand for substations in Yangon City.

- Maximum Power Demand in 2020
  - The maximum loads of Hlawga 33 kV, Ywama, Thaketa and Ahone are 10% higher than the maximum loads of the four substations in 2018-2019.
  - The maximum loads of the 66 kV systems for Hlawga, Bayintnaoung and East Dagon were estimated by extrapolating the expected value of the JICA Data Collection Survey on Urban Area Distribution Network Development.
  - Maximum loads of the 33 kV systems for Ahlone, Hlaingtharyar, Kamarnat, Myaungdagar, Thnlyin, and Wartayar were estimated from the 2014 survey results.
- Maximum Power Demand in 2024
  - The maximum load of the 66 kV systems was assumed by extrapolating the expected value of the JICA distribution network rehabilitation plan.
  - The maximum load of the 33 kV systems was assumed based on the results of the 2014 survey.
- Maximum Power Demand in 2027
  - The maximum load of the 66 kV systems was assumed by extrapolating the expected value of the JICA distribution network rehabilitation plan.
  - The maximum load of the 33 kV systems is assumed in the same way as in 2024.
- Maximum Power Demand in 2030
  - The maximum load of the 66 kV systems was assumed by extrapolating the expected value of the JICA distribution network rehabilitation plan.
  - The maximum load of the 33 kV systems is assumed in the same way as in 2027.

The results are shown in the following table. The maximum power demand in Yangon will be around 2,070 MW in 2020, 4,170 MW in 2024, 5,700 MW in 2027, and 7,710 MW in 2030.

Table 1.3-4 Maximum Power Demand Forecast in Yangon

(MW)	2020		2024		2025		2027		2030	
	66 kV	33 kV	66 kV	33 kV	66 kV	33 kV	66 kV	33 kV	66 kV	33 kV
Hlawga	75.4	319.9	146.6	265.6	162.6	294.7	200.2	362.7	273.4	495.4
Ywama	110.3	84.9	88.3	18.0	98.0	20.0	120.6	24.6	164.7	33.6
Bayintnaung	165.3	-	343.0	-	380.5	0.0	468.4	-	639.7	-
Dagon E	119.3	-	130.8	-	145.1	0.0	178.6	-	243.9	-
New E. Dagon	-	0.0	130.8	0.0	145.1	0.0	178.6	0.0	243.9	0.0
Thaketa	339.9	138.6	361.3	109.1	400.8	121.0	493.4	149.0	673.9	203.4
Thuwanna	-	-	118.5	-	131.5	0.0	161.9	-	221.1	-
S.Okkalapa	-	-	195.0	-	216.3	0.0	266.3	-	363.7	-
Thida	-	-	271.6	-	301.3	0.0	370.9	-	506.6	-
Ahlone	206.9	121.0	226.6	110.0	251.4	122.1	309.5	150.3	422.7	205.2
Kyaik Ka San	-	-	171.0	-	189.8	0.0	233.6	-	319.0	-
Hlaingtharyar	-	119.0	-	274.1	0.0	304.1	-	374.3	-	511.2
West University	-	-	-	274.1	0.0	304.1	-	374.3	-	511.2
Kamarnat	-	38.2	-	175.8	0.0	195.1	-	240.1	-	327.9
Myaungdagar	-	74.0	-	341.0	0.0	378.3	-	465.7	-	636.0
Thanlyin	-	39.9	-	183.9	0.0	204.0	-	251.2	-	343.0
Wartayar	-	19.4	-	89.2	0.0	98.9	-	121.8	-	166.3
Thilawa	-	100.0	-	146.4	0.0	162.5	-	200.0	-	200.0
Total	1,017.1	1,054.9	2,183.4	1,987.2	2,422.5	2,204.7	2,982.0	2,713.9	4,072.6	3,633.4
		2,072.0		4,170.6		4,627.2		5,695.9		7,706.0

(Source: JICA Survey Team)

Various power demand forecasts were compared with the power demand forecasts in this survey. The estimated value this time is between the estimated value of the power development plan capacity improvement project (December 2017) and the estimated value of the JICA Data Collection Survey on Urban Area Distribution Network Development, Sep. 2018.

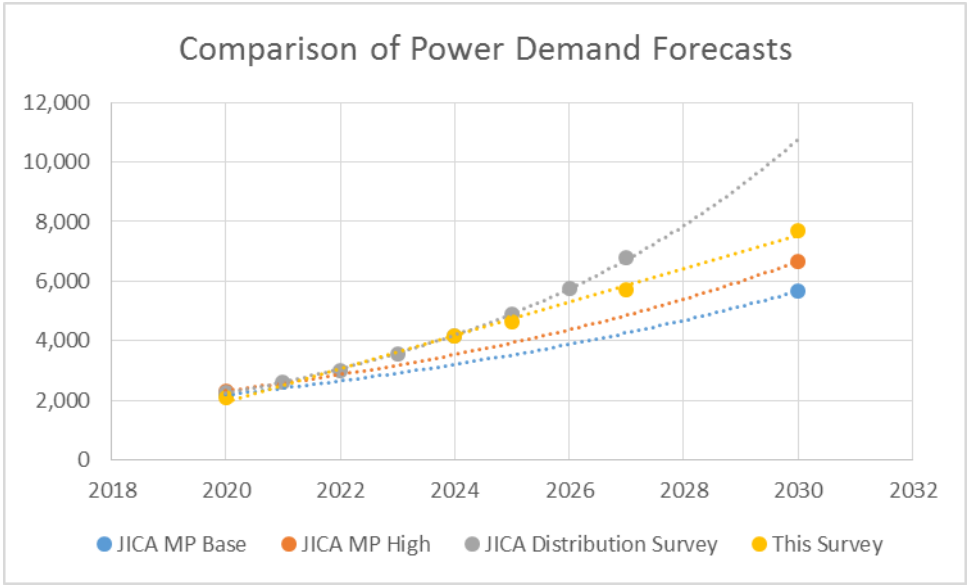


Figure 1.3-1 Comparison of Various Demand Forecasts and Demand Forecasts in This Survey

JICA MP: the Project for Capacity Development of Power Sector Development Planning (December 2017)
JICA Distribution Survey: JICA Data Collection Survey on Urban Area Distribution Network Development, Sep.2018 (demand forecast up to 2027)

1.4. Power Generation Plan in Yangon

The existing power plants in Myanmar are shown in Table 1.4-1. JV/BOT is for export.

Table 1.4-1 Existing Power Plants in Myanmar

No.	Power Station Name	Capacity (MW)	No.	Power Station Name	Capacity (MW)
Installation power of hydropower plants					**3,225**
State-owned power station					
1	Baluchaung (1)	28	13	Keng Taung	54
2	Baluchaung (2)	168	14	Yeywa	790
3	Kinda	56	15	Shwegyin	75
4	Sedawgyi	25	16	Kun	60
5	Zawgyi (1)	18	17	Kyeeon Kyeewa	74
6	Zawgyi (2)	12	18	Nancho	40
7	Zaungtu	20	19	Hpyauuhkyaungg	40
8	Thapanzeik	30	20	Upper Paunglaung	140
9	Mone	75	21	Myogyi	30
10	Paunglaung	280	22	Myittha	40
11	Yenwe	25	23	Rarj gyaoh	4
12	Kabaung	30			
JV/ BOT Power Station			**IPP/ BOT Power Station**		
24	Shweli (1)	600	27	Thauk-ye-khat (2)	120
25	Dapein (1)	240	28	Baluchaung (3)	52
26	Chpwinge	99			
Installation power of gas-fired power plants					**2,283**
State			STG		
1	Kyawannhkyaungg	54.3	1	Hlawga	54.3
2	Mann	36.9	2	Ywama nedo	9.4
3	Shwedaung	55.35	3	Ahlone	54.3
4	Myanaaung	34.7	4	Tharkheta	35
5	Sahtone	50.95	Rental		
6	Hlawga	99.9	1	Kyawwathpyauu (V Power)	90
7	Ywama	36.9	2	Myinnhkyaan (V Power)	133
	Ywama (NEDO)	24	3	Myinnhkyaan (V Power)	90
	Ywama (240)	240	4	Kyawwatsai (Powergen)	145.49
8	Ahlone	99.9			
9	Tharkheta	57	IPP		
10	Selawar	50	1	Ahlone (Toyo Thai)	94
Private			2	Hlawga (MCP)	50
1	Toyo Thai	27	3	Ywama (UPP)	50
2	Myanmar Lighting	78	4	Tharkheta (Max Power)	50
3	UREC	36	5	Myanmar Lighting	152
4	Sembcorp	82	6	Sembcorp	143
			7	UREC	70
Charging power of coal-fired power plant					**120**
1	Te kyit	120			
Installation Power of Solar Power Plant					**40**
1	Mainnbhuu	40			

(Source: Data from DPTSC)

The existing power generation facilities at Thaketa, Ahlone, Ywama and Hlawga in Yangon City are shown in the table below. Yangon City has an additional 50 MW gas-fired thermal power plant in Thilawa.

Table 1.4-2 Power Generation Facilities at Thaketa, Ahlone, Ywama and Hlawga in Yangon City

Tarkheta	MW	MVA		**Ywama**	MW	MVA
MOGE	9			GT1	18.45	25
MAX POWER	50			GT2	18.45	25
UREC	106			GT3	24	28.3
GT1	19	23.915		NEDO	9.4	
GT2	19	23.915		GT1	122	150
GT3	19	23.915		GT2	122	150
ST	35	43.625		MSP/GEPP	52	
Ahlone				**Hlawga**		
GT1	33.3	43.05	One Unit Stand By	GT1	34.86	43.575
GT2	33.3	43.05		GT2	34.86	43.575
GT3	33.3	43.05		GT3	34.86	43.575
ST	54.3	67.875		ST	54.3	67.875
GT1	47	58.75	Stand By	MCP(1)	26	
GT2	47	58.75		MCP(2)	27	

Source: Consulting Services for Urgent Rehabilitation and Upgrade Project Phase 1 Power System Analysis Report, 2016

The following table shows the power plants under construction in Myanmar. A total of 1,355.4 MW of hydropower plants is under construction, mainly in northern Myanmar. After the completion of the on-going 500 kV upgrade, it is expected that power will be transmitted to Yangon City via the 500 kV transmission line. Thahton gas-fired power station is located east of Yangon and north of Mawlamyine district. Minbu Solar is located about 120 km west of Nay Pyi Taw, Magway district, and Phase I 40 MW has already been completed.

Table 1.4-3 Power Plants under Construction in Myanmar

No.	Project	MW
Hydro		
1	Shweli (3)	671
2	Upper Yeywa	280
3	Middle Paunglaung	152
4	Upper Kyaingtaung	51
5	Upper Beluchaung	30.4
6	Thahtay	111
7	Deedoke	60
Gas		
8	Thahton	118.9
Renewable Energy		
9	Minbu	170

Note: Minbu Solar Project (40 MW, Phase 1) has been already completed.

Source: Data from DPTSC

The following emergency power sources were recruited in 2019. The emergency power sources in Yangon will be installed at Ahlone, Thanlyin and Thaketa. All assume a Take or Pay contract.

Table 1.4-4 Emergency Power Supply recruited in 2019

Name	Capacity	Fuel	Contract years	
Kyun Chaung	20 MW	(Gas) inland gas field (Magway Region)	5 years	
Ahlone	120 MW	(Gas) Tanada Gas Field	5 years	
Kyauk Phyu	150 MW	(LNG) Steel Mill IPP	5 years	
Thanlyin	350 MW	(LNG, land-based gas, barge, or other)	5 years	Connected to Thilawa
Thaketa	400 MW	(LNG)	5 years	
Total	1,040 MW			

There are other plans for around the city of Yangon, including thermal power in the Thilawa and Mawlamyine areas, as well as imports from Thailand, but none has been decided. Emergency power is planned to be recruited in 2020. In addition, there is a trend of building IPP power plants in Yangon City. The power supply plan for Yangon in this study is set as shown in the table below.

Table 1.4-5 Power Generation Plan in Yangon

The figures are in MW of power generation capacity.

	Existing		Emergency added 2020	Emergency added 2021	IPP New	Total
	State	IPP				
Tarkheta	92.0	165.0	400.0	0.0	500.0	1,157
Aholne	154.2	94.0	120.0	0.0	300.0	668
Seikkyi Khanaungto	0.0	0.0	0.0	300.0	0.0	300
Ywama	314.3	52.0	0.0	0.0	300.0	666
Hlawga	158.9	53.0	0.0	400.0	0.0	612
Thanlyin	0.0	0.0	350.0	0.0	0.0	350
Thilawa	0.0	50.0	0.0	0.0	350.0	400
East Dagon	0.0	0.0	0.0	200.0	0.0	200
Mee Linn Gyaing (500 kV)					1,390.0	1,390
Total	719.4	414.0	870.0	900.0	2,840.0	5,743

1.5. Power System Plans

1.5.1. Plans

(1) Existing System and MOEE Plan

The figure below shows the existing 230 kV system in Yangon City.

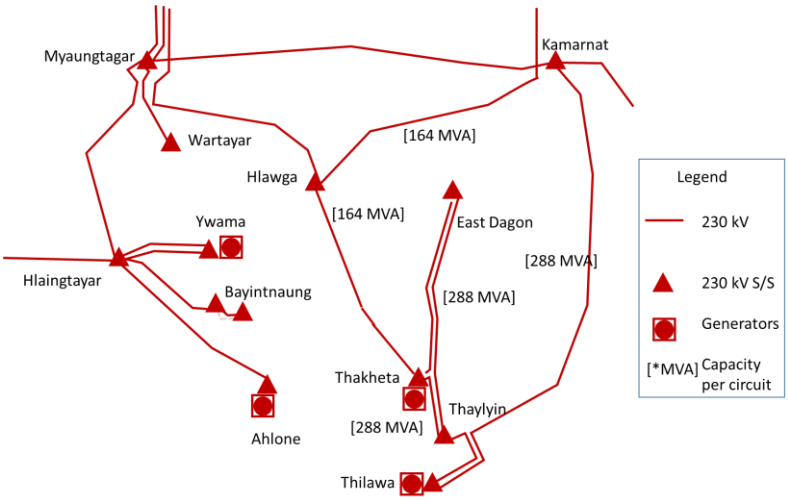


Figure 1.5-1 Existing 230 kV System in Yangon City (January 2020)

The 500 kV facilities are currently under construction in Phase I and II of the ODA loan project and they are not part of the existing grid. Most 230 kV transmission lines consist of one route and one circuit. East Dagon-Thaketa has a double circuit transmission line, but one circuit has not been serviced yet; both ends are open and not charged. The 230 kV line from the north through Hlawga to Thaketa, called the Lawpita Line, was constructed when the Baluchan hydropower plant started operation. At that time, the standard capacity of the transmission line was small, so the capacity per line of this transmission line was 164 MVA, which is smaller than the currently used standard capacity (288 MVA). Since the current 230 kV system does not have sufficient transmission capacity, there are sections where the capacity is insufficient during peak demand and sections where a large supply interruption is expected when one circuit of the transmission line is stopped.

There is no fixed plan for the development of the 500 kV and 230 kV power systems in Yangon City, but the general concept of the MOEE plan is as follows.

- Establish new 500 kV substations in the east and west of the city (West: Hlaingtayar, East: around East Dagon).
- 500 kV substations are supplied by 500 kV transmission lines from distant but economical power sources such as those in the north and southeast.
- The 230 kV transmission lines in Yangon city will consist of two circuits per route and will be supplied from the 500 kV substations east and west of the city.
- 230 kV transmission lines from the east-west 500 kV substations to the city are interconnected via several substations.
- Since there are many places where it is difficult to secure transmission line routes, transmission lines will be constructed along wide roads with relatively little traffic and existing transmission line routes.

(2) Status of Power Flow in 2020

The figure below shows the power flow of the 230 kV system in Yangon in 2020 in a situation where supply and demand are relatively severe without emergency power generators installed. Only the existing power sources were used in the city. The power flow of one 230 kV circuit from the north to Thaketa via Hlawga exceeds the capacity during peak power demand. For this reason, when no

emergency power generators are installed, there is a concern that the load on Yangon will be reduced during peak power demand.

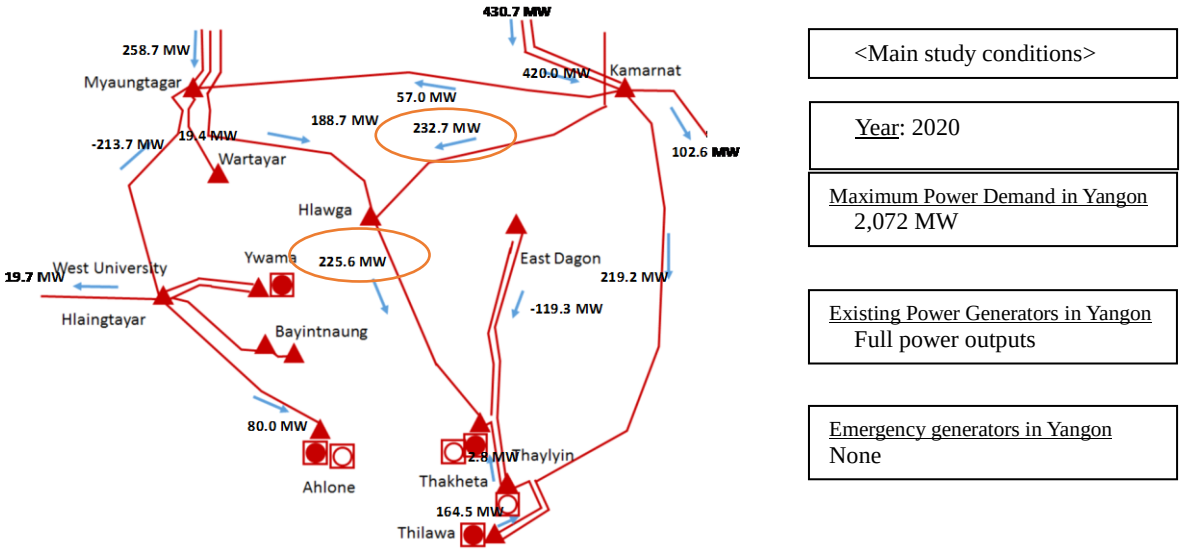


Figure 1.5-2 Power Flow in 2020 (Without Emergency Generators)

Figure 1.5-3 shows the expected power flow when the aforementioned emergency power supply is installed at the 230 kV substations - Ahn City. The power flows from Thaketa and Thanlyin to Hlawga and East Dagon, which in turn overloads the flow between Thaketa and Hlawga. The following measures can be considered to improve this situation.

1. Suppress output of emergency power supply

or

2. Increase the number of circuits between Thaketa and Hlawga

The power flow in each case is shown in Figure 1.5-4 and Figure 1.5-7. DPTSC has decided to implement the measures described in item 2 and plans to implement procurement in 2020.

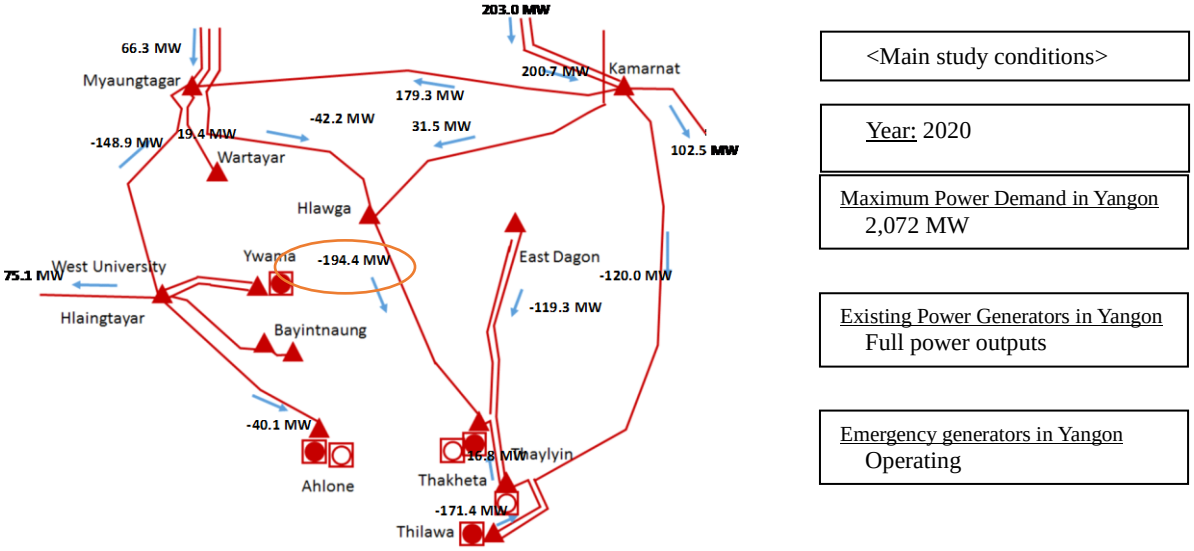


Figure 1.5-3 Power Flow in 2020 (With Emergency Generators)

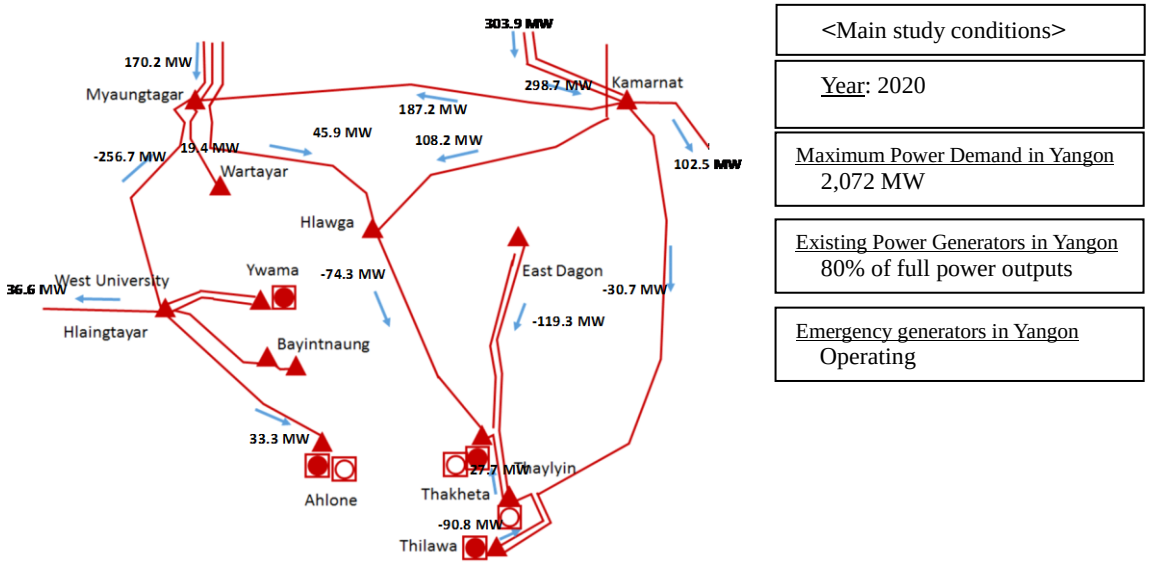


Figure 1.5-4 Power Flow in 2020 (With Emergency Generators and 80% of Full Power Outputs of Generators)

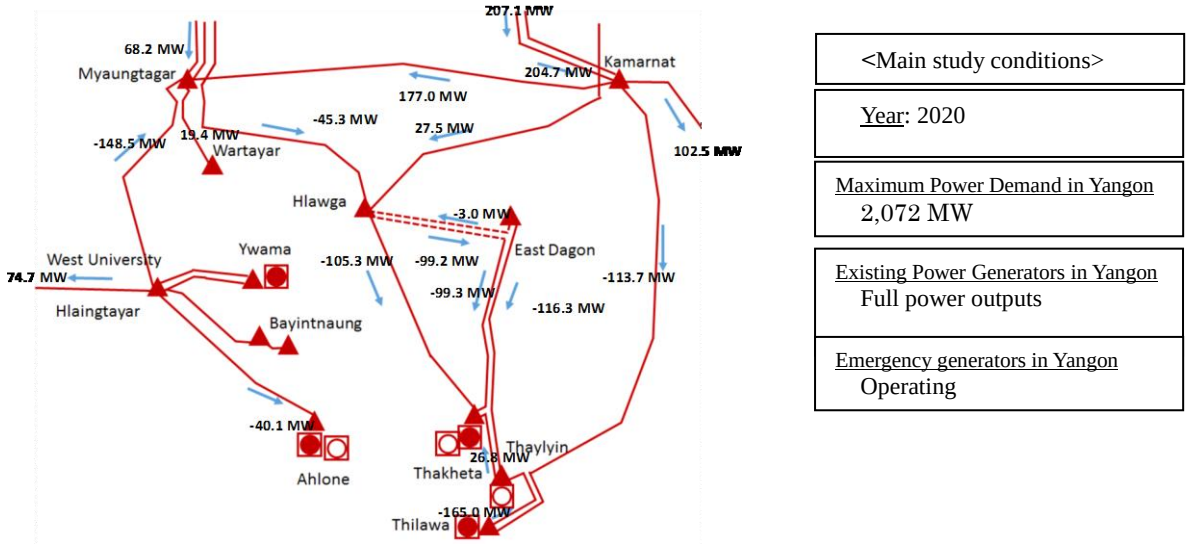


Figure 1.5-5 Power Flow in 2020 (With Emergency Generators and New Lines Hlawga-East Dagon)

(3) Status of Power Flow in 2025

Contractual operation of the emergency power generators is ongoing until 2025. Phase II has also been completed, and the Hlaingtayar-Watayar-Hlawga-East Dagon 230 kV double-circuit transmission line[2], which is currently undergoing preparations for bidding, will have been completed in order to secure the power flow from emergency power sources. Therefore, as shown in Figure 1.5-6, the power flow at the time of maximum demand is within the capacity of the transmission line even in the event of a single circuit fault if the emergency power generators are operated, so there are no problems.[3]

[2] Watayar-Hlawga-East Dagon 230 kV double circuits transmission line is via DPTSC's own funding.
[3] In the power flow calculation shown below, 230 kV transmission lines in the western part of Yangon, such as the Hlaingyayar-500 kV HTL transmission line, may be overloaded. This needs to be considered.

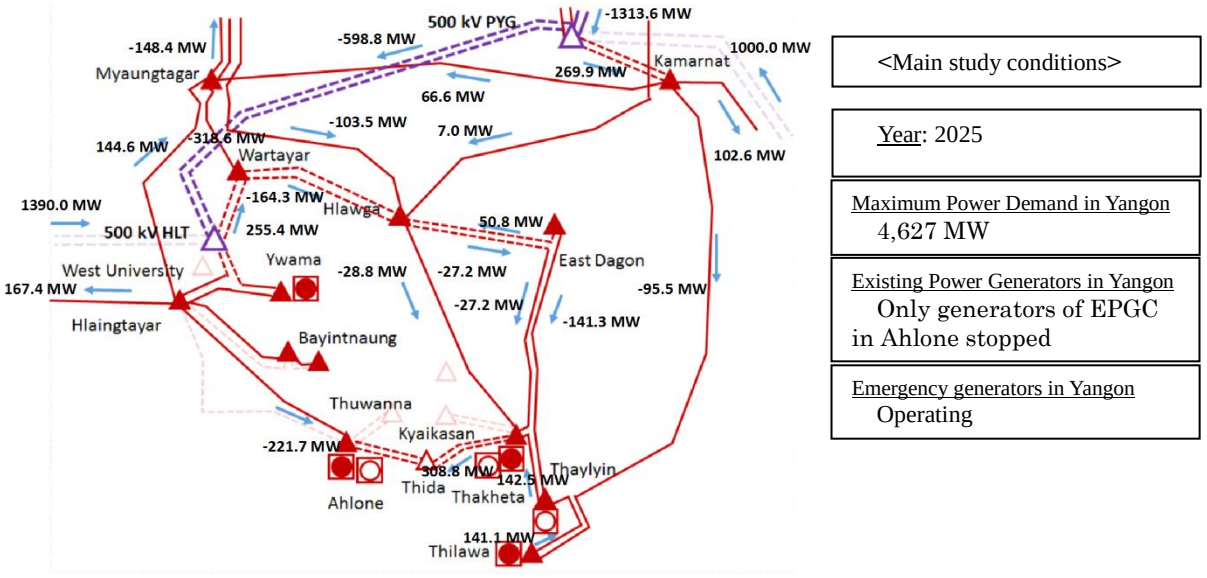


Figure 1.5-6 Power Flow in 2025 (With Emergency Generators; with Phase II and without Phase III)

However, the emergency power generators contracted in 2020 are supposed to operate until 2025, so it is more economical to abolish them in 2025 if a reliable and cheaper power supply can be realized. Figure 1.5-7 shows the power flow at the time of maximum power demand when the emergency power generators installed in 2020 are stopped in 2025. The power flow of the 500 kV Hlaingtayar-Wartayar from west to east is heavy, and the power flow of Hlawga-Thaketa exceeds the transmission line capacity. Therefore, in order to stop the emergency power generators and switch them to more economical power from the north, it is necessary to implement Phase III and increase the power supply to eastern Yangon City.

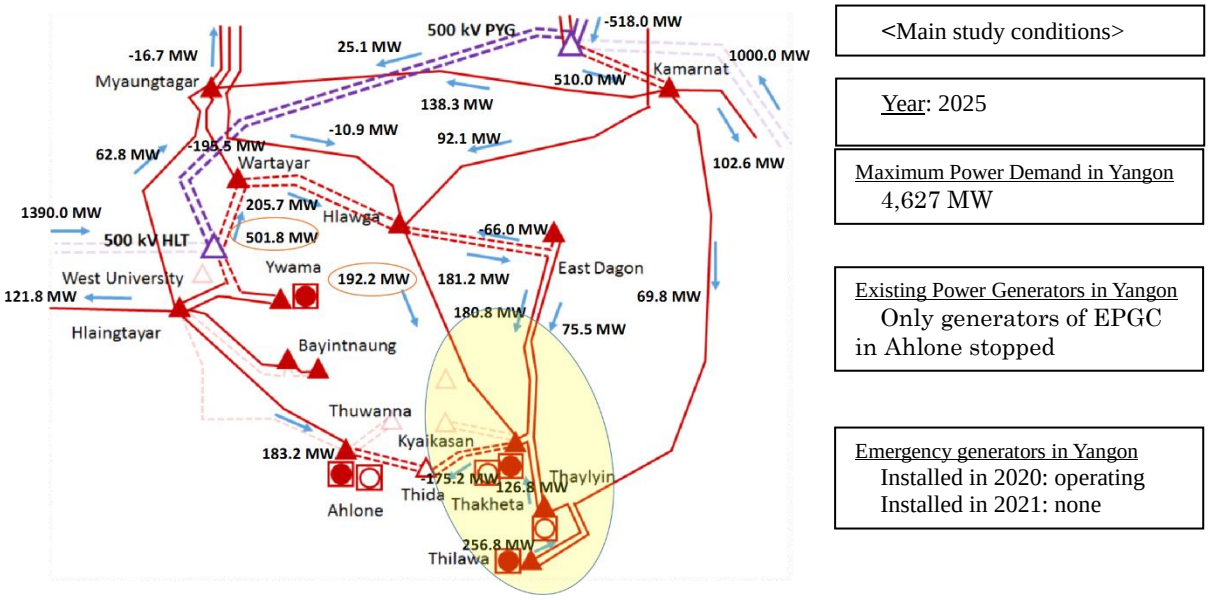


Figure 1.5-7 Power Flow in 2025 (Without Emergency Generators in 2020; with Emergency Generators in 2021 and without Phase III)

(4) Examination of the Scope of Phase III

As a measure to realize an efficient power supply from the outside to the eastern part of Yangon city, a new 500 kV substation will be constructed in the eastern part of Yangon city, and power will be

transmitted from the Payage substation, under construction in the northern part of Yangon city, using a 500 kV transmission line. Due to the large size of the 500 kV equipment, the land area is large, and no installation of buildings is usually allowed under transmission line land. Due to such restrictions, the 500 kV substation in the eastern part of Yangon City will be installed at a location away from the demand center area of Yangon City. For this reason, it is necessary to install 230 kV transmission lines from the 500 kV substation to the center of Yangon. The existing 230 kV substations, which are relatively close to the new 500 kV substation, are Hlawga and East Dagon.

Initially assumed scope:

- 500 kV Pharyargyi - New East Dagon Transmission Line
- 500 kV New East Dagon
- 230 kV New East Dagon – Hlawga
- 230 kV New East Dagon – East Dagon

Figure 1.5-8 shows the power flow around 2027 when only the initially assumed scope was implemented and the emergency power generators stopped. The power supplied from the 500 kV New East Dagon to the city of Yangon will increase, and the transmission line for New East Dagon – Hlawga and Hlawga-Thaketa will be overloaded.

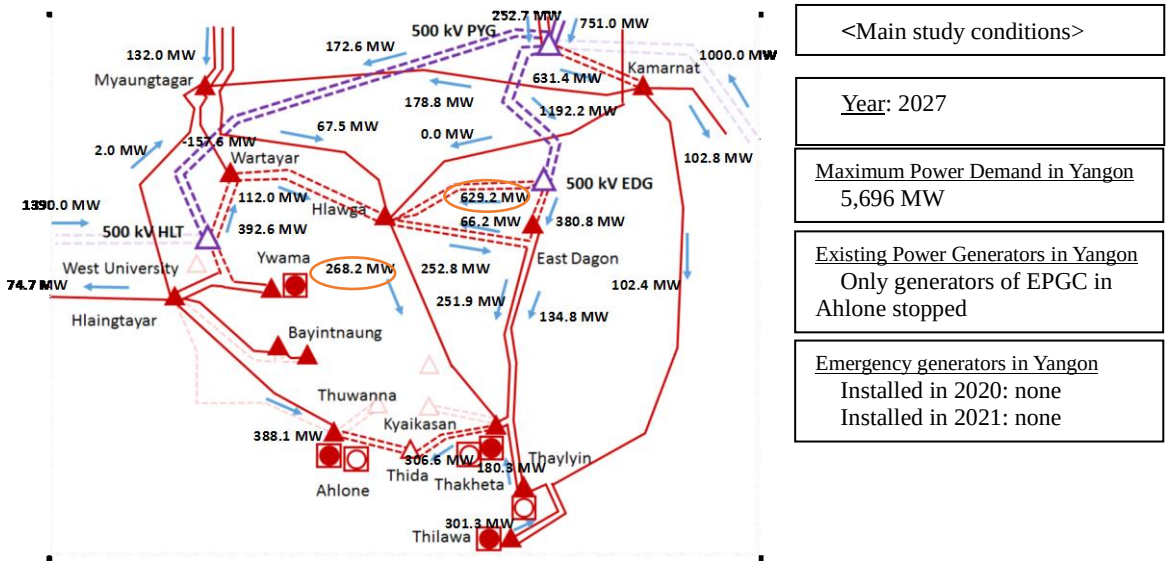


Figure 1.5-8 Power Flow in 2027 (Without Emergency Generators and with the Initially Assumed Scope)

As a countermeasure to eliminate overloading in these sections, it is conceivable to construct a 230 kV transmission line from the 500 kV Sar Ta Lin substation to Yangon city and increase the transmission capacity to Yangon city. The following two plans are considered.

A: A new two-line transmission line from 230 kV East Dagon to 230 kV South Okkalapa will be constructed.

B: Rebuild the existing 230 kV Lawpita line from the north to Thaketa via Hlawga, or use the route to construct a new double circuit transmission line.

Plans A and B, and the power flow charts when each is implemented, are shown below. In each case, the 230 kV power flow in eastern Yangon City is improved and no overloaded section occurs. Also, in a single circuit fault, the power flow was within the capacity of the transmission line. For this reason, the desired purpose can be achieved by adding plan A or plan B to the initial scope.

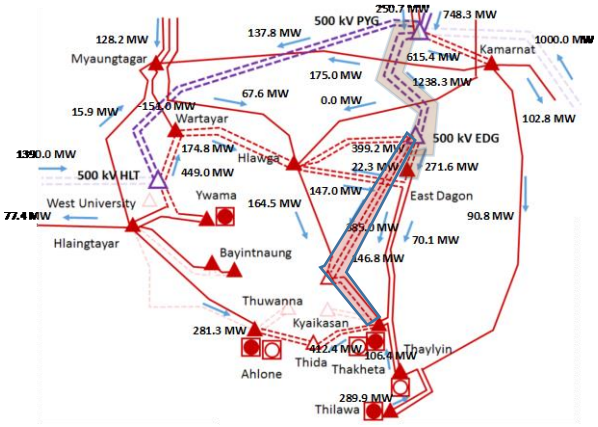


Figure 1.5-9 Power Flow in 2027 (With 230 kV transmission line from East Dagon-South Okkalapa (A))

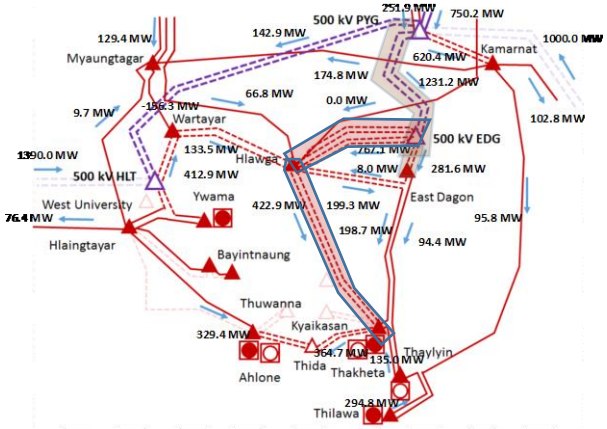


Figure 1.5-10 Power Flow in 2027 (Rebuilding the existing 230 kV Lawpita line from the north to Thaketa via Hlawga for new double circuits (B))

Concerns regarding plans A and B were as follows.

(Plan A)

DPTSC was concerned about the impact of the 230 kV East Dagon – South Okkalapa construction on the surrounding environment. The East Dagon-South Okkalapa section near South Okkalapa is a densely populated area and construction of overhead transmission lines is difficult. There is heavy traffic around South Okkalapa even at night, and the DPTSC was concerned about the impact on the surrounding environment when underground construction work is carried out on roads.

- Traffic jams during the construction period (there will be problems even if only one lane is stopped and construction is done only at night)
- Complaints from residents in the vicinity of the construction area
- Suspension of water and gas pipes, payment of compensation to related organizations

(Plan B)

There are plans to install new 230 kV transmission lines on the Sar Ta Lin - Hlawga - South Okkalapa - Thaketa route to introduce power from the 500 kV Sa Ta Lin into the city.

The transmission line will be constructed using the existing single circuit transmission line (Lawpita line). Depending on the method of construction, it is assumed that the Lawpita line will be shut down for a long time, which may cause power supply problems.

As a result of discussions with DPTSC, Plan B was adopted, and a new 230 kV four circuit line will be installed from 500 kV Sar Ta Lin to Hlawga. Power supply interruption caused by the suspension of the existing transmission line, which was a concern in Plan B, will be resolved by continuing operation without discontinuing the emergency power generators in five years. In addition, underground transmission lines will be used in part of the rebuilding section of the Lawpita line.

Summarizing the above results, it is recommended to set and implement the components of the Phase III project as follows. The new 500 kV substation was named the Sar Ta Lin substation. Hereinafter, this name is used.

- 500 kV double circuits: Pharyargyii - Sar Ta Lin
- 500 kV substation: Sar Ta Lin
- 230 kV double circuits: Sar Ta Lin – East Dagon
- 230 kV four circuits: Sar Ta Lin – Hlawga
- 230 kV double circuits: Hlawga – Thaketa (using the existing route of the 230 kV Lawpita line from Hlawga to Thaketa, new double circuits will be constructed.)
- 230 kV Hlawga GIS Bus
- 230 kV East Dagon GIS Expansion

The abovementioned proposed components were agreed between DPTSC and the Study Team on February 5, 2020.

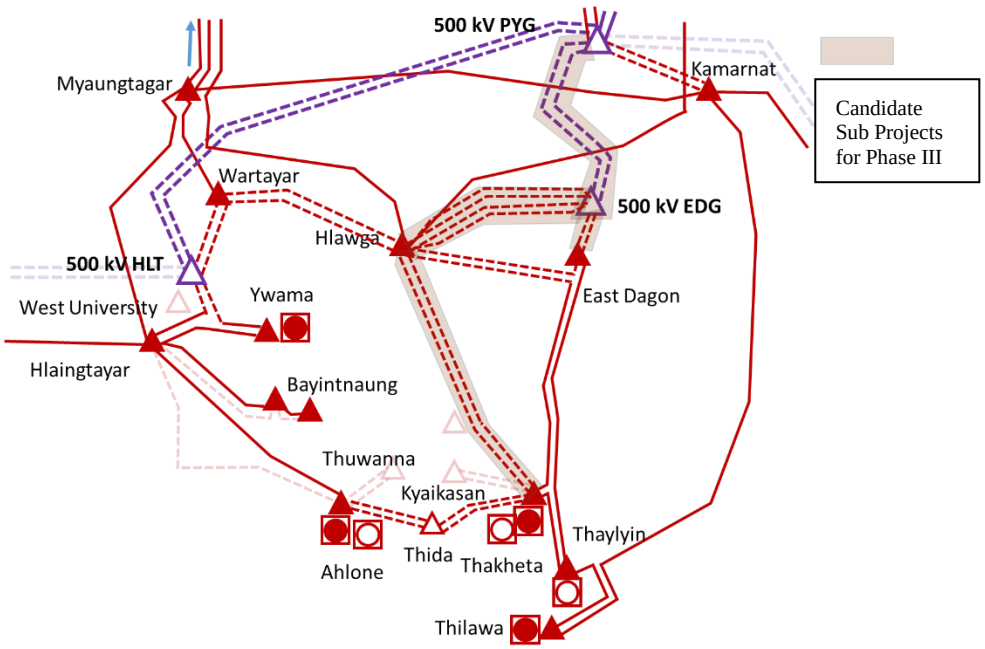


Figure 1.5-11 Phase III Project Scope

After the completion of Phase III, as shown Figure 1.5-12 in Figure 1.5-13 and, even if the emergency power supply is stopped as scheduled, the power in the northern part can be transmitted to eastern Yangon and the supply capacity can be secured.

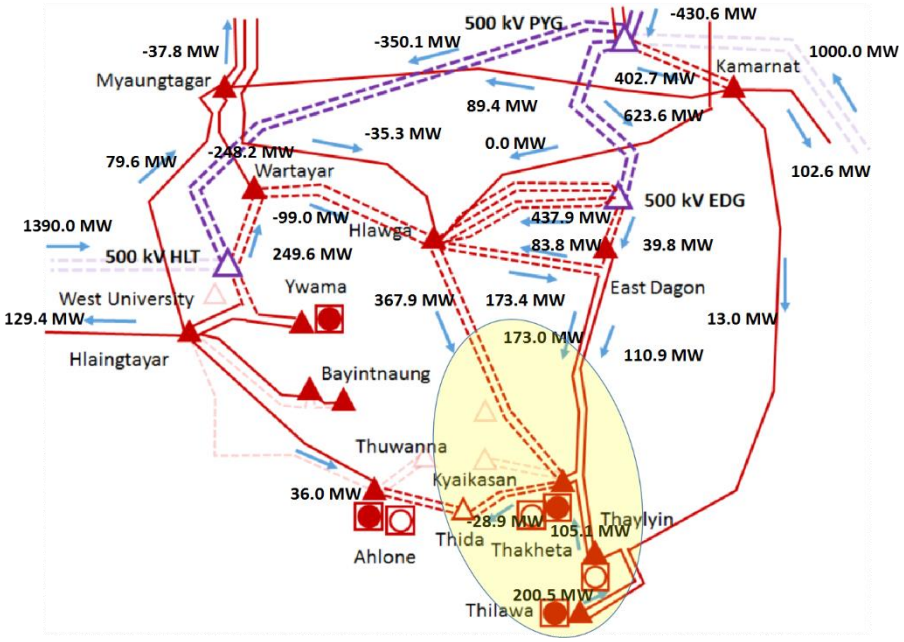


Figure 1.5-12 Power Flow in 2025 (Without Emergency Generators in 2020, with Emergency Generators in 2021, and with Phase III)

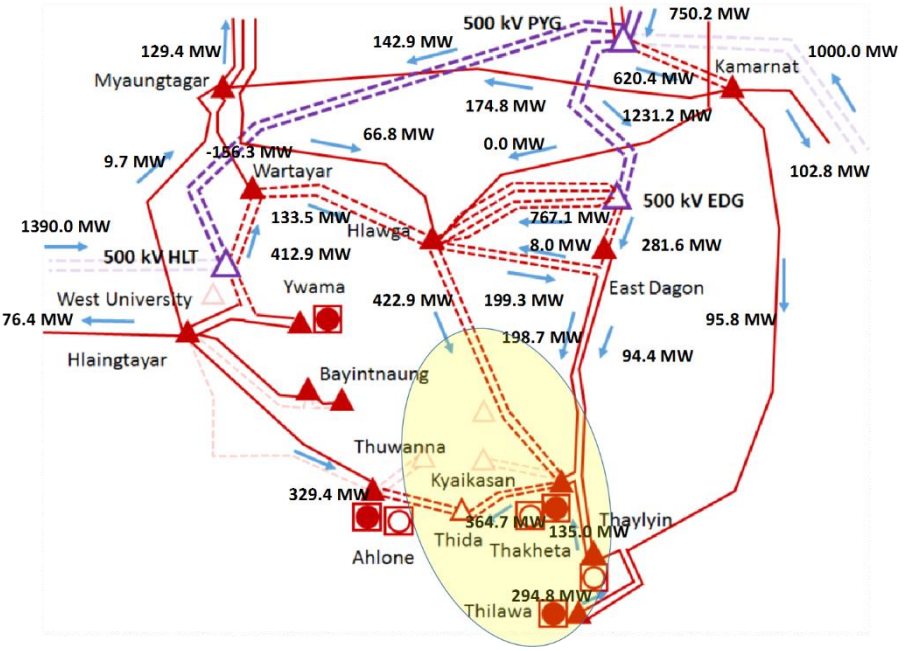


Figure 1.5-13 Power Flow in 2027 (Without Emergency Generators in 2020, without Emergency Generators in 2021, and with Phase III)

Figure 1.5-14 shows the power flow in 2030 when this project is implemented. If this project is implemented, the power flow in eastern Yangon will remain within the capacity of the facilities.

According to the calculation results, the load of Sar Ta Lin exceeds 2,000 MW, so five transformers are required. (In this project, the layout of substations up to four units is presented, but it is possible to install a fifth substation on the site judging by the area of the site.) In addition to the installation of the fifth unit, the following countermeasures are conceivable and need to be studied in the future.

- Consider the installation of a fifth unit (since there is enough space on the site, it can be installed

at that time)

- Establish a fourth 500 kV substation
- Installation of new power supply in Yangon city

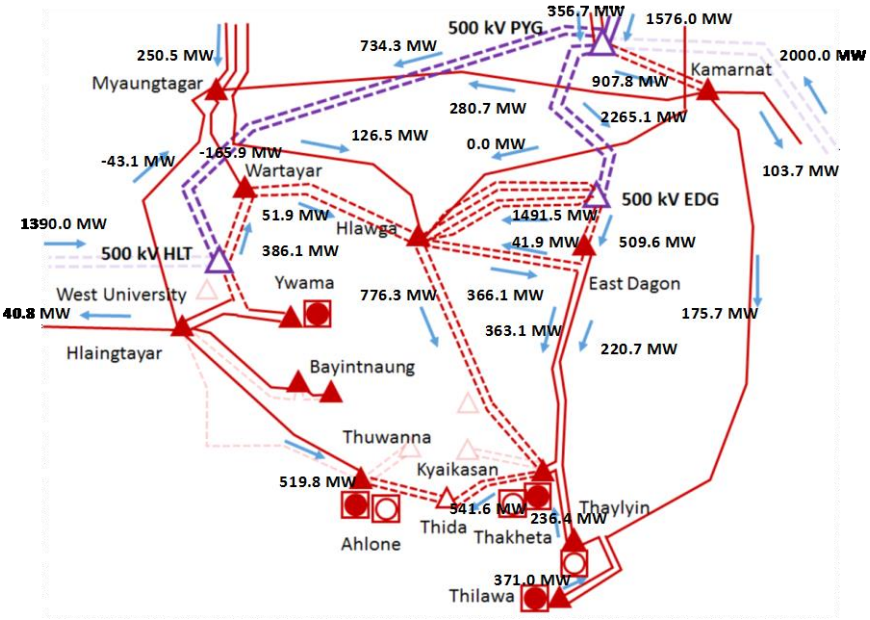


Figure 1.5-14 Power Flow in 2030 (Without Emergency Generators in 2020, without Emergency Generators in 2021, and with Phase III)

(5) Power Flow Calculation Conditions

The conditions of the power flow calculation described above are shown below.

- Power load in Yangon: Table 1.3-4 Maximum Power Demand Forecast in Yangon
- Power generators: Table 1.3-4 Maximum Power Demand Forecast in Yangon

However, the government-owned Ahlone 154.2 MW has been shut down due to information that it will be used as a backup after IPP operation commenced.

The constants per km of the 500 kV and 230 kV overhead transmission lines required for the power flow calculation in the Yangon area were set to the values shown in Table 1.5-1.

Table 1.5-1 Line Parameters per Unit Length of New Overhead Transmission Lines

(Unit: p.u./km, 100 MVA Base)

Voltage Class (kV)	Resistance	Reactance	Admittance
230	0.000089863	0.000569130	0.002025963
500	0.000007511	0.000104556	0.010976457

The resistance and the reactance are parameters representing a loss due to the current of the transmission line and a voltage drop due to the magnetic field, respectively, and the admittance is a parameter representing a voltage rise due to a charging current of the transmission line. The values differ depending on the voltage class, the arrangement of the transmission lines, and so on. The line parameters per km of the 230 kV underground transmission line are set as in Table 1.5-2.

Table 1.5-2 Line Parameters per Unit Length of New Underground Cables

(Unit: p.u./km, 100 MVA Base)

Voltage Class (kV)	Resistance	Reactance	Admittance
230	0.00001701	0.00029100	0.03988566

The transformer parameters of the new 500 kV substation are as follows.

Table 1.5-3 Transformer Parameters of the New 500 kV Substation

Capacity	500 MVA
% Impedance	14%

1.5.2. Fault Currents

The fault current in a three-phase short circuit of the 230 kV bus was calculated. The generator connected to the 230 kV substation in Yangon was set to be connected to the 230 kV bus via a 15% impedance (step-up transformer). (In actual fact, there are places where the step-up transformer of the generator is connected to the 66 kV or 33 kV bus. In this case, since the impedance between the 230 kV bus and the generator becomes larger than the conditions described above, the fault current of the kV bus is smaller than the value calculated under these conditions.)

The next transient reactance of the generator was set to 20%. When a generator is connected to the 66 kV or 33 kV bus, the fault current of the 66 kV or 33 kV bus increases. Therefore, the fault current of the 66 kV and 33 kV bus needs to be confirmed in each case. The Myanmar generators outside Yangon were modeled as much as possible.

The result was that the fault current was less than 31.5 kA for all 230 kV buses, which was within the level of fault current allowed for the 230 kV system in Myanmar.

1.5.3. Stability

Generally, the SIL value of a transmission line is used as a criterion for easily determining the transmission stability. The SIL value is a power flow value at which the decrease/increase of the voltage at both ends of the transmission line becomes zero, and is a numerical value unique to the transmission line. The guideline for the transmission power limit, which is restricted by stability, is expressed in multiples of SIL. The longer the transmission distance, the smaller the limit.

In terms of guidelines for the transmission limit, the transmission distance is about twice the SIL when the transmission distance is 100 miles (about 160 km), and about 3 times the SIL when the transmission distance is 50 miles (about 50 km).

The SIL value of a normal 230 kV transmission line in Myanmar is around 180 MW. The 230 km transmission line in Yangon city has a short transmission distance of 50 km or less, and the power flow per line is less than three times the SIL value. Therefore, there are no stability problems in the 230 kV system in Yangon city.

The 230 kV power flow in Yangon city is more limited by the heat capacity of the transmission line than by the stability.

1.5.4. Voltage Maintenance

In the 230 kV system in Yangon City, power flows from the periphery to the center of the city, and the voltage at the center of the city tends to decrease. In order to improve the voltage drop, it is necessary to install a power capacitor. It is effective to install a power capacitor on the load side, and it is considered effective to install it on the load side of the 230 kV system in Yangon city, such as at Taketa, Aron, or Thanlyin. For the substation where the power capacitor is installed, it is necessary to measure and study the power factor of the load along with the power flow of the transmission line, the load of the substation, and the power generated.

1.5.5. New 1,250 MW Thilawa LNG Power Plant

It is presumed that the transmission method for this power plant is under consideration, but based on the size of the power output, two general proposals can be considered.

- A new 500 kV transmission line will be built to transmit 1,250 MW to the Sar Ta Lin area.

- A new 500 kV line will be built to transmit part of the 1,250 MW to Sar Ta Lin, and a new 230 kV line will be built to transmit the rest of the 1,250 MW to Thilawa, Thanlyin and Thakhta, depending on the size of the regional demand.

Both the former and the latter proposals will require the construction of a new 500 kV transmission line, and the route for the line from Thilawa to Sar Ta Lin will need to be surveyed. The latter will require a route study of a 230 kV transmission line through the densely populated areas in southern Yangon, but it is unclear whether a feasible route can be secured.

Power flow calculations were conducted for the case where the former transmission method was adopted for 2027. The results are shown in Figure 1.5-15. Compared to the cross section shown in powwe flow from Pharyargyi to the north via Sar Ta Lin is reduced by about 1,000 MW, and since the Figure 1.5-3 conditions of power sources and loads south of Pharyargyi are unchanged except for Thilawa 1,250 MW, the output of power sources in the northern part of the country will be curtailed due to the increase of Thilawa 1,250 MW.

Although the power flow on the 230 kV system from Sar Ta Lin to Yangon city will increase, the power flow in eastern Yangon will continue to be within the capacity of the facility due to the increase in lines from this project.

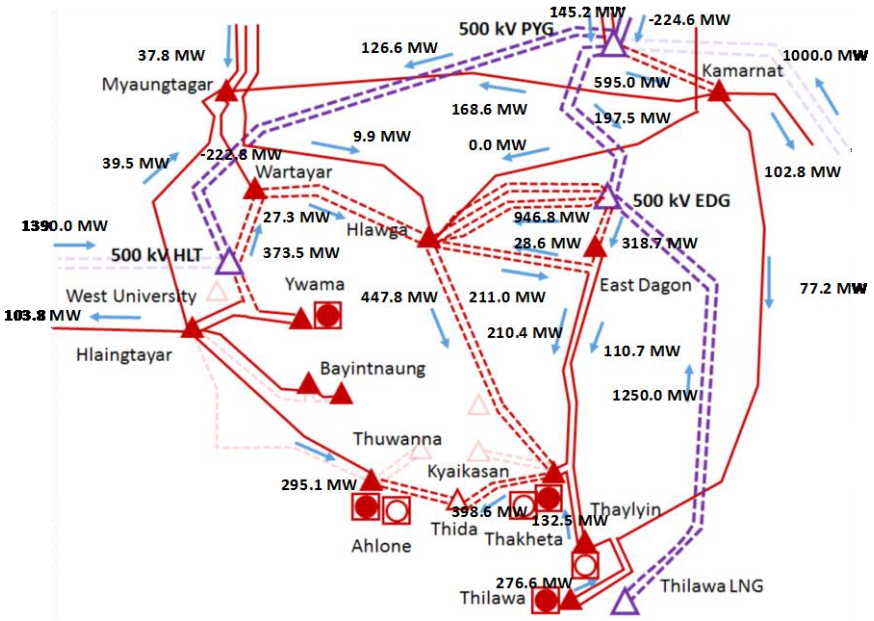


Figure 1.5-15 Power Flow in 2027 (without emergency power in 2020, without emergency power in 2021, with Phase III, with Thilawa LNG 1,250 MW)

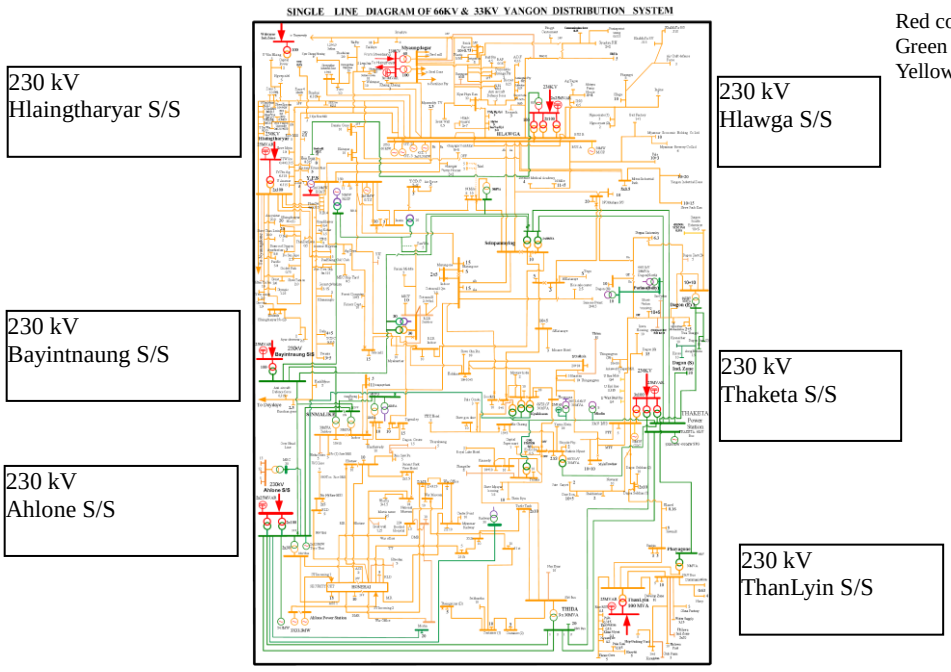
1.6. Power Distribution Plan in Yangon

1.6.1. Plan

Yangon Electricity Supply Corporation (YESC), a MOEE organization, conducts the power distribution business in Yangon. YESC has drawn up a five-year plan[4] for power distribution network development and has revised it from time to time. The main distribution network in Yangon consists of 66 kV and 33 kV distribution lines and substations, and 66 kV and 33 kV distribution lines are supplied from the 230 kV substation. Below that, an 11 kV or 6.6 kV distribution line is connected. YESC plans to upgrade from 33 kV to 66 kV and from 6.6 kV to 11 kV. There are many plans for adopting GIS-type switchgear and buses, which are compact equipment, for 66 kV. (Source: JICA Data Collection Survey on Urban Area Distribution Network Development, Final Report, Sep. 2018)

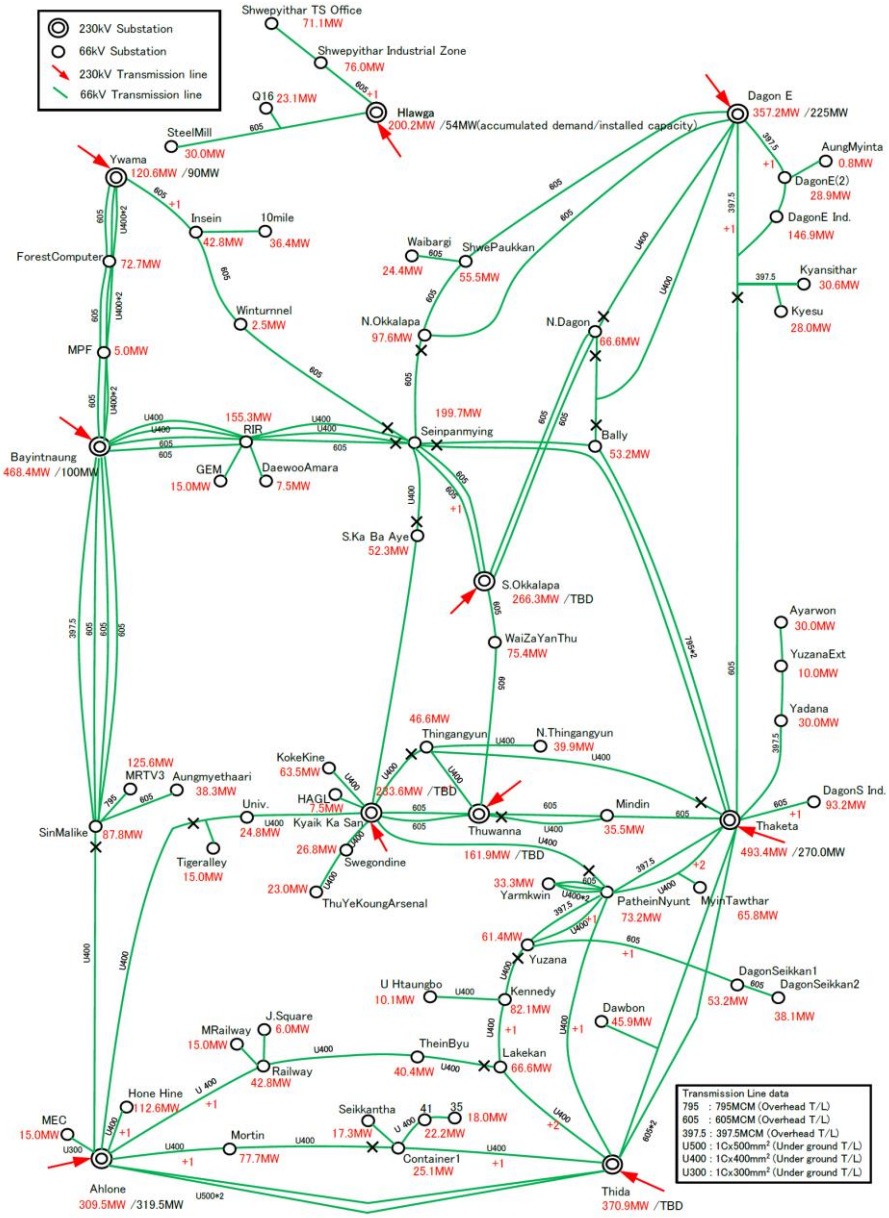
Figure 1.6-1 shows the main power distribution network in Yangon around 2014-2015. Figure 1.6-2 shows the plan for the 66 kV distribution system in Yangon City in 2027.

[4] Most recently, it was formulated for the years 2011/11-2015/16 and 2016/17-2019/20.



(Source: JICA Data Collection Survey on Urban Area Distribution Network Development, Final Report, Sep. 2018)

Figure 1.6-1 66 kV and 33 kV Systems in Yangon in 2014-2015



(Source: JICA Data Collection Survey on Urban Area Distribution Network Development, Final Report, Sep. 2018)

Figure 1.6-2 66 kV System in Yangon in 2027

1.6.2. Current Progress

Based on the aforementioned YESC five-year plan, several donors are providing support for the development of the distribution network in Yangon. The main areas of support are described below.

- ADB Power Distribution Improvement Project

The LA was signed in 2014. In the Yangon, Mandalay, Sagaing and Magway regions, four 66/11 kV substations and four 33/11 kV substations will be upgraded and distribution lines will be replaced in Yangon.

- Thailand NEDA (Neighboring Countries Economic Development Cooperation Agency)

Financing of approximately 1.4 billion baht for distribution line projects in North Dagon, North Okkalapa and Shwepaukkan in Yangon.

- JICA Power Distribution Improvement Project in Yangon Phase I

The LA was signed in 2015. It will provide financing of 6.1 billion yen and renovate 66 kV distribution substations in four townships in Yangon, including distribution lines in 11 townships.

- Urban Area Power Distribution Improvement Project

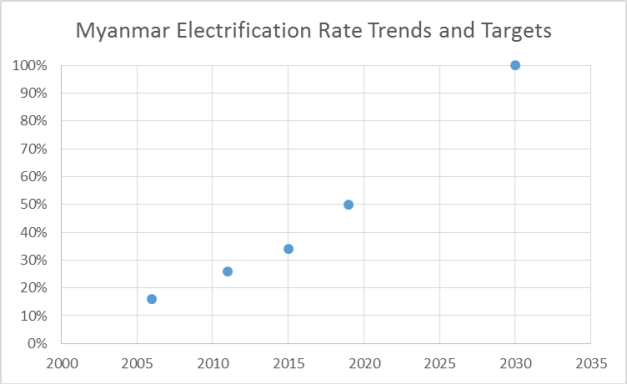
The LA was signed in January 2020. The loan amount is 12.288 billion yen. Rehabilitation and enhancement of distribution network equipment to improve power supply in Yangon and Mandalay.

1.7. Electrification Plans

1.7.1. Plans

(1) Changes in Electrification Rate

Figure 1.7-1 shows the transition of the electrification rate in Myanmar. The target value for 2030 is also shown at 100%. From the end of 2019 to the beginning of 2020, the electrification rate reached 50%. Compared to the target value, it is progressing smoothly, but the annual investment required in the future is expected to increase.



(Source: Data from JETRO)

Figure 1.7-1 Myanmar Electrification Rate Trends and Targets

(2) National Electrification Plan (NEP)

From 2014 to 2015, with the support of the World Bank, the National Electrification Plan (NEP) was formulated. NEP aims to reach 100% electrification by 2030. Ultimately, 90% of the new power supply will be supplied from the grid. However, in some areas where grid extension is very slow, there are plans to implement off-grid electrification, called pre-electrification connections, before full-scale grid electrification. Even in areas where on-grid electrification is anticipated in the future, implementing off-grid electrification will have the effect of deferring investment in grid extensions, and off-grid power will be maintained even after electrification via grid extension has been implemented. The main methods for off-grid electrification are as follows.

・Home solar system

・Mini-hydropower

・Mini-grid

The gap between the cost of electrification and the recovery from tariffs will be covered by government subsidies, but the policy is to set the power tariff to be recovered from fee incomes. However, in the end, electrification will also contribute to poverty reduction, so the electricity tariff system will be reviewed taking into account the ability to pay among households.

1.7.2. Progress

As mentioned above, from late 2019 to early 2020, Myanmar's electrification rate reached 50%. The main projects are shown below.

- National Electrification Project

The National Electrification Project was launched in 2015 with the support of the World Bank to promote electrification planned at the NEP. This project targets areas where grid-based electrification will not be implemented within 10 years, or will not be implemented after that, and where private implementation is not expected (Chin, Kachin, Kayin, Shan, Rakhine, Taninthayi, and Sagaing regions).

Extension and installation of medium-voltage distribution lines 375 million USD

Off-grid electrification 172 million USD

Technical Assistance 20 million USD

- The Project for Electrification of Rural Villages

In 2014, the Project for Electrification of Rural Villages (grant limit: 994 million yen) was implemented as grant aid by JICA. In this project, small-scale hydropower and solar power were introduced to the villages.

- Regional Development Project for Poverty Reduction Phase I

The LA of a yen loan (17 billion yen) for this project was concluded in 2013, and Phase 2 (23.97 billion yen) was concluded in 2017. This includes rehabilitation of roads and bridges, construction and expansion of 66 kV transmission and distribution networks, and development and expansion of water supply facilities.

- Regional Infrastructure Improvement Project

The LA was signed in January 2020. This is a project to develop basic infrastructure in rural areas of Myanmar, mainly in the Chin, Rakhine, Mon, Cain and Tanintharyi regions, and consists of 70 subprojects (roads and bridges: 35, electricity: 25, water supply: 10) totaling 38,842 million yen.

- ADB Off-Grid Renewable Energy Demonstration Project (47128-001, TA 8657-MYA)

This was implemented from 2014 to 2018. It included the installation of clean energy-based (mainly solar) systems, lowest cost electricity access to selected pilot facilities in Mandalay, Sagaing, Magway, Chin, Kayah and Rakhine and capacity building for government and private institutions for planning, manufacturing, installing, operating and maintaining clean energy systems.

- ADB Accelerated Rural Electrification Project (53223-001)

This is a proposed project with an assumed total of US $200 million. It targets Ayeyarwady, Bago (East), Magway, and Kayin regions. It includes 48 66/33/11 kV medium-voltage substations, 715 km of 66 kV distribution lines, 438 km of 33 kV distribution lines, and automatic distribution systems.

1.7.3. Support from Other Donors

In addition to the above, construction of 500 kV transmission lines in Myanmar and 230 kV substations in Yangon are currently underway.

JICA provides support for the 500 kV Metihla substation, the Taungoo substation (Phase I), the 500 kV Pharyargyii substation, the Hlaingtayar 500 kV substation, and a transmission line between the new Pharyargyii and Hlaingtayar (Phase II) as yen loan projects. The Pharyargyii Substation will be

connected to a 500 kV transmission line financed by Korea from the northern Taungoo Substation, which will be constructed as Phase I, and the transmission line project has begun since 2019.

In addition, as a transmission line to the 500 kV system in Yangon, there are plans for a 500 kV transmission line from the future power source in the Mawlamyine area in the southeast to Pharyargyii, and if a large-scale power supply is developed in the Thilawa area, a 500 kV transmission line could be built to Sar Ta Lin.

The 500 kV Sar Ta Lin substation will provide power to meet the increasing demand for 230 kV substations in eastern Yangon, such as Hlawga, East Dagon, South Okkalapa, Kyaikasan, Thaketa, Thida, Thaylyin, and Thiruawa. Even if power is supplied from power plants in Hlawga, Thaketa, Thaylyin, and Thilawa, the still insufficient power will be transmitted from the 500 kV Sar Ta Lin substation to eastern Yangon.

After studying the Transmission and Distribution Improvement Project in 2013, ADB is supporting the construction of four new 230 kV substations in Yangon - Thida, Kyaikasan, South Okkalapa, and West University - and a transmission line for Thida-Thaketa-Kyaikasan. The LA was signed in 2016 (Loan 3330-MYA: Power Transmission Improvement Project).

In addition, the Power Network Development Project provides support for 230 kV transmission lines between Ahlone and Thida (16.6 km) and 230 kV transmission lines between Mawlamyine-Ye-Dawei (286 km).

There are plans to build a 500 kV transmission line from China to the Pharyargyii substation in northern Yangon and import power from China. MOEE called on China to implement the FS.

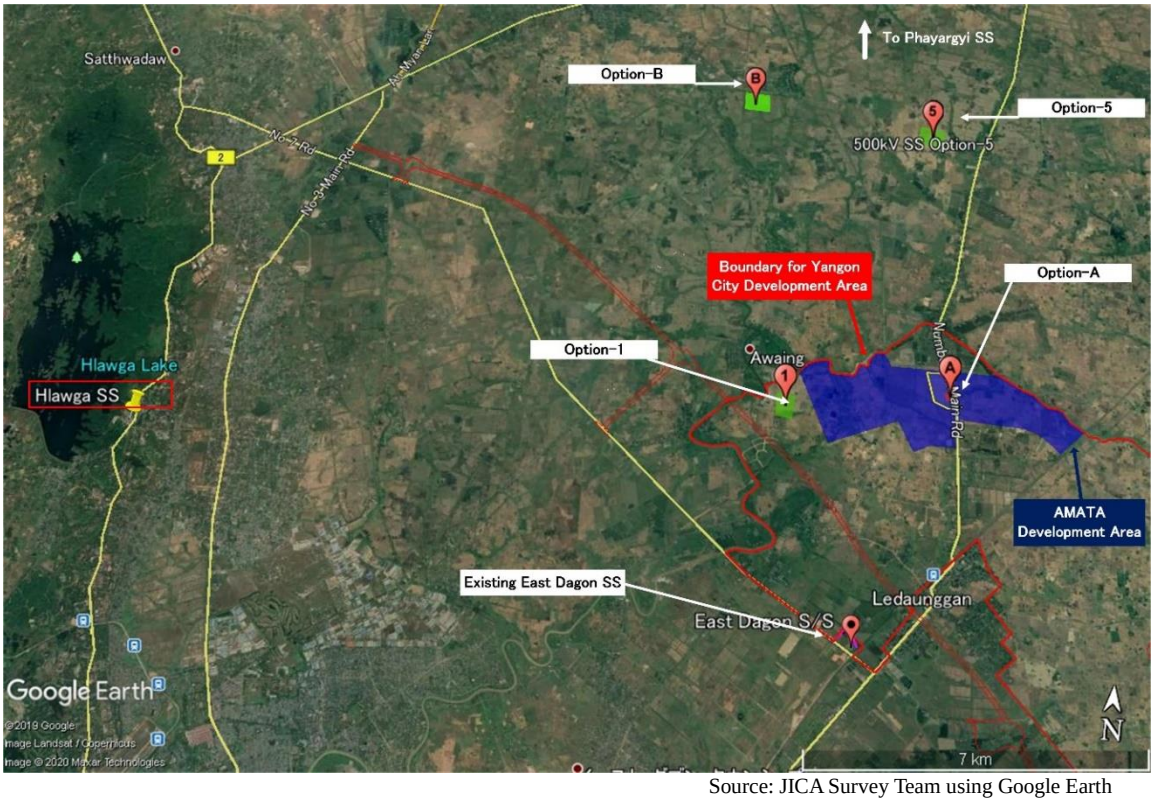
2. Selection of Location for New 500 kV Substation

2.1. Selection of Location for New 500/230 kV Substation

We studied the location for the new 500 kV substation, which is planned to be connected to Pharyargyii substation, including expansion of the existing East Dagon substation.

Since the 500 kV transmission line to be constructed under this Project will supply a large amount of electric power to Yangon City, where power demand is the largest in Myanmar, it is preferable to supply electric power from the east side of Yangon City from the aspect of system operation, considering that it is planned for the under-construction Hlaingtaya substation to supply electric power to Yangon City from the west side of Yangon City. Therefore, as shown in Figure 2.1-1, we selected the following candidates for the new 500 kV substation as premises for expansion of the existing East Dagon substation.

- Expansion of Existing East Dagon 230 kV Substation
- East Dagon Area No. 1 (Option-A)
- Hlegu Township Area (Option-B)
- East Dagon Area No. 2 (Option-1)
- East Dagon Area No. 3 (Option-5)



Source: JICA Survey Team using Google Earth

Figure 2.1-1 Candidates for New 500 kV Substation

2.2. Necessary Dimensions for New 500/230 kV Substation

2.2.1. 500 kV Switchgear

In selecting the location for each candidate, we set the facility configuration of 500 kV switchgear which will be necessary for construction in the Project as minimum requirements.

Table 2.2-1 Minimum Required Facility Configuration for 500 kV Switchgear in the Project

	Phase 3 Project	Remarks
Busbar Arrangement	One and a Half Circuit Breaker	
Number of 500kV Transmission Line Feeders	6 feeders	To Pharyargyii SS: 2 feeders To Thilawa: 2 feeders Spare: 2 feeders
Number of Transformer Feeders	3 feeders	Incl. one unit in future

Source: JICA SURVEY TEAM

Table 2.2-2 shows the expandability and area ratio for Gas Insulated Switchgear (GIS) and Hybrid Gas Insulated Switchgear (H-GIS), which are applied in Pharyargyii Substation, and Air Insulated Switchgear (AIS). As shown in the following table, GIS and H-GIS will be effective for substations that do not have enough spare for the installation of equipment because the necessary dimensions for installation are GIS is about 15% and the same of H-GIS is about 45% compared with AIS. In addition, H-GIS and GIS are more reliable than AIS because all equipment and connecting points between pieces of equipment are enclosed with gas insulation and the possibility of earth faults in busbars is low.

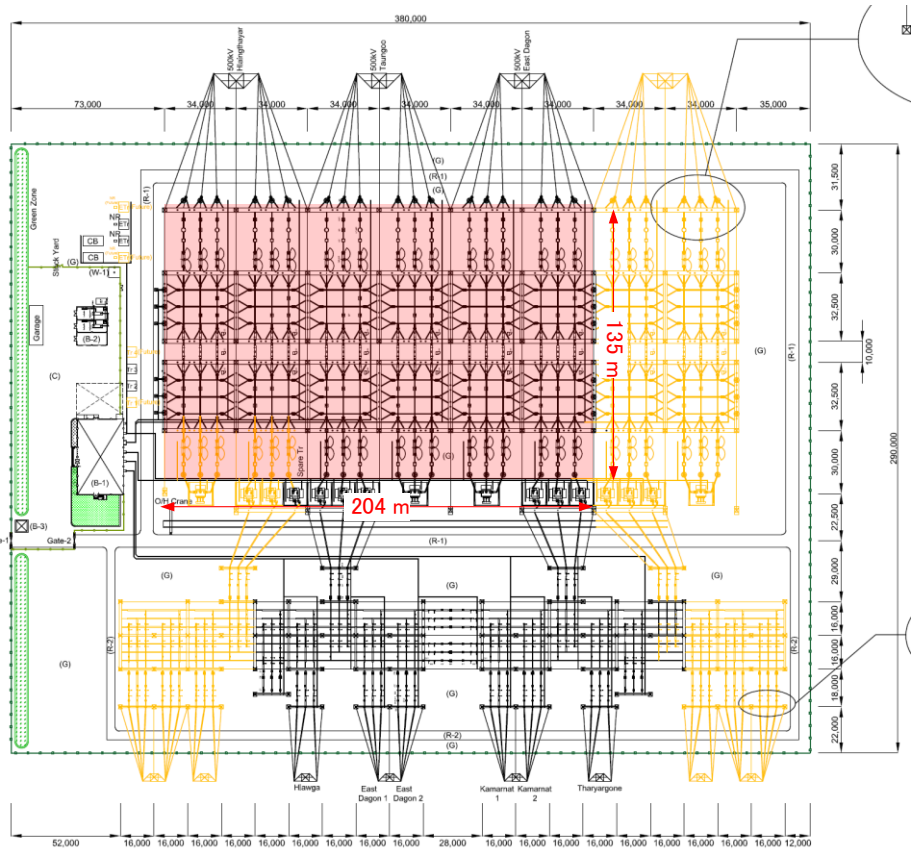
Table 2.2-2 Expandability and Area Ratio of Switchgear in the Case of One and a Half CB Arrangement with 2 Transmission Line

Type	GIS	H-GIS	AIS (Reference)
Insulation Method	SF6 Gas	SF6 Gas	Air
Facility Reliability	Excellent	Good	Fair
Expandability	a) Small space is required for expansion b) Same manufacturer is desirable for expansion	a) Same manufacturer is desirable for expansion of switchgear b) Easy expansion of busbar	a) Expansion of switchgear is easy, while a huge amount of space will be required
Area Ratio	Approx. 15 %	Approx. 45%	100%

Source: JICA SURVEY TEAM

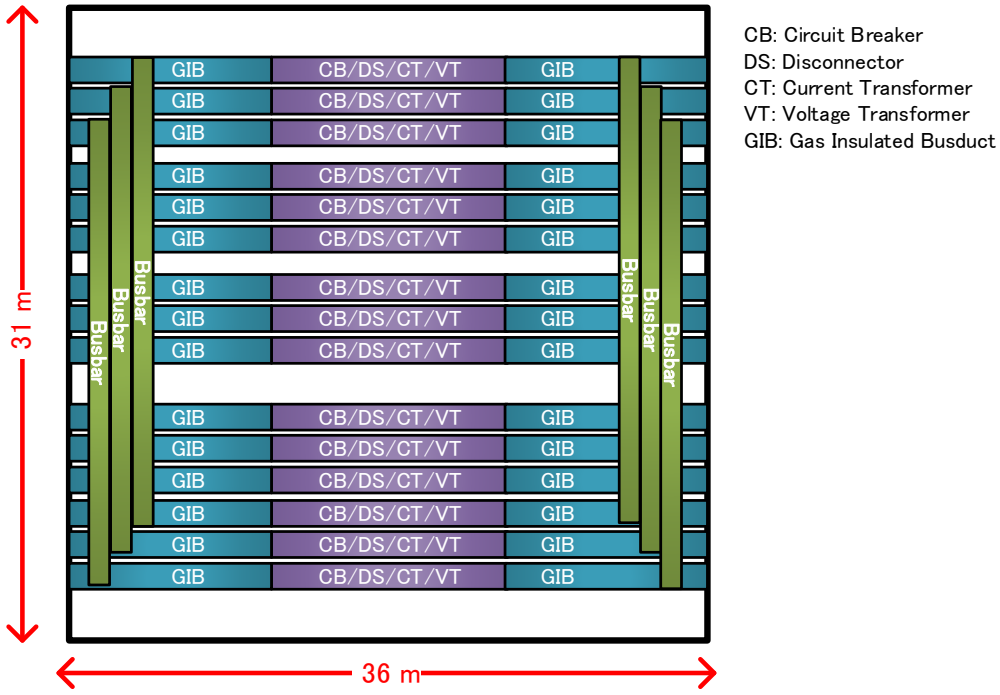
Considering that the new 500 kV substation which is to be constructed in this Project will have an important role in power supply to Yangon City, and Pharyargyii Substation consists of H-GIS, we recommend applying GIS or H-GIS to the new 500 kV substation from the viewpoint of facility reliability.

Dimensions required for GIS and H-GIS are shown in Figure 2.2-1 and Figure 2.2-2.



Source: Bidding Documents in Phase 2 Project

Figure 2.2-1 Dimensions Required in 500 kV H-GIS



Source: JICA SURVEY TEAM

Figure 2.2-2 Dimensions Required in 500 kV GIS

While GIS is applied in the study for expansion of the existing East Dagon Substation due to the limited space, H-GIS is applied to other candidates for construction of the new 500 kV substation in

consideration of future expansion plans.

2.2.2. 500/230 kV Transformer

The basic specifications of the 500/230 kV transformer in reference to Phase 2 Project are shown in Table 2.2-3.

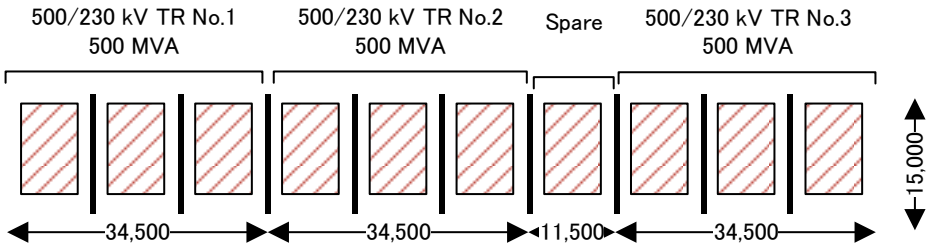
Table 2.2-3 Specifications of 500/230 kV Transformer in the Project

Item	Phase 3 Project
Rated Voltage at Primary Side	500 kV
Rated Voltage at Secondary Side	230 kV
Rated Voltage at Tertiary Side	33 kV
Phase (Three or Single)	Single Phase Transformer (Auto Transformer)
Vector Symbol	YNa0d11
Rated Capacity	500 MVA (166.6 MVA/phase) x 3
Cooling Type	ONAF/ONAN

Source: JICA Survey Team

We considered the space dimensions when three units of transformer are installed in the new 500 kV substation taking into account one spare unit.

Figure 2.2-3 shows the necessary dimensions of the 500/230 kV transformer.



Source: JICA Survey Team

Figure 2.2-3 Necessary Dimensions of the 500/230 kV Transformer

2.2.3. Dimensions of 500/230 kV Substation

Considering the above, we assumed that a substation with 60 Acre dimensions will be enough to secure space for not only the necessary facilities even in the case of H-GIS, but also the residential area for the substation's operation and maintenance staff.

2.3. Study on Expansion of Existing East Dagon Substation

As shown in Figure 2.3-1, we studied the possibility of installing the 500 kV switchgear and 500/230 kV transformer within unused space in the existing East Dagon Substation.

Figure 2.3-1 Available Space for Expansion in Existing East Dagon Substation

2.3.1. 500 kV Switchgear

As studied in 2.2 above, H-GIS cannot be installed in the available space at the existing East Dagon Substation because H-GIS requires dimensions of 200 m x 130 m, and it is also impossible to secure the space for the 500/230 kV transformer and construction of the gantry structure.

Hence, we applied GIS in studying the expansion of the existing East Dagon Substation.

2.3.2. Expansion Study

The layout arranging 500 kV GIS, 500/230 kV transformer and gantry structures for 500 kV transmission lines is shown in Figure 2.3-2 and Figure 2.3-3. In the study, Gas Insulated Busduct (GIB) is applied for connection between 500 kV GIS and transformer/gantry structures so as to save space.

It will be possible to install facilities for this Project only in the available space, as shown in Figure 2.3-2. However, this expansion plan cannot be recommended because there is not enough space for construction of a gantry structure in future, limited space for expansion of 230 kV switchgear and other concerns like acquisition of the surrounding field in the case of further expansion to install an emergency thermal plant.

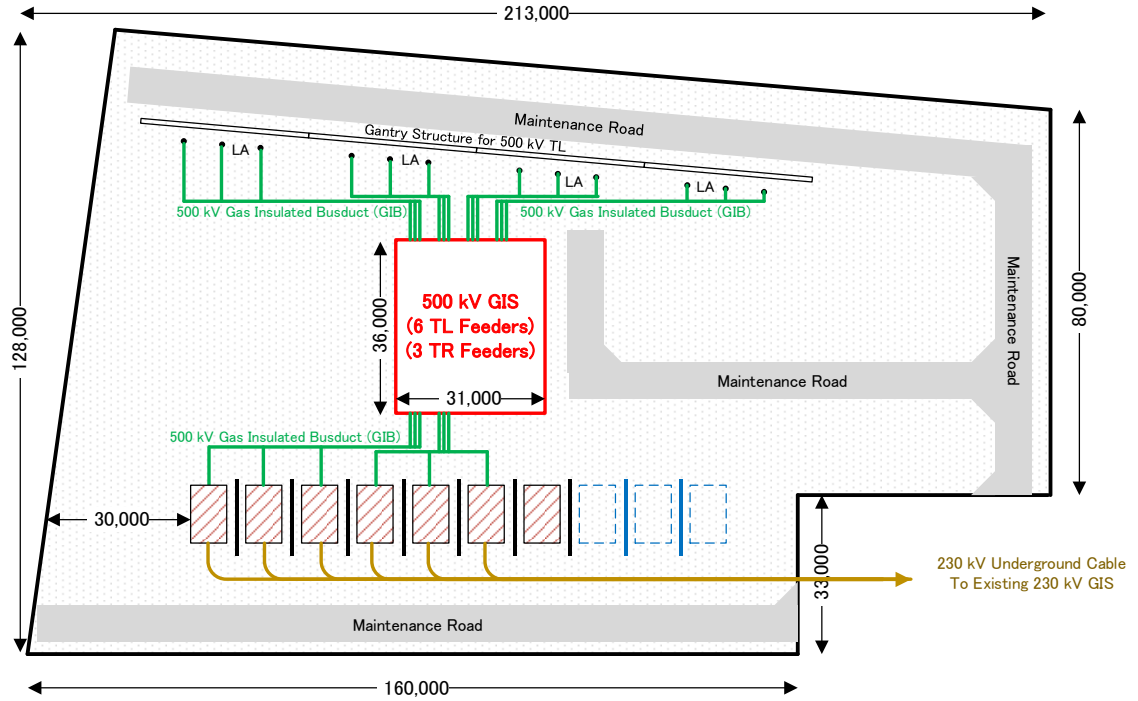
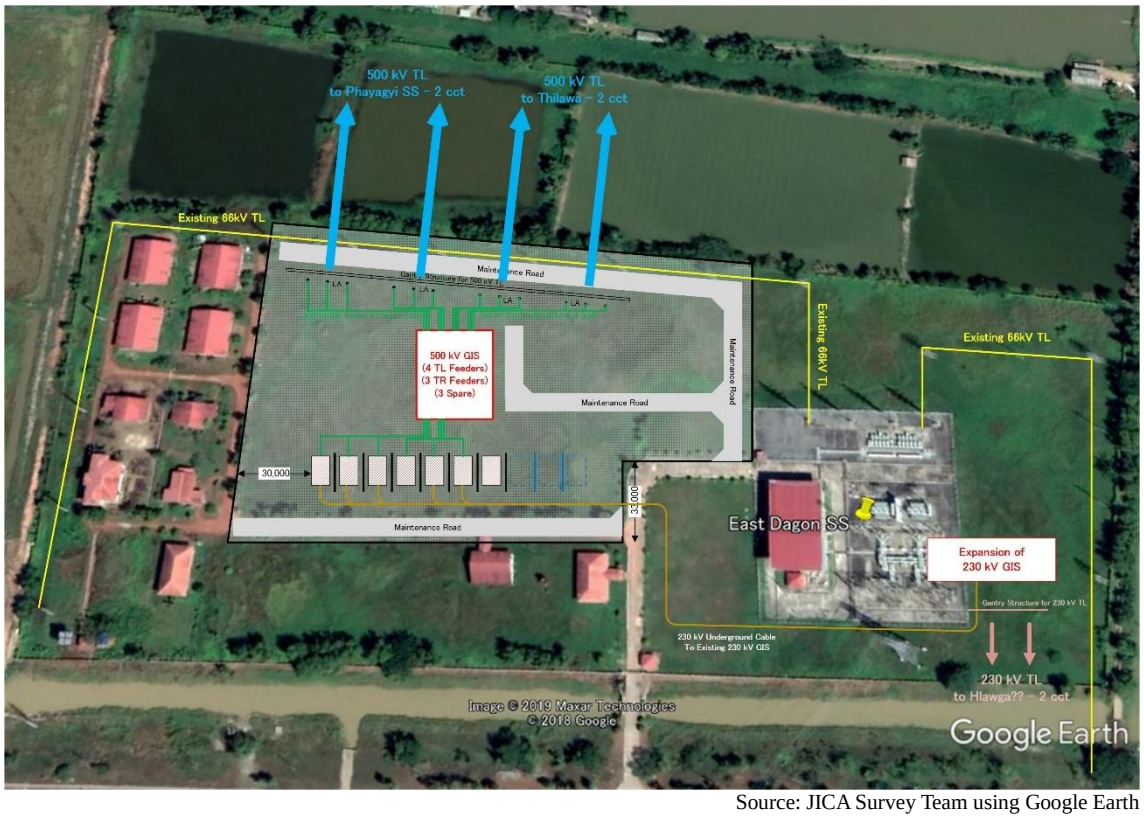


Figure 2.3-2 Arrangement of 500 kV Facilities in Existing East Dagon Substation



Source: JICA Survey Team using Google Earth

Figure 2.3-3 Situation after Expansion in East Dagon Substation

2.4. Study on Western Side of Yangon - Hlegu Township Area (Reference)

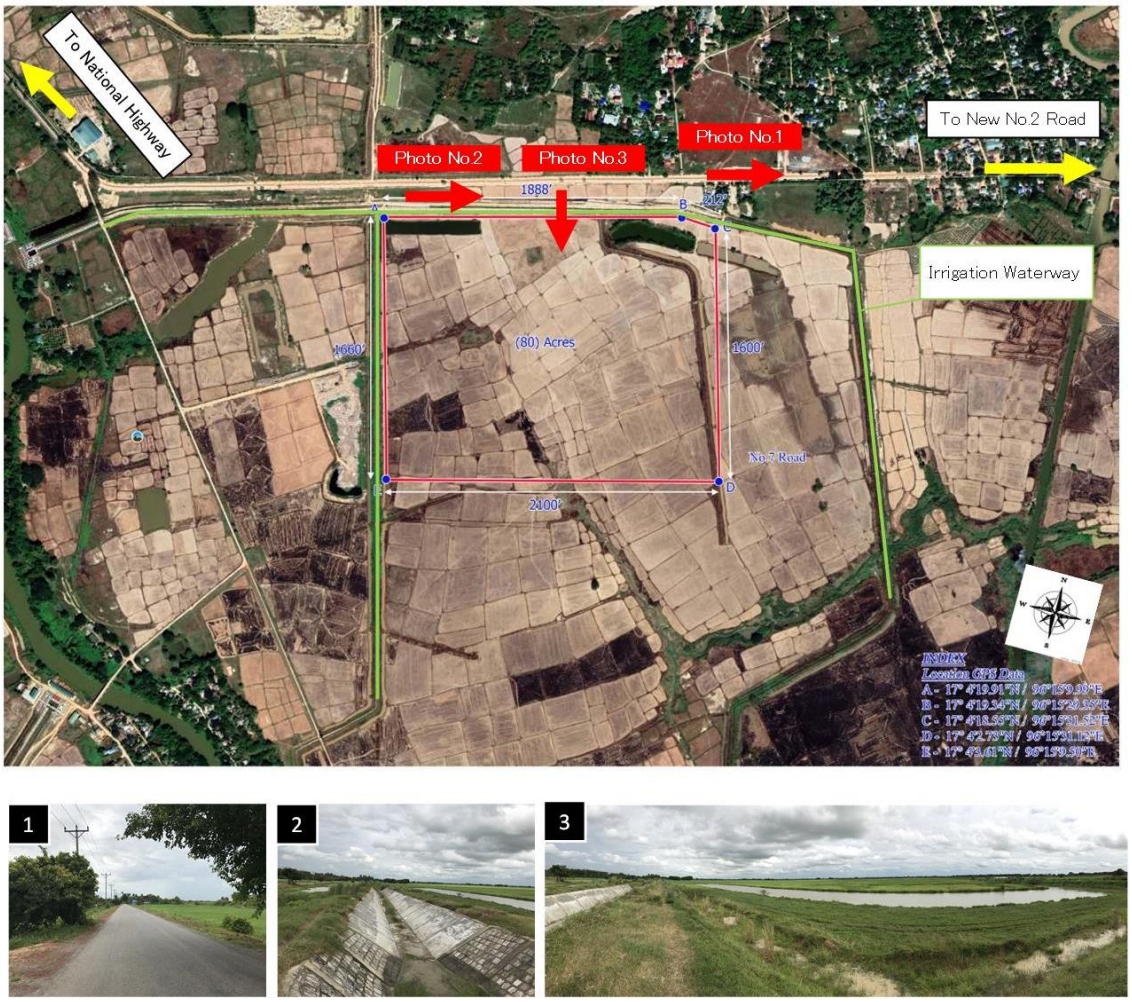
DPTSC proposed two locations as candidates for the new 500 kV substation on the western side of Yangon City, Hlegu Township Area, because there are several plans to construct industry complexes, which will create a large amount of power demand if candidates are close to the planned substation

location.

However, supplying power to these industry complexes will also be possible from Hlaingtaya Substation constructed in Phase 2, considering system operation. Therefore, it is preferable that the new 500 kV substation requiring power supply from the eastern side of Yangon City be located on the eastern side of Yangon City, centered around the East Dagon area. For reference, Option-B, which is one of the candidates on the western side of Yangon City proposed by DPTSC, is described below.

2.4.1. Substation Candidate Option-B in Hlegu Township

The planning map for substation candidate Option-B in Hlegu Township is shown in Figure 2.4-1.



Source: DPTSC

Figure 2.4-1 Substation Candidate Option-B in Hlegu Township

The main features of substation candidate Option-B in Hlegu Township are listed as follows:

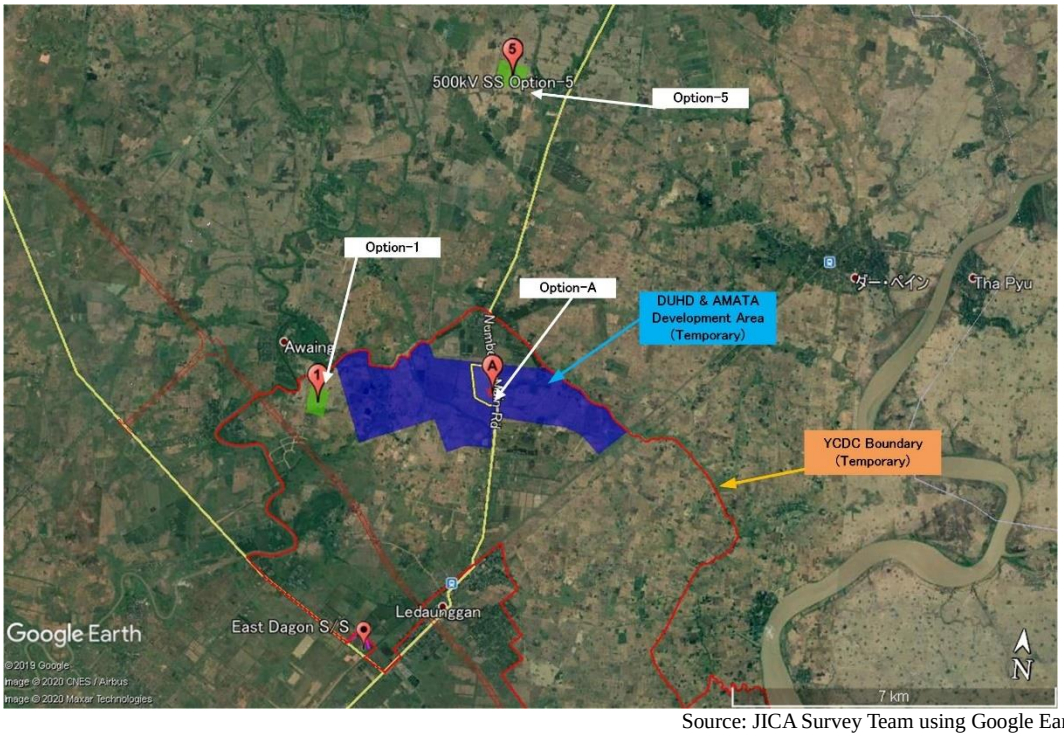
- Area Dimensions: 80 Acres
- Private rice paddy and outside of Yangon City Development Area
- Good access conditions
- Existing 33 kV distribution line which can be used for power supply during construction work
- Water reached 2.0 m above the paddy field ground level in past flood

2.5. Study on Eastern Side of Yangon (East Dagon Area)

Taking into account the fact that Hlaingtaya substation will supply power to the western side of Yangon City, it would be preferable to construct the new 500 kV substation on the eastern side of Yangon City to ensure reliable system operation if expansion of the existing East Dagon substation

proves difficult.

On the other hand, East Dagon is in an area managed by Yangon City Development Committee (YCDC), as shown in the following figure. It is expected that negotiations to acquire the land will be difficult because many residential areas and industrial complexes will be constructed in the future within the YCDC area.



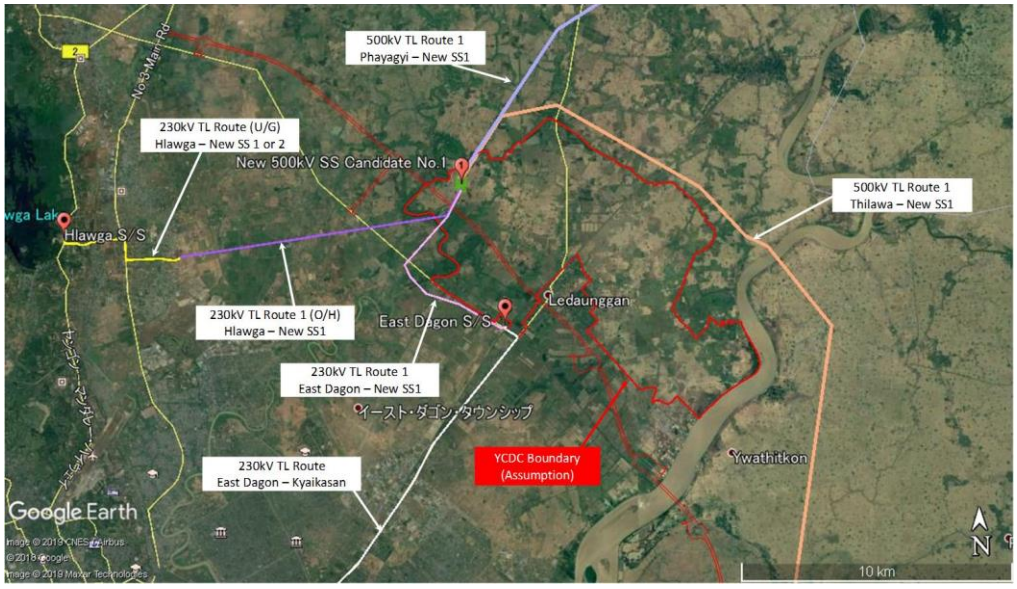
Source: JICA Survey Team using Google Earth

Figure 2.5-1 YCDC Area and Selected Candidates in East Dagon Area

Inside the YCDC area, there are plans to develop a 2,000 acre economic complex by the "Department of Urban & Housing Development (DUHD)", of the Ministry of Construction (MOC), and AMATA group in Thailand. As a result of discussions with DUHD, we selected two locations for the new 500 kV substation inside (Option-1) and outside (Option-5) the YCDC area, because securing land for the new 500 kV substation (about 60 acres) inside an economic complex like Option-A will affect its development plan, and it is assumed that it will be difficult to construct the transmission line inside an economic complex. The locations of the new 500 kV substation were selected from the point of access from the existing road for transporting heavy equipment like 500/230 kV transformers.

2.5.1. Substation Candidate Option-1 in East Dagon Area

The planning map for the substation candidate referred to as Option-1 in the East Dagon Area is shown in Figure 2.5-2 and Figure 2.5-3 with the planned route for the 500 and 230 kV transmission lines:



Source: JICA Survey Team using Google Earth

Figure 2.5-2 Substation Candidate Option-1 in East Dagon Area (Wide-Area)

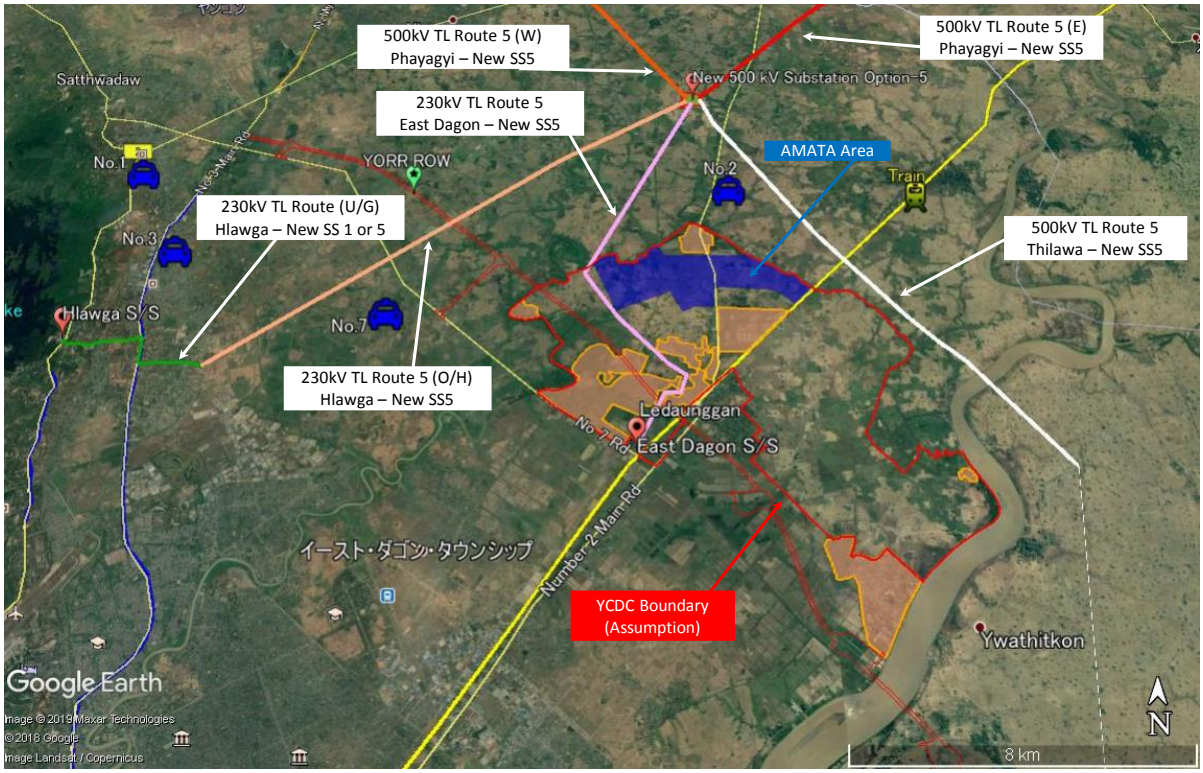
Source: JICA Survey Team using Google Earth

Figure 2.5-3 Substation Candidate Option-1 in East Dagon Area (around Substation)

As shown in Figure 2.5-2 above, laying 500 kV transmission lines from the new substation to Pharyargyii and Thilawa will be difficult because the transmission lines will cross a residential area and national road, while influence on the YCDC management area will be small. In addition, construction of a 230 kV transmission line to the existing East Dagon and Hlawga substations will be difficult because it will be laid within the YCDC management area and have to cross the existing 230 kV transmission line.

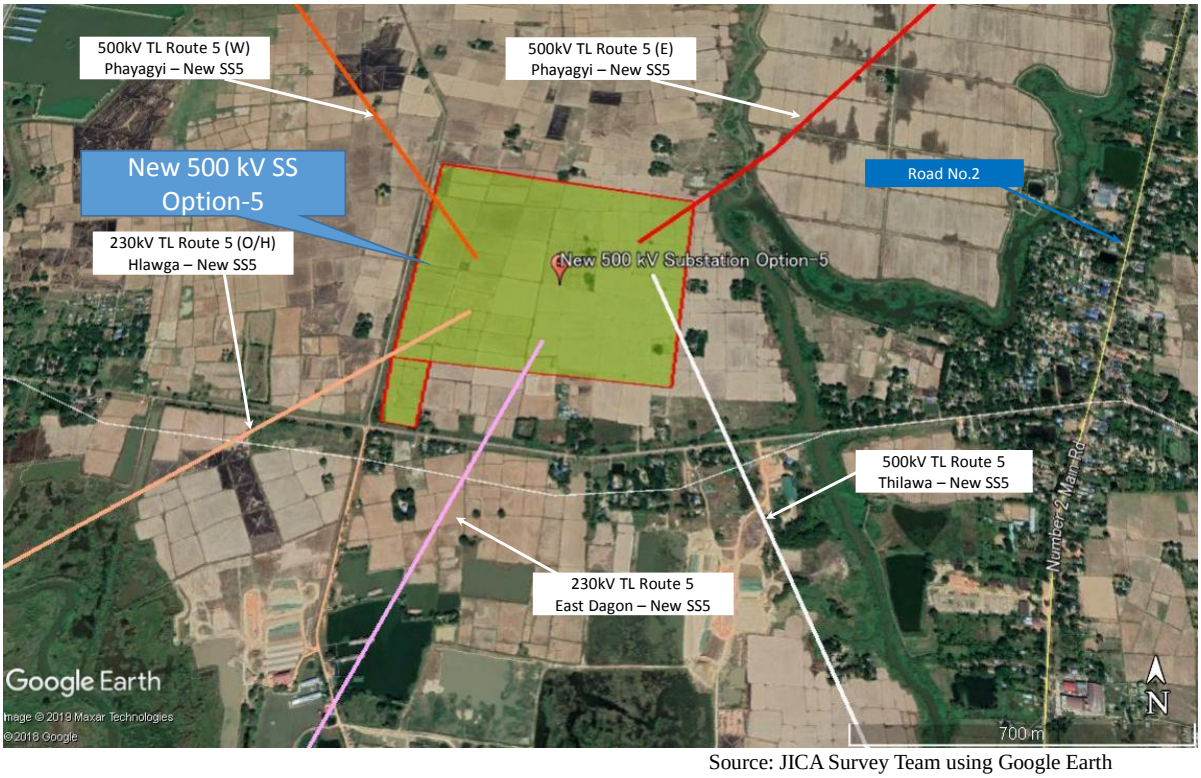
2.5.2. Substation Candidate Option-5 in East Dagon Area

The planning map for substation candidate Option-5 in the East Dagon Area is shown Figure 2.5-4 and Figure 2.5-5 with the planned route for the 500 and 230 kV transmission lines:



Source: JICA Survey Team using Google Earth

Figure 2.5-4 Substation Candidate Option-5 in East Dagon Area (Wide-Area)



Source: JICA Survey Team using Google Earth

Figure 2.5-5 Substation Candidate Option-5 in East Dagon Area (around Substation)

As shown in Figure 2.5-4 above, construction of 500 kV transmission lines from the new substation to Pharyargyii and Thilawa will be easier than the candidate Option-1 proposed in Sub-chapter 2.5.1 because it is not necessary to cross the national road or residential area and the influence on the YCDC

management area is also small, as Option-5 is located outside YCDC. In addition, Option-5 is recommended from the aspect of future expansion of the transmission line system since Option-5 has room for future expansion due to its surrounding conditions.

2.6. Comparison of Candidates and Conclusion

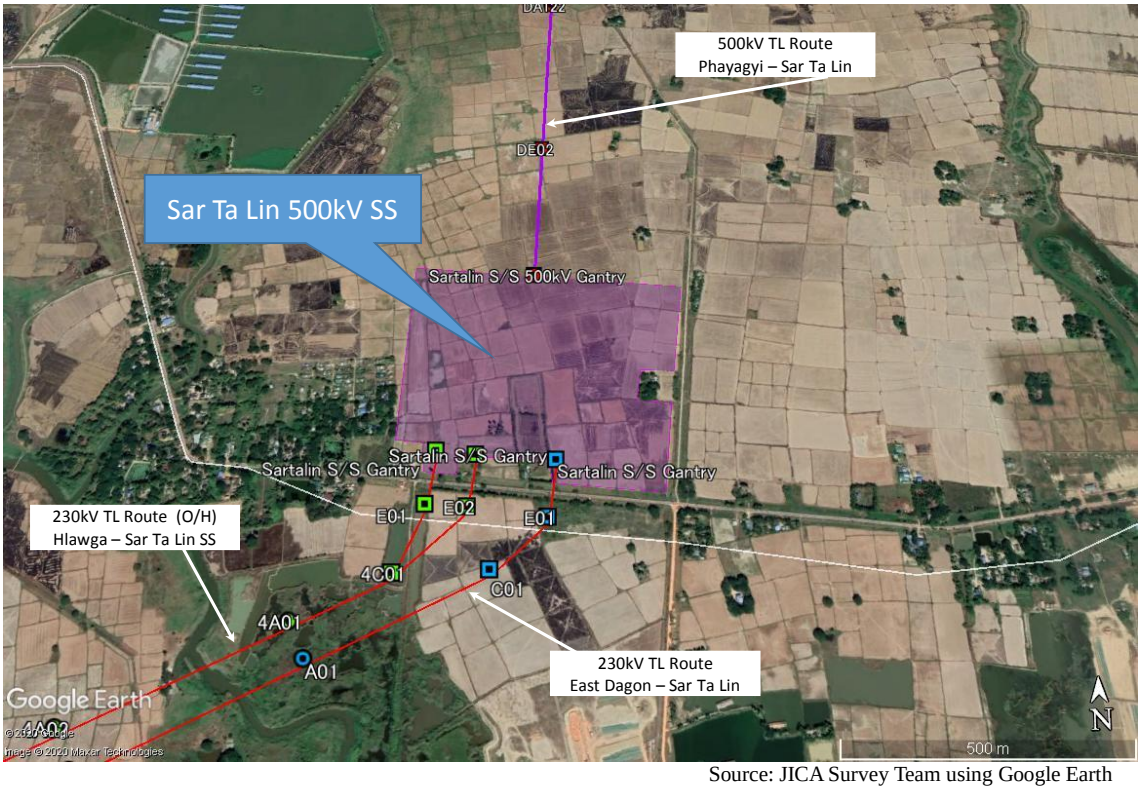
Candidates for the new 500 kV substation selected above were compared from the aspects of facility expandability, construction costs and system operation, as below:

Table 2.6-1 Comparison of Candidates for New 500 kV Substation

Item	East Dagon (Existing)	Option-A (Reference)	Option-B (Reference)	Option-1	Option-5
System Operation	A(5)	A(5)	C(1)	A(5)	B(3)
Construction of SS	A(5)	C(1)	A(5)	B(3)	A(5)
Expandability of SS	D(0)	C(1)	A(5)	C(1)	A(5)
Construction Cost of SS	A(5)	B(3)	B(3)	B(3)	B(3)
Construction of TL	C(1)	C(1)	C(1)	B(3)	A(5)
Construction Cost of TL	A(5)	B(3)	C(1)	A(5)	B(3)
Land Acquisition for SS	A(1)	B(3)	C(1)	B(3)	B(3)
Land Acquisition for TL	B(3)	C(1)	B(3)	C(1)	A(5)
Evaluation	B (25)	C (18)	C (20)	B (24)	A (29)

Source: JICA Survey Team

In conclusion, taking into account the above factors, candidate Option-5 in the East Dagon Area was found to be the most effective. As a result of several discussions with DPTSC based on the above comparison, DPTSC and the JICA Survey Team agreed to construct the new 500 kV substation on land next to the west side of the Option-5 location, in consideration of the connection of 230 kV transmission lines as MOM, shown in Annex 2-1. In this regard, the new 500 kV substation was named "Sar Ta Lin Substation", from the region where it is located. The following figure shows the location of Sar Ta Lin Substation.



Source: JICA Survey Team using Google Earth

Figure 2.6-1 Substation Candidate Option-5 in East Dagon Area (around Substation)

3. Study for Transmission Line Route Selection

3.1. Study for Transmission Line Route Selection

The team carried out field investigations for the selected route, and topographical and geological surveys for transmission lines, as needed. The team discussed the outcome with the C/Ps and drew a figure of the transmission line route.

[Points to note in the transmission line route investigation]

The general categories of land/facilities/properties in the following table, such as airports, microwave communication routes, large rivers etc., need to be considered in the construction of transmission lines in Myanmar. Several routes that avoid these categories will then be examined via desk study. In order to conduct efficient and effective investigations, an accurate route map using the latest topographical data, such as Google Earth, etc., is to be prepared and the team will utilize it effectively in the on-site investigation.

Table 3.1-1 Categories to Note in Preliminary Investigation for Transmission Line Construction

General categories representing an obstacle	- National parks: Avoidance in terms of environmental and social considerations - Yangon International Airport and Military Airport: Considering building restrictions on air routes - Micro communication routes: Considering the height and direction of communication route - Large-scale rivers: Understanding the possibility of long spans and clearance of vessels to be navigated, etc. - Extra-high voltage transmission lines: Considering clearance between conductors - Expressways, major roads: Considering road widths, road-accessorized equipment, height on roads, traffic volumes, etc. - Railroads: Considering track widths, track accessories (such as communication lines), height on tracks, avoidance measures for conductor drop, etc. - Housings/Dwellings: Avoidance and reducing the amount of inhabitant relocation - Schools, Religious facilities/cemeteries and Local community facilities: Avoidance in terms of environmental and social considerations - Chimneys: Avoiding electrical accidents and avoiding passing chimneys of brick sinter pots to prevent conductor corrosion
Individual categories in Myanmar representing an obstacle	- Military facilities/sites: Avoiding military facilities, which are widely distributed and have large site areas in Myanmar - Rubber forests and Mango Gardens: Necessity of avoidance to reduce RoW compensation due to high asset value - Teak forest: Necessity of avoidance to reduce RoW compensation because it constitutes a major part of commercial forest in Myanmar
Categories representing an obstacle for overhead lines	- Areas of weak soil: The foundation support layers in weak areas such as river basins are to be confirmed via visual inspection and geological investigation - Weir areas: Confirmation of weir water level (for examination of foundation configuration) - Roads: Access methods at construction stage, necessity of temporary construction and maintenance methods after construction
Categories representing an obstacle for underground lines	Underground burials: Confirmation of underground burials for water pipes, gas pipes and electric power lines Crossing points of rivers, railways and so on

Source: JICA survey team

[Route Investigation Methods for Overhead Transmission Lines]

For the route investigation, an expert from the team confirms the Categories to Note (Table 3.1-1) for the sites and selects the final routes via vehicle and on foot, with a route map pre-prepared using Google Earth and other tools. In addition, in mountainous areas - and especially in rubber forests and mango fields, where the C/Ps emphasize route selection (areas of western Pharyargyii, southern Bago, etc.) - the study team also confirms proposed transmission route avoidance plans to avoid the locations of fields.

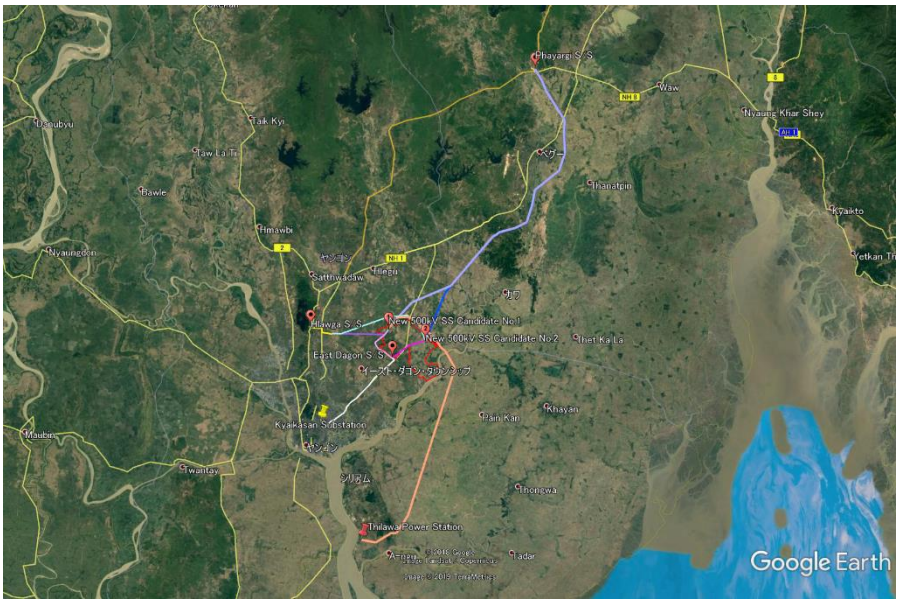
[Route Investigation Methods for underground transmission lines]

Preliminary route selection for underground transmission lines is carried out on a map (such as Google Maps). Route surveys in the field are performed considering the following items comprehensively.

- Traffic situation
- Obstacles to route selection for underground transmission lines
- Residences surrounding routes selected for underground transmission lines
- Crossing points of rivers, railways and so on

3.2. Route map for Transmission Lines

An overall view of this project is shown below. Pharyargyii substation, as the base point, is located around 90 km north of the center of Yangon city.



Source: JICA survey team

Figure 3.2-1 Overall View of Phase III project

Based on the results of the site investigations described in the previous section, the team compares multiple alternative plans by considering the economics, workability, site conditions, construction plans, environmental and social considerations, etc. Optimal plans and designs for transmission lines are developed to proceed to the preliminary design stage.

- **<u>500 kV Pharyargyi-Sar Ta Lin Overhead transmission line</u>**

Pharyargyi substation is located about 90 km northeast of Yangon. Sar Ta Lin substation was eventually determined as a 500kV new construction in the northern part of Yangon. The route connecting the two substations had the following three candidates. Route A (64 km long) going south, parallel to the ODA loan 500 kV Pharyargyi-Hlinetaya transmission line, which will start construction soon, about 20 km and going south to the Sar Ta Lin substation. Route B (72 km long), which passes south of Route A. Route C (70km long), which runs mainly through the riverbed on the east side of Bago city.

As a result of evaluating and comparing these three routes, the eastern route (Route C) was determined for the following reasons.

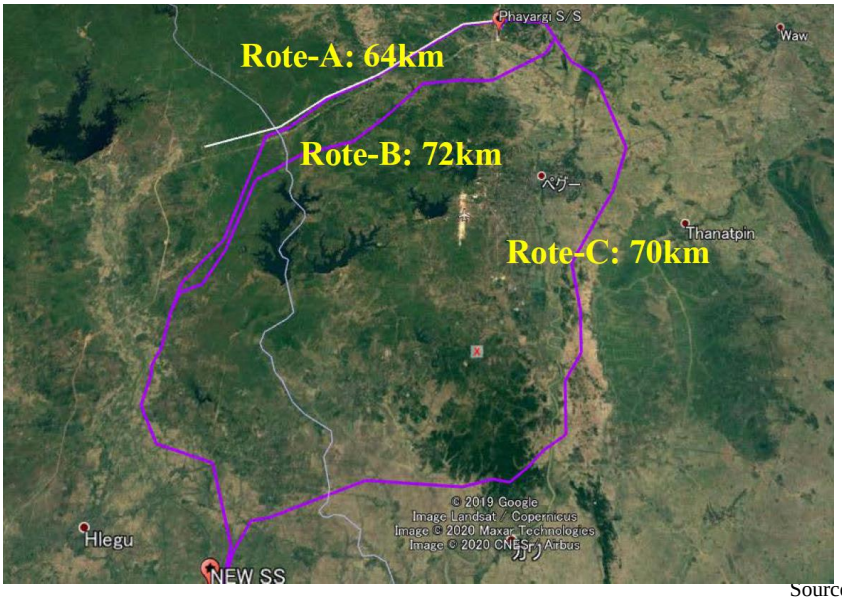
> Outlet of overhead transmission line from Pharyargyi substation without changing.

> It is flat countryside and passes through a riverbed.

> No land negotiation regarding rubber forests or mango gardens is required.

> Good access to the construction site.

However, this route is long and most of it passes through riverbeds and countryside - areas which have weak soil conditions. Therefore, most of the tower foundations must be pile type foundations, so the construction costs increase by around 50% compared to Routes A or B.



Source: JICA survey team

Figure 3.2-2 500 kV Pharyargyi-Sar Ta Lin Route Map of Overhead Transmission Lines

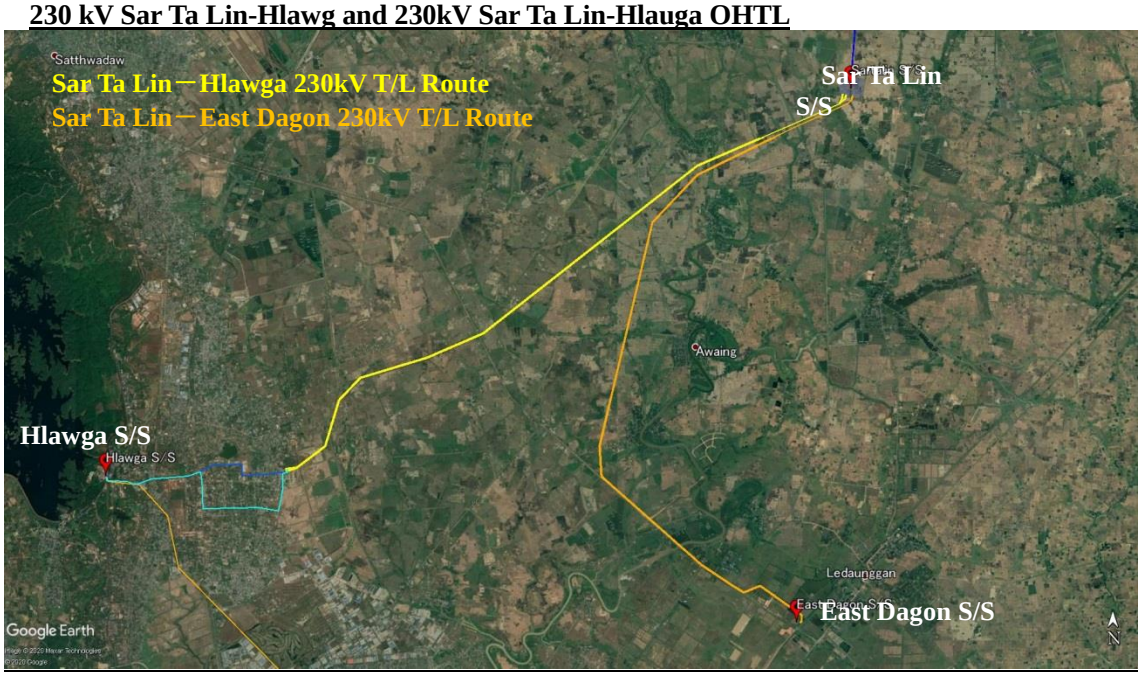
Table 3.2-1 Evaluation of 500kV Route

Route	Total Length (km)	Expected Weak Soil Area (km)	Plantation Area (km)	Forest Protection Area (km)	Crossing Points	Connection Bay in Pharyargyi S/S	Evaluation
A	64km	27km (42%)	1km	5km	Highway: 2 National road: 1 River: 1 T/L: 2	**P14 T/L must be shifted to right side bay and P14 T/L towers from No.1-7 also moved to North.**	×
	◎	○	◎	△	△	×	
B	72km	27km (38%)	15km	5km	National road: 2 River: 1 T/L: 2	Originally planned bay in Pharyargyi S/S can be used.	×
	△	○	×	△	○	◎	
C	70km	68km (97%)	3km	None	National road: 5 Railway: 3 River: 3 T/L: 5	As above	○
	○	△	○	◎	△	◎	

Source: JICA survey team

Near the existing 230kV Hlawga substation, there are military and national parks in the north, residential areas in the east and south, and Hlawga Lake in the west. In consideration of environmental and social considerations and the feasibility of transmission line construction, it was decided that the Sar Ta Lin-Hlawga transmission line route would include underground line because the vicinity of the Hlawga substation will be densely populated with residential areas. The demarcation point from the overhead line is the boundary between the residential area and the cultivated area to reduce construction costs. The 17km overhead transmission route from the Sar Ta Lin substation to the branch tower passes through the countryside and does not pass through residential areas. This transmission line will have a much larger transmission capacity in the future judging by the system analysis, and will become a four-circuit route. The Sar Ta Lin-East Dagon transmission line route has a route length of 21km that detours the future YCDC area. From the Sar Ta Lin substation, it heads south for 10 km through the countryside and follows the No. 7 road southeast to the East Dagon substation. There are some houses along National Road Route 7.

- **230 kV Sar Ta Lin-Hlawg and 230kV Sar Ta Lin-Hlauga OHTL**



Source: JICA survey team

Figure 3.2-3 Map of 230kV Sar Ta Lin-Hlawga and 230kV Sar Ta Lin-Hlawga OHTL

- **Outline of 230 kV Underground Transmission Line route**

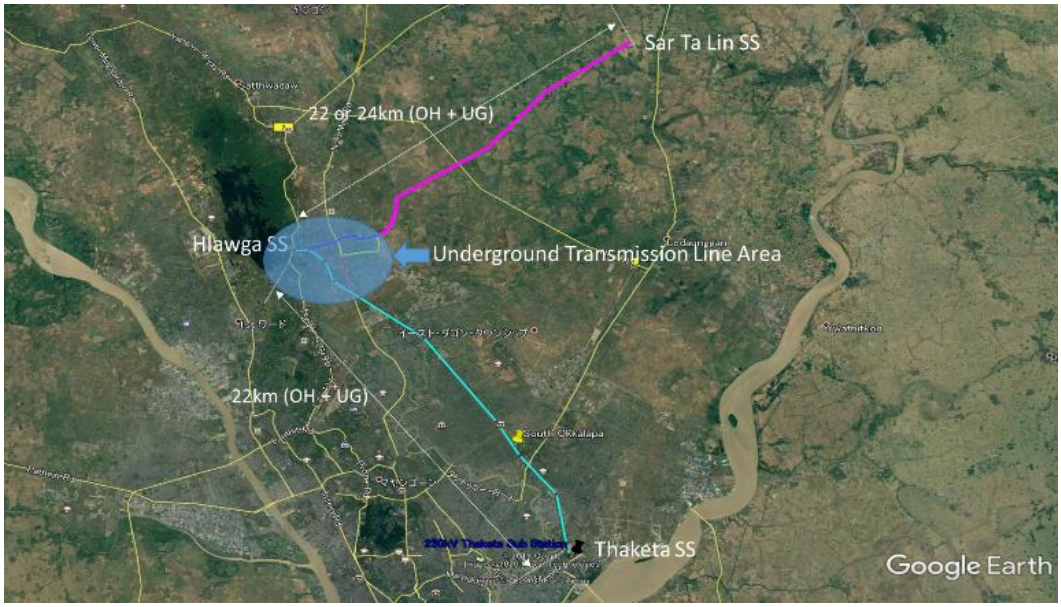
This scope of the underground transmission line facilities is as follows:

>1 system: Sar Ta Lin substation to Hlawga substation, 4 circuits

>1 system: Thaketa Substation to Hlawaga Substation, 2 circuits

Every underground transmission line is planned to pass through a branch tower from the overhead transmission line without circuit breakers.

These transmission lines are planned to be underground because the area around the Hlawga substation has many residential developments.



SOURCE: JICA survey team

Figure 3.2-4 230kV Overall View of Underground Transmission Line System

- **Outline of 230kV UGTL (Sar Ta Lin SS – Hlawga SS)**

The Transmission line from Sar Ta Lin SS to Hlawaga SS is 4 circuits, in accordance with the power system analysis. The transmission line is overhead, starting from Sar Ta Lin substation. It is difficult to build towers for overhead transmission lines in the area of Hlawga Substation because of residential developments. This area is underground transmission, under a public road. It is necessary to divide it into two routes from the branch tower to NHG3 road because the road is very narrow.

North Route to Hlawga SS)
(Width of road: 3m)

Source: JICA survey team

North Route to Hlawga SS
(Width of road: 5m)

South Route to Sar Ta Lin SS
(Width of road: 10m)

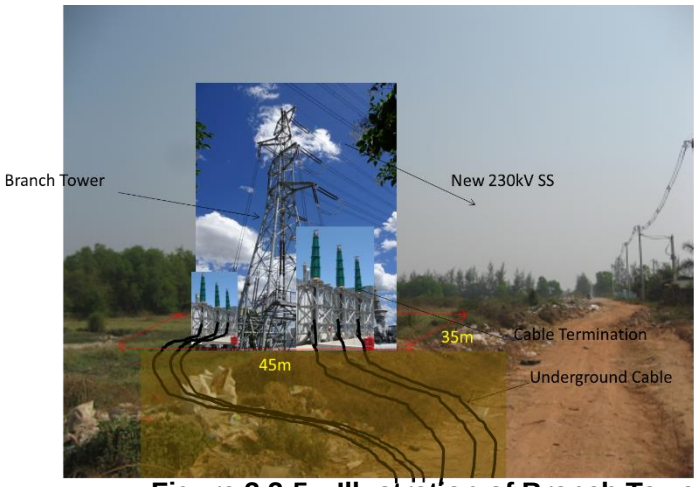
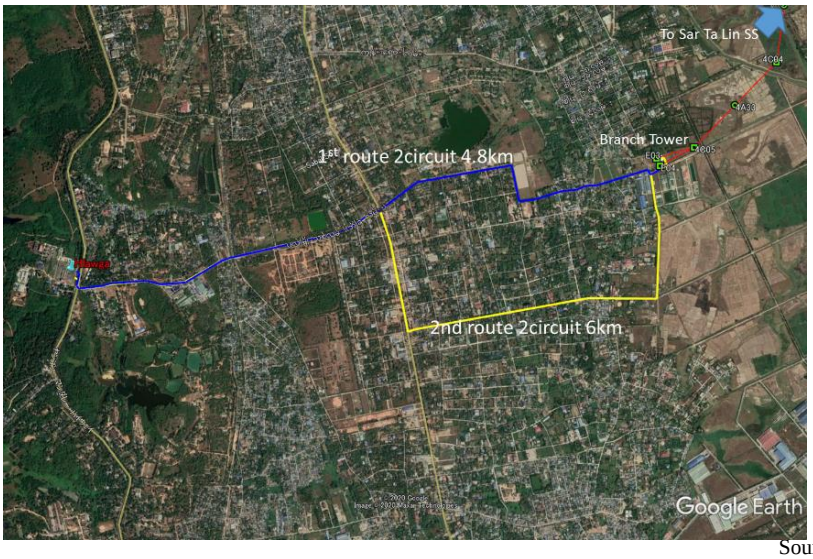


Figure 3.2-5 Illustration of Branch Tower

This figure shows an outline of a branch tower. The conductor from the tower goes down to a cable

termination, then underground. The required area is 35m x 45m, taking into consideration a fence for the borderline with the public area.

This figure shows an outline of Sar Ta Lin SS to Hlawga SS. The blue line is around 4.8km in length and shows the north route. The yellow line is around 6km in length and shows the south route. These routes merge from the intersection of the NH3 road.

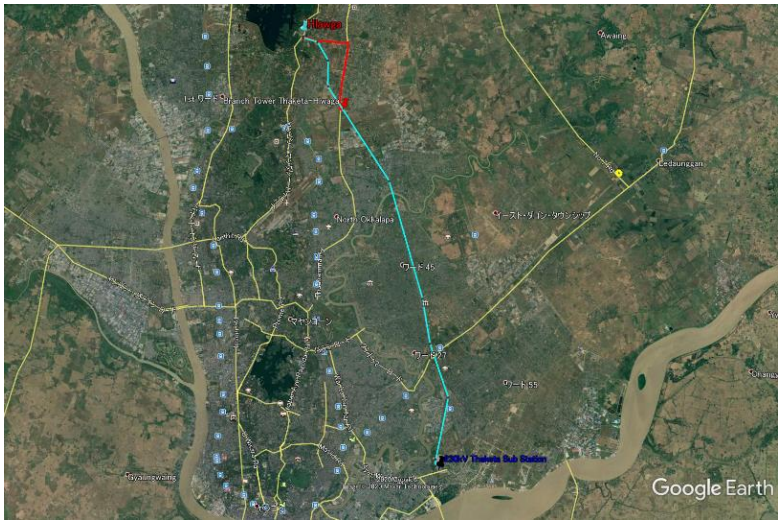


Source: JICA survey team

Figure 3.2-6 230kV Sar Ta Lin SS – Hlawga SS UGTL Route

- **Outline of 230kV UGTL (Thaketa – Hlawga SS)**

Underground cables are applied for replacement and repowering of the existing overhead transmission line between Thaketa SS and Hlawga SS because it passes through dense residential areas. The existing line is replaced for the new transmission line, with a tower around 18km from Thaketa substation. Underground transmission line is planned from the branch tower to Hlawga SS, through the NH3 road. The length is around 5.7km. This figure shows an outline of the overhead and underground transmission lines.



Source: JICA survey team

Figure 3.2-7 230kV Thaketa SS - Hlawga SS Route Outline

Source: JICA survey team

Figure 3.2-8 Expected Site for Branch Tower of 230kV Thaketa – Hlawga Line

Branching for the underground transmission line is on the same, existing route without changing ROW, and the underground transmission line has access to a public road.

- **<u>All 230 kV UGTL routes for this scope (2 systems, 6 circuits)</u>**

This figure shows an outline of the 230kV underground transmission line system in this project. Every underground transmission system is built in a duct system from the branch tower.

Sar Ta Lin - Hlawga North Route (blue line): around 2.5km
Sar Ta Lin - Hlawga South Route (yellow line): around 2.8km
Thaketa - Hlawga (red line): around 2.5km

This line connects with Sar Ta Lin – Hlwga south line at the intersection of the NH3 road. This route is 4 circuits. These underground transmission lines are built in a tunnel system. The length is around 0.9km. In addition, these 4 circuits connect with the Sar Ta Lin – Hlawga north line at another intersection of the NH3 road. These 6 circuits go to Hlwga Substation. These underground transmission lines are built in a tunnel system, and the length is around 2.3km.

Source: JICA survey team

Figure 3.2-9 230kV Overall UGTL View (Close-up)

Source: JICA survey team

This figure shows the situation at the road between the NH3 road and Hlwga SS. There are utility pipes on both sides of the road. It is necessary to build the tunnel in the center of the road, avoiding both utility pipes.

Source: JICA survey team

These figures show the NH3 road. The picture on the left shows the intersection of the NH3 road. The underground transmission lines become 6 circuits at this intersection. The picture on the right shows the NH3 road to the 4 circuits. This road is wide, with no paving on either side.

Source: JICA survey team

Entrance of Hlawga SS (to Mandalay)

Source: JICA survey team

In front of HlawgaSS
(to Hlawga SS)

Traffic is heavy on the Yangon - Mandalay Highway in front of Hlawga substation.

3.3. Soil Investigation

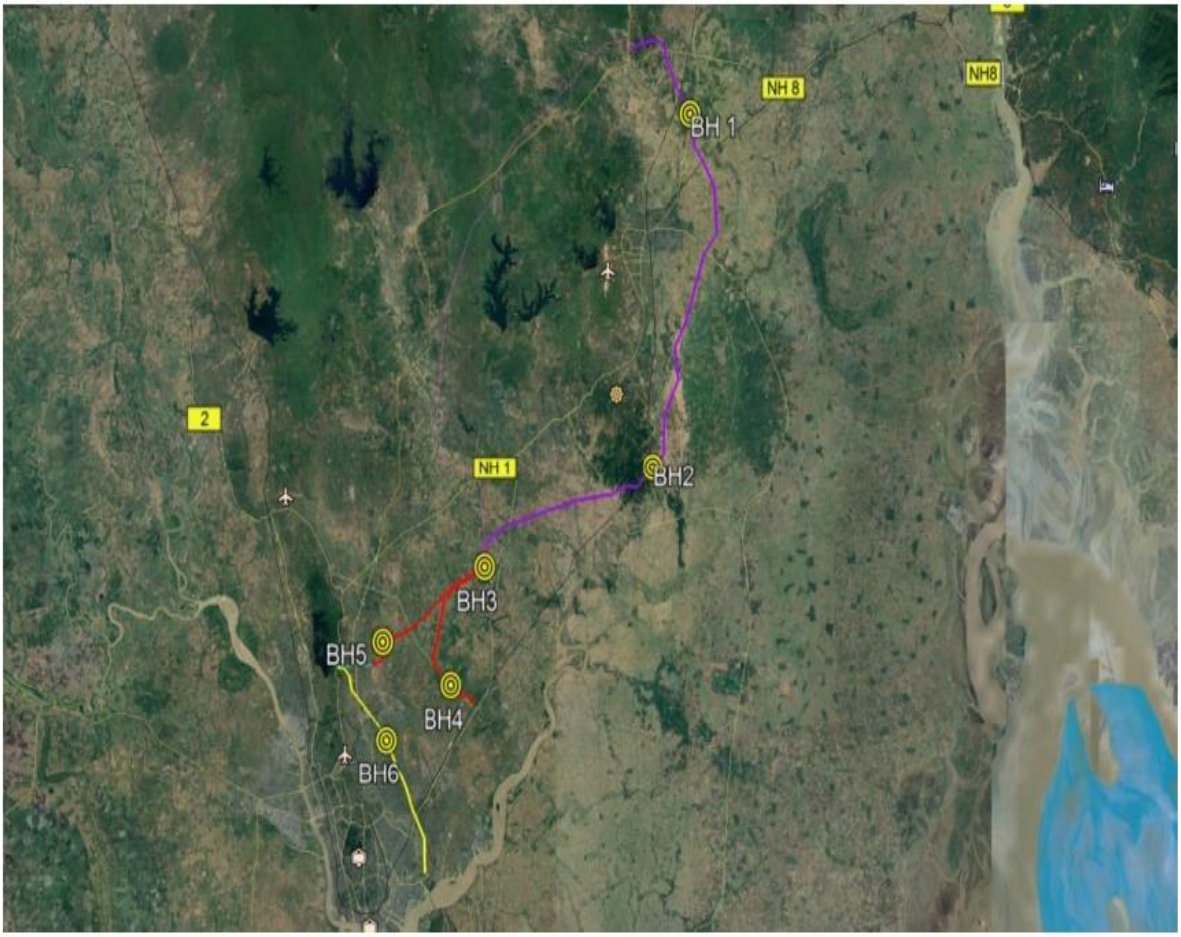
A soil investigation survey was executed to obtain basic information for studying the Transmission Line (hereinafter referred to as “TL”) route, foundations of the overhead towers and construction method for the underground TL. The detailed report on the Soil Investigation is to be reffered attached “Final Report for Route Study and Geological Survey for Transmission Lines under The Republic of the Union of Myanmar National Power Transmission Network Development Project - Preliminary Survey & Site Survey for Underground Transmission line on Phase III project”.

(1) Method of Soil Investigation

This soil investigation was executed at the following points based on Sar Ta Lin S/S, angle towers and towers near the river.

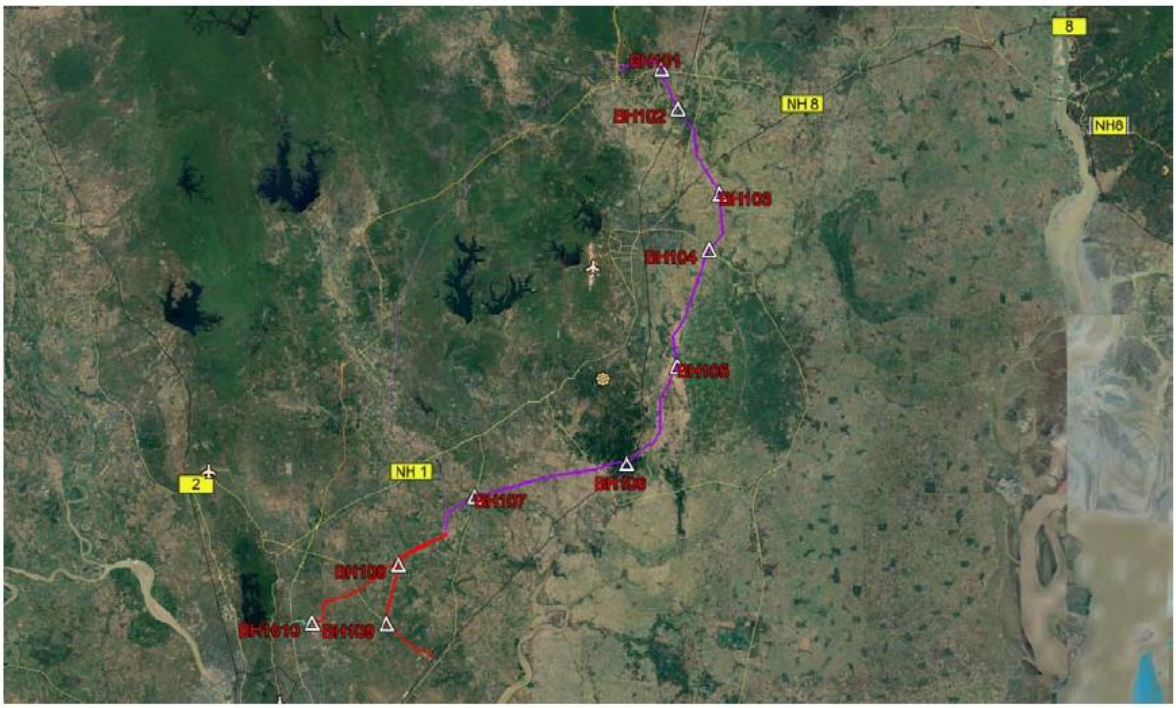
- 6 (six) standard borings (BH1~6) of 40.5m depth and laboratory tests.
- 15 (fifteen) simplified borings （BH101~109, BH1010, bh101~bh105） of 10.0m depth.

The locations for the soil investigation are shown in Figure 3.3-1, Figure 3.3-2 and Figure 3.3-3.



Source: JICA Study Team based on Google Earth

Figure 3.3-1 Locations of Standard Borings



Source: JICA Study Team based on Google Earth

Figure 3.3-2 Locations of Simplified Borings 1/2

Source: JICA Study Team based on Google Earth

Figure 3.3-3 Locations of Simplified Borings 2/2

(2) Geology of Project Area

The map for the TL Route, adding to the 1977 geological map of this project area, is shown in Figure 3.3-4 and Figure 3.3-5.

The locations of this project area are classified into 3 groups: Alluvium, Irrawaddy Formation, and Pegu

Group. Alluvium is soft ground, Irrawaddy Formation is solid soil ground, and Pegu Group is rock ground.

Most of the TL routes are on the Alluvium, which is relatively new and soft soil.

Near Phayargi S/S, the area near the middle of the TL route between Pharyargyii S/S and Sar Ta Lin S/S and the area near Hlawga S/S are on Irrawaddy Formation, which is relatively solid from Miocene to Pliocene.

Alluvium is the river terrace deposit of older alluvium and mainly consists of sand, silt, clay and some gravel. Irrawaddy Formation is the continental and marginal marine deposits of the Miocene – Pliocene belonging to the Irrawaddy Formation.

Since the Sagaing fault is found from Yangon city to the north of Yangon, based on the Figure 3.3-4 geological map, it is necessary to consider avoiding this fault when selecting tower locations.

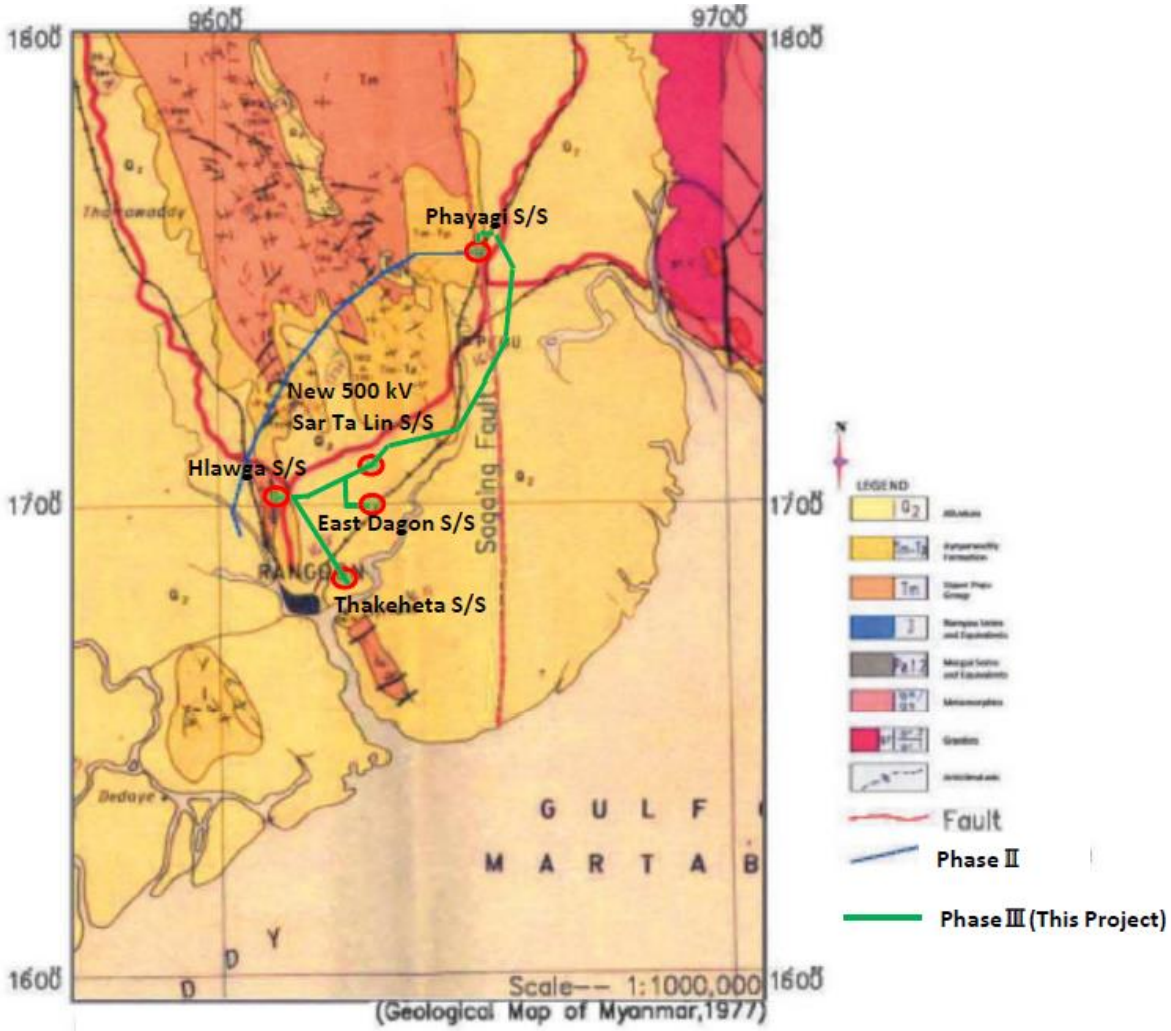
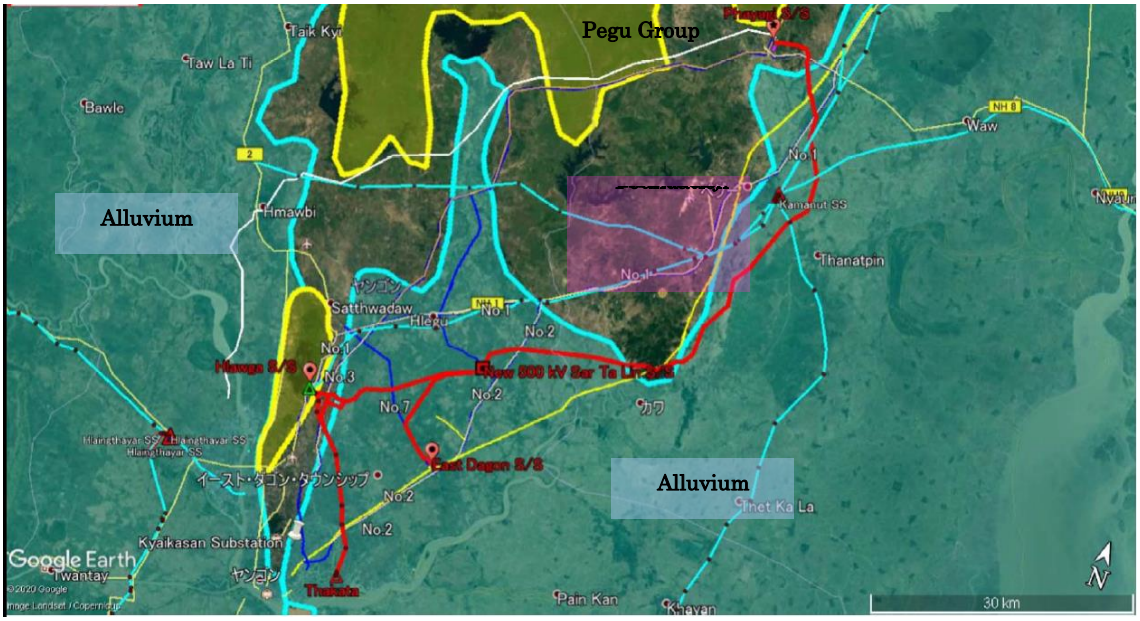


Figure 3.3-4 Geological Map of TL Route (1)



Source: JICA Study Team based on Google Earth

Figure 3.3-5 Geological Map of TL Route (2)

(3) Results of Soil Investigation

Boring logs as surveyed in this project are shown below. A boring log from Hlawga S/S, excerpted from "URGENT REHABILITATION AND UPGRADE PROJECT (PHASE 1) RENOVATION WORKS OF TRANSMISSION SYSTEM (PACKAGE 2) P2", and boring logs from East Dagon S/S are shown in the following figures.

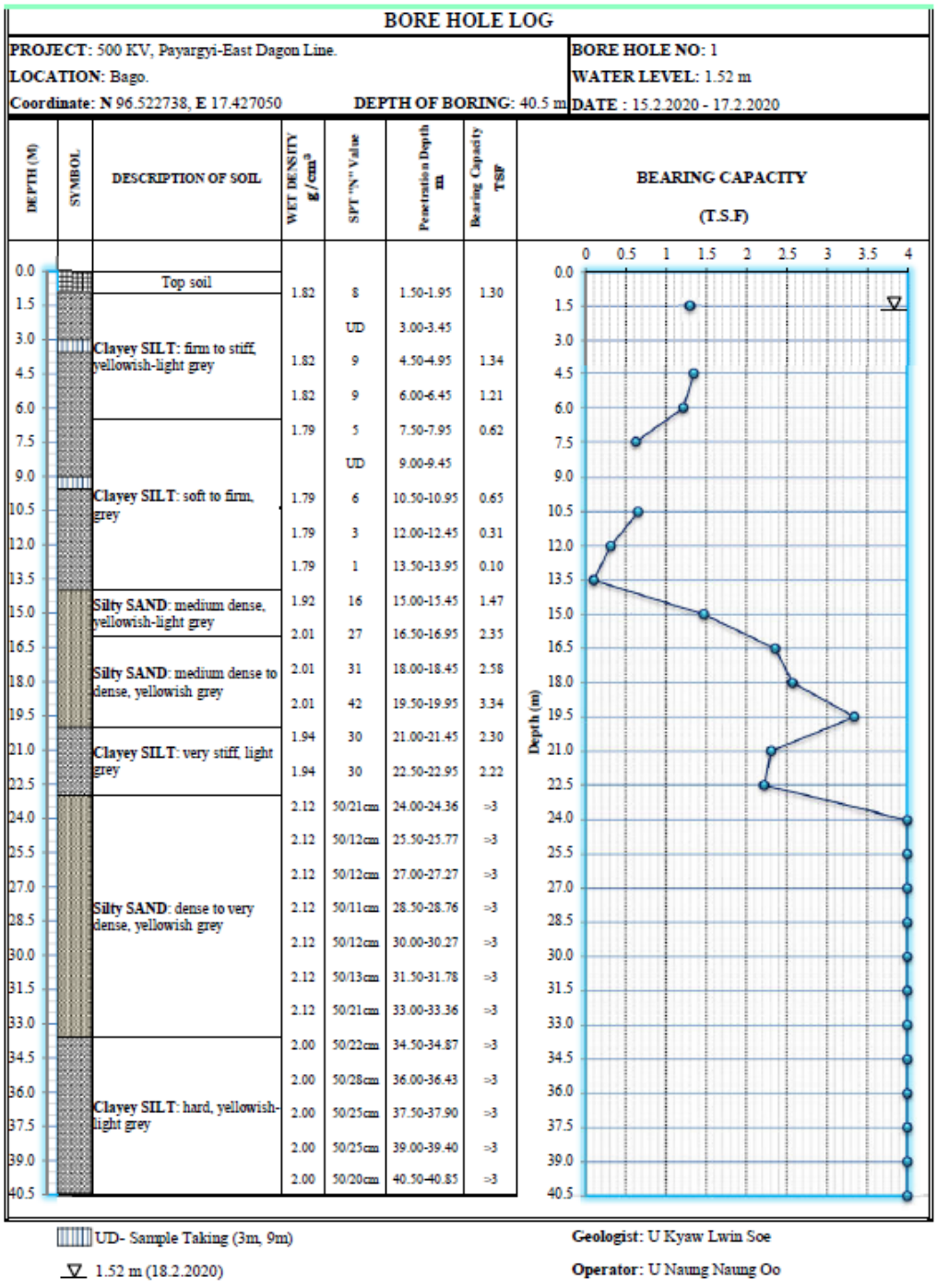


Figure 3.3-6 BH 1 Boring Log

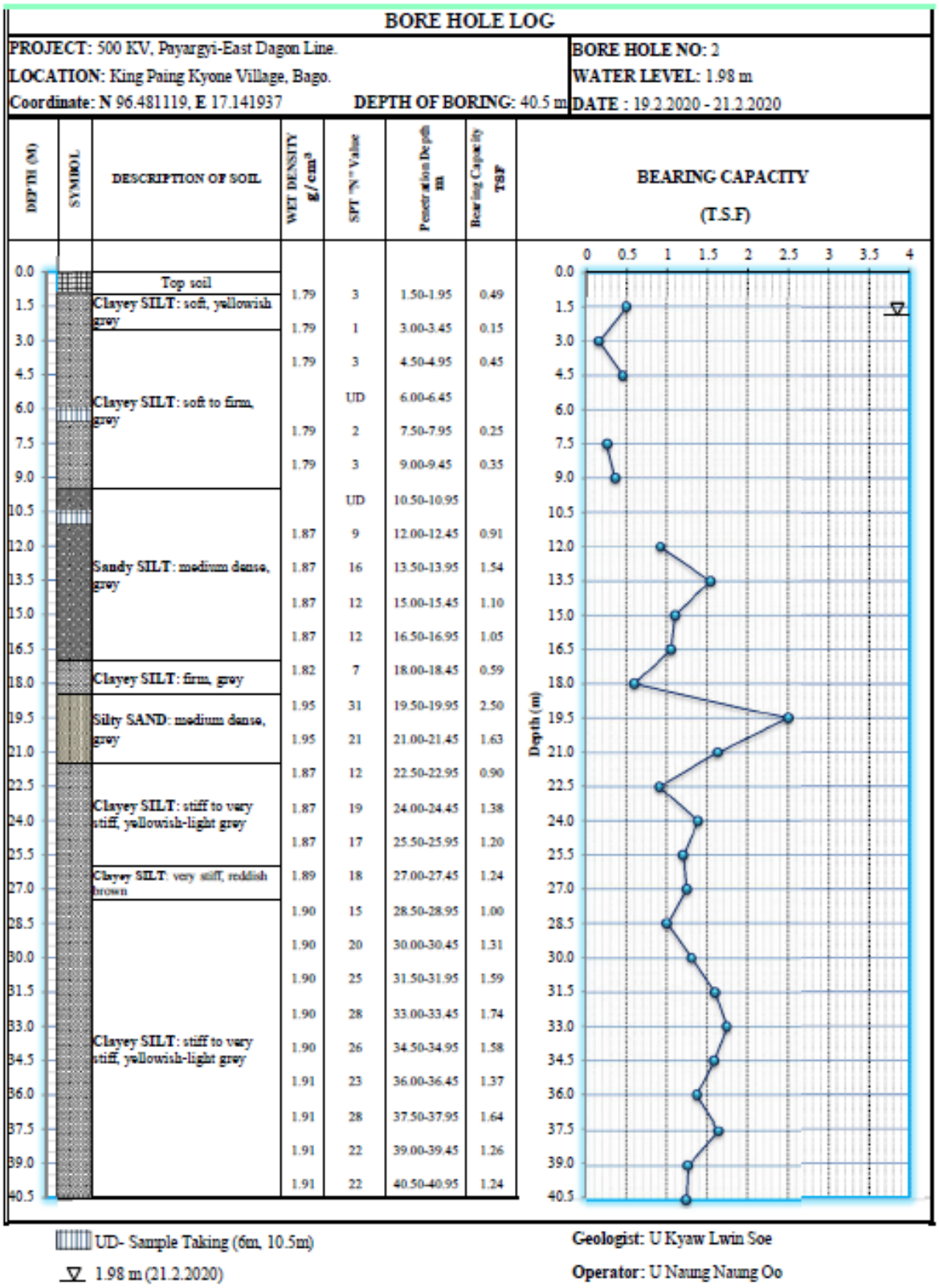


Figure 3.3-7 BH 2 Boring Log

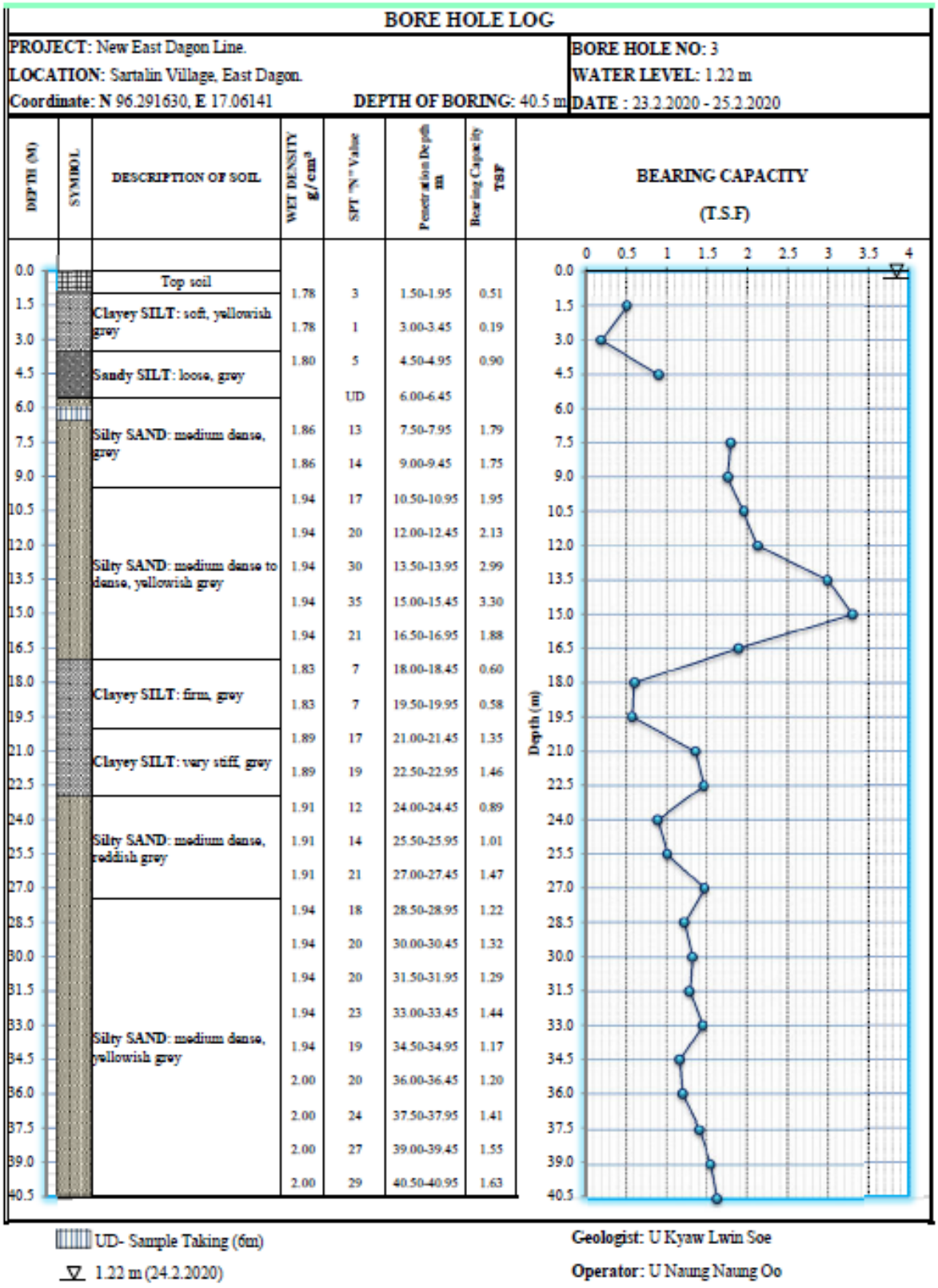


Figure 3.3-8 BH 3 Boring Log

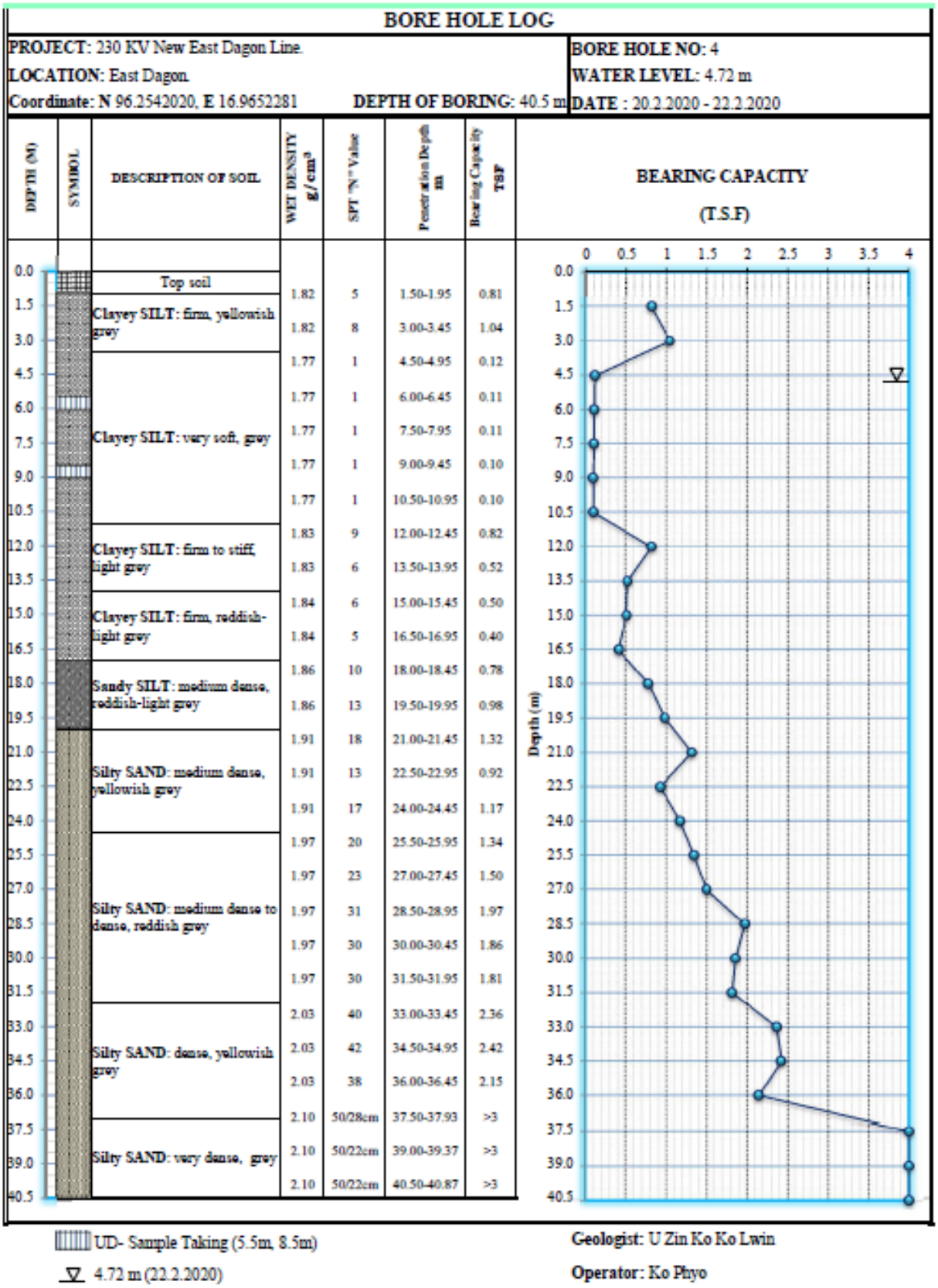


Figure 3.3-9 BH 4 Boring Log

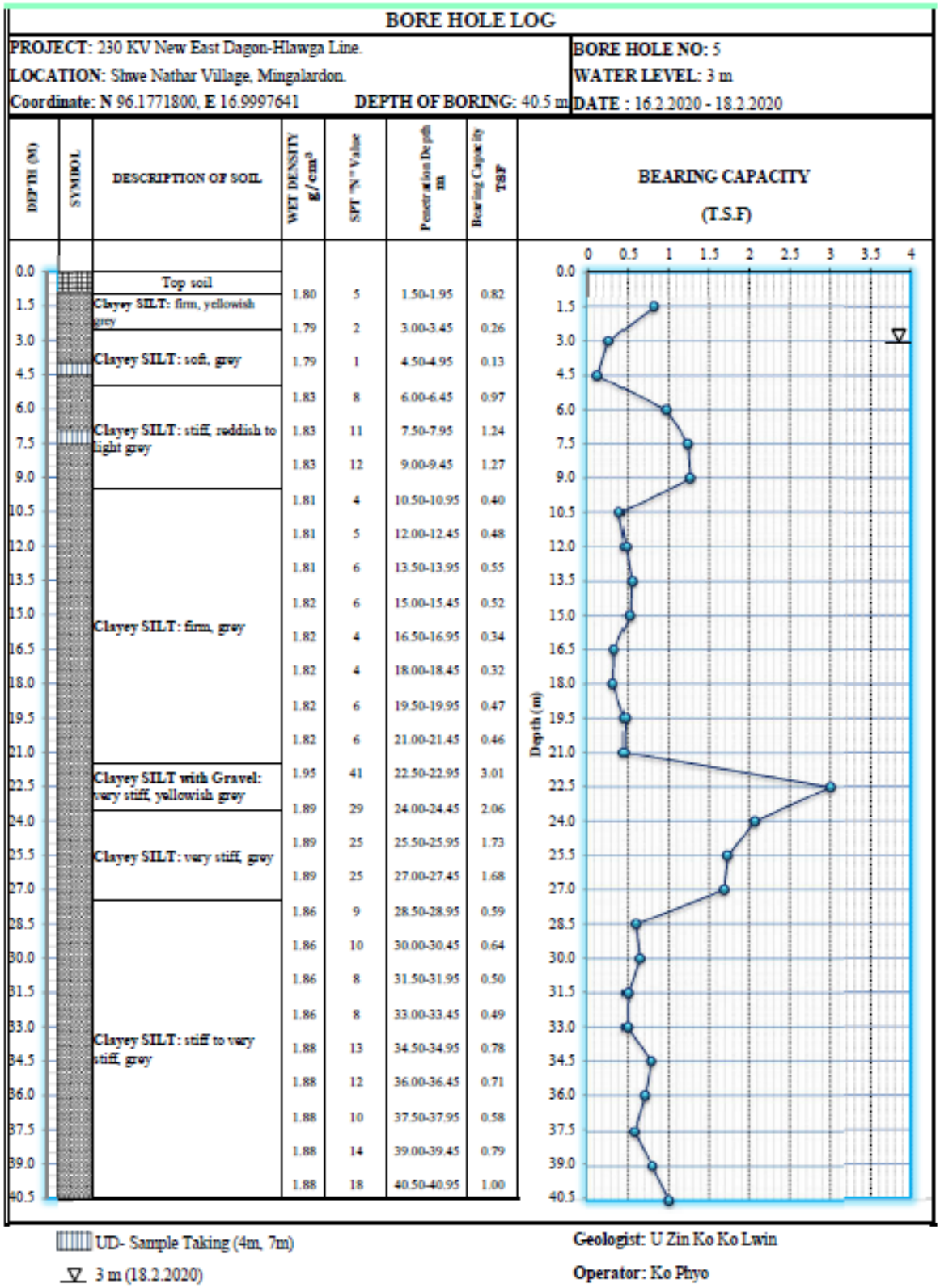


Figure 3.3-10 BH 5 Boring Log

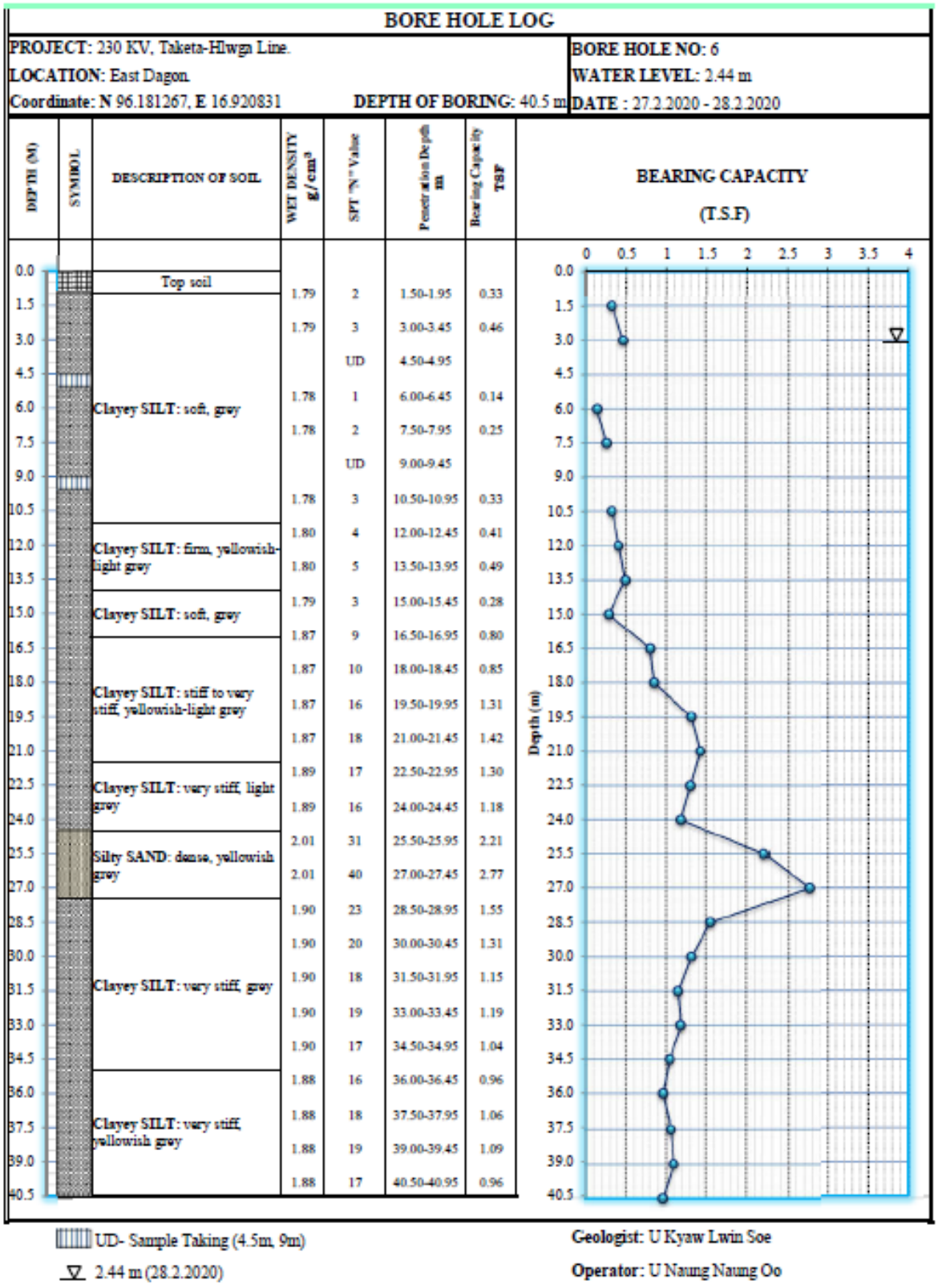


Figure 3.3-11 BH 6 Boring Log

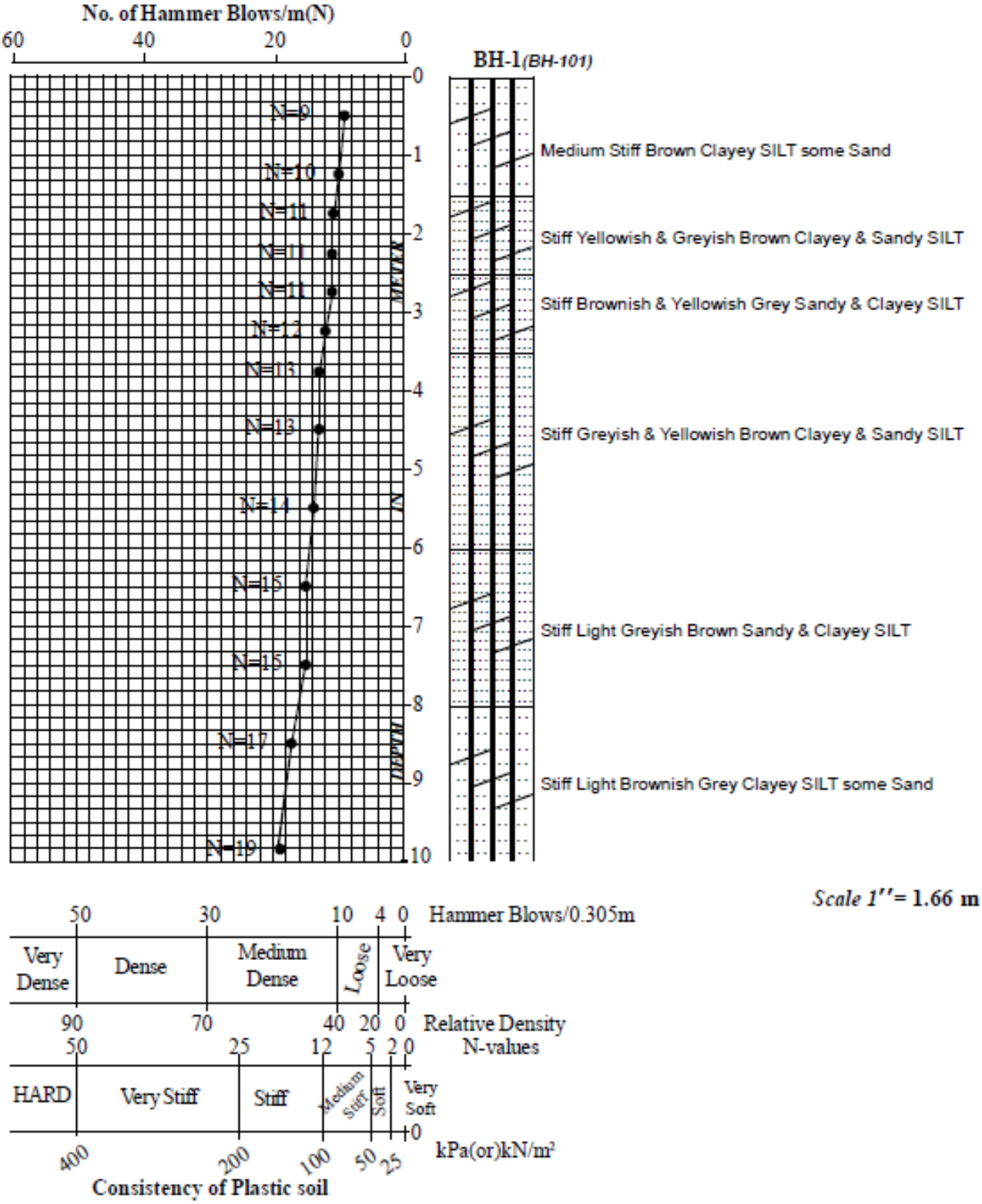


Figure 3.3-12 BH 101 Boring Log

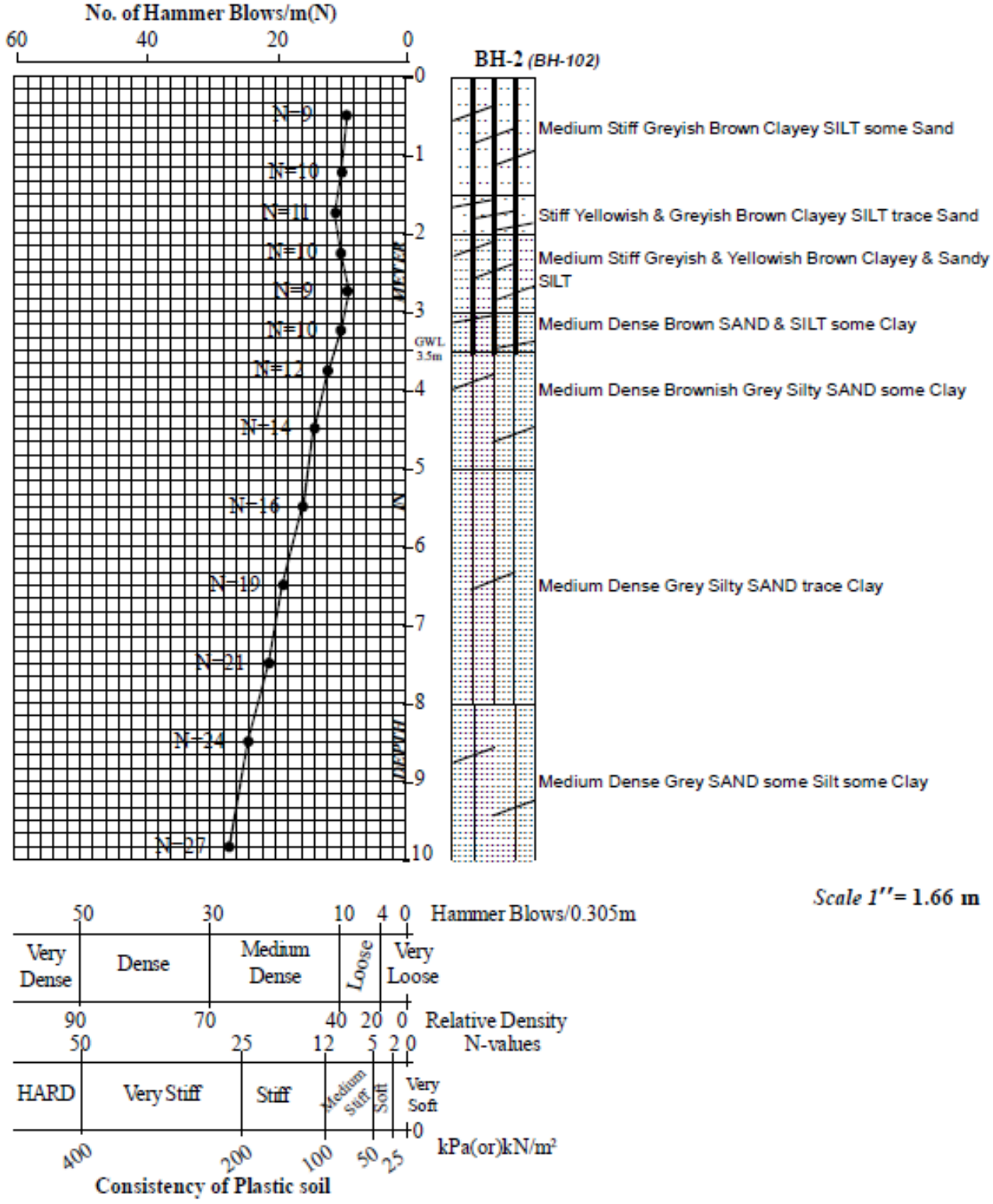


Figure 3.3-13 BH 102 Boring Log

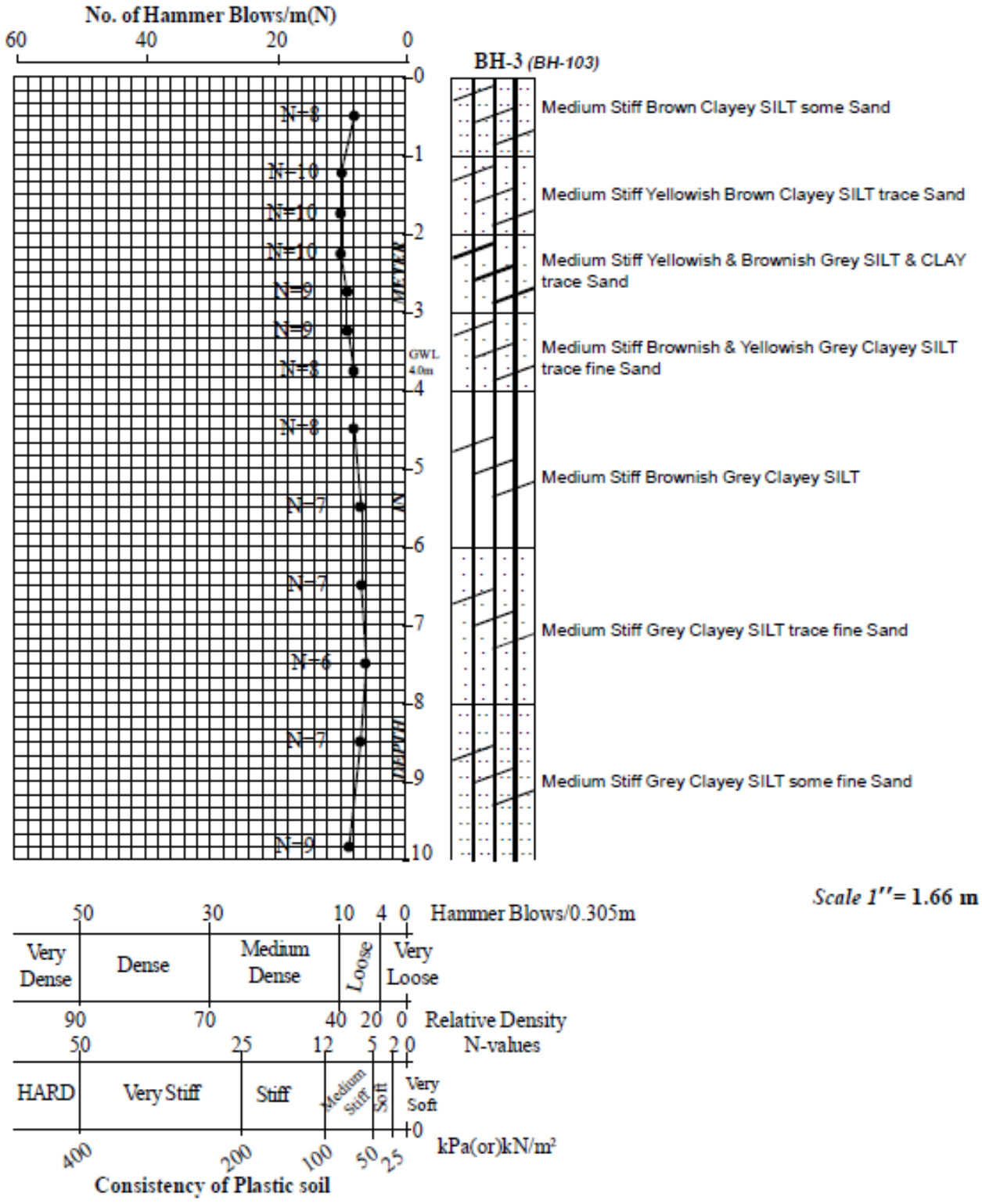


Figure 3.3-14 BH 103 Boring Log

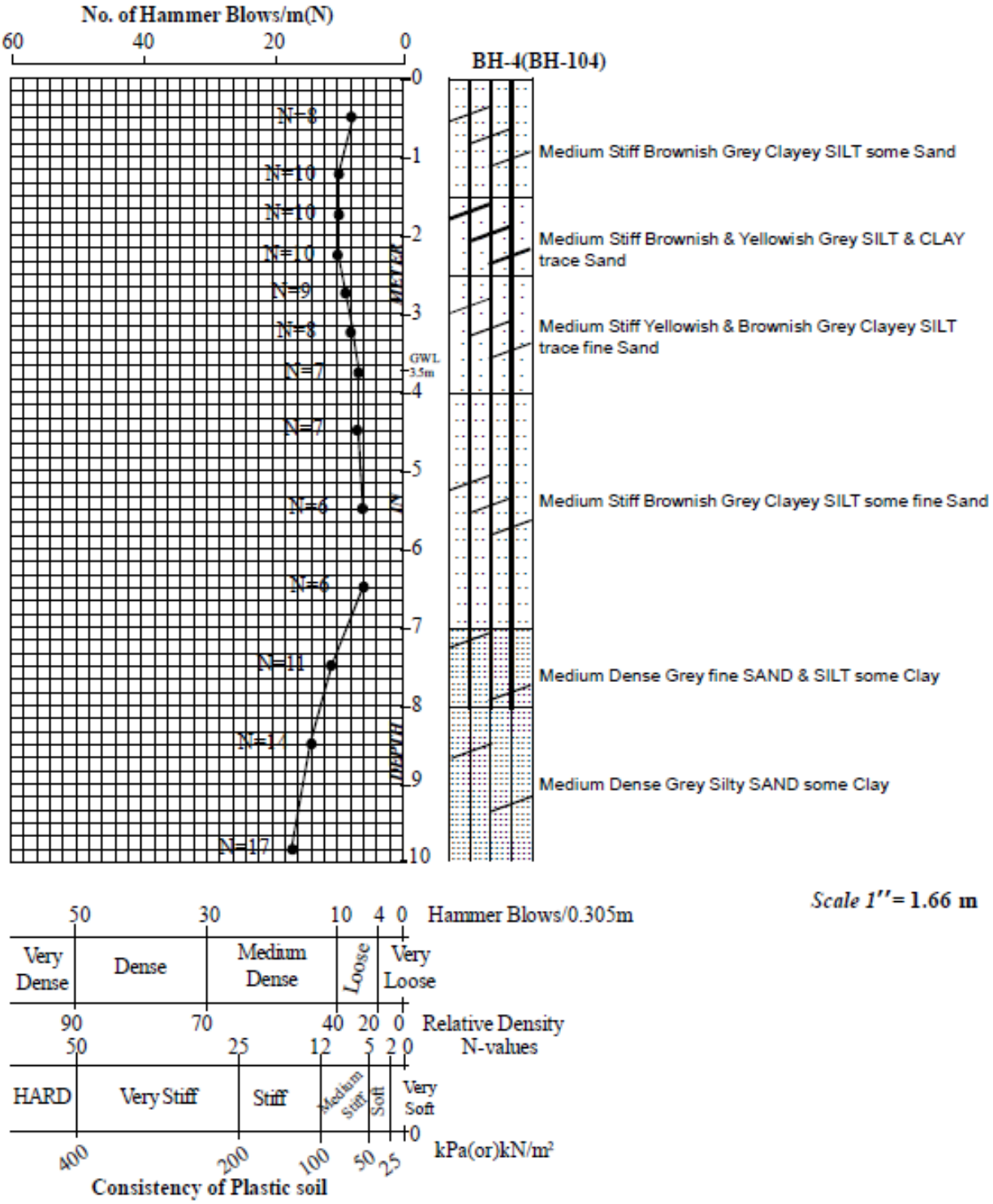


Figure 3.3-15 BH 104 Boring Log

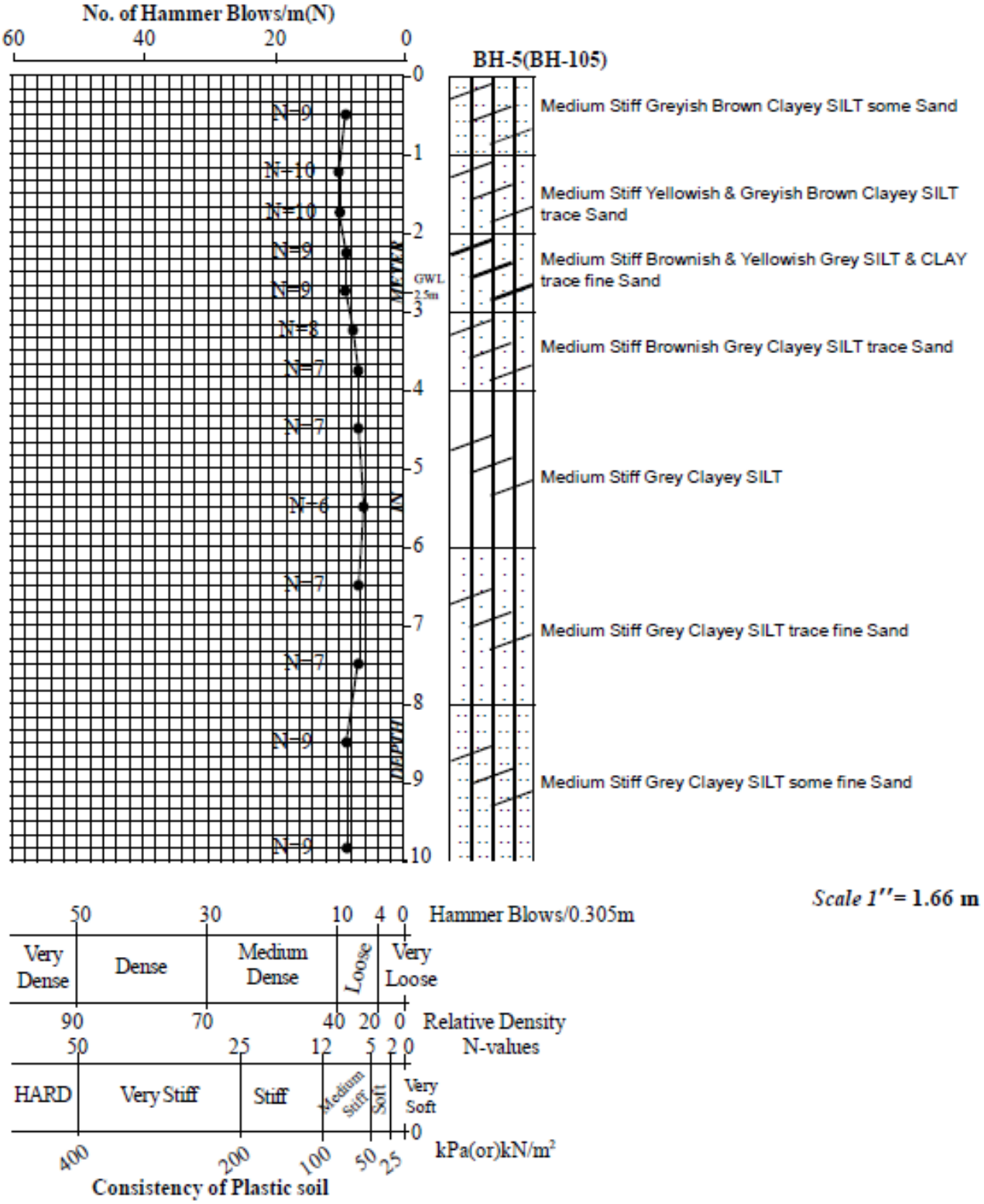


Figure 3.3-16 BH 105 Boring Log

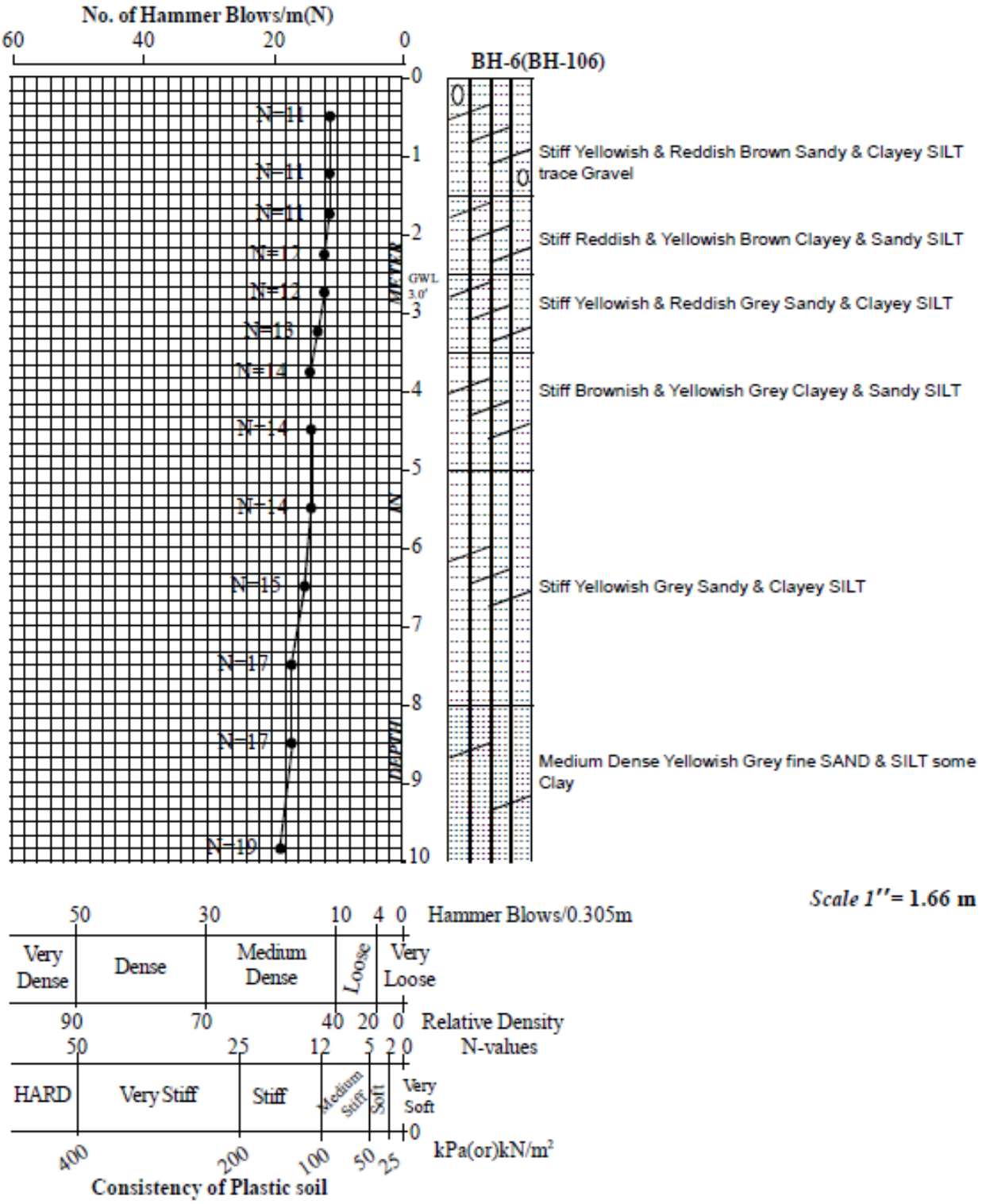


Figure 3.3-17 BH 106 Boring Log

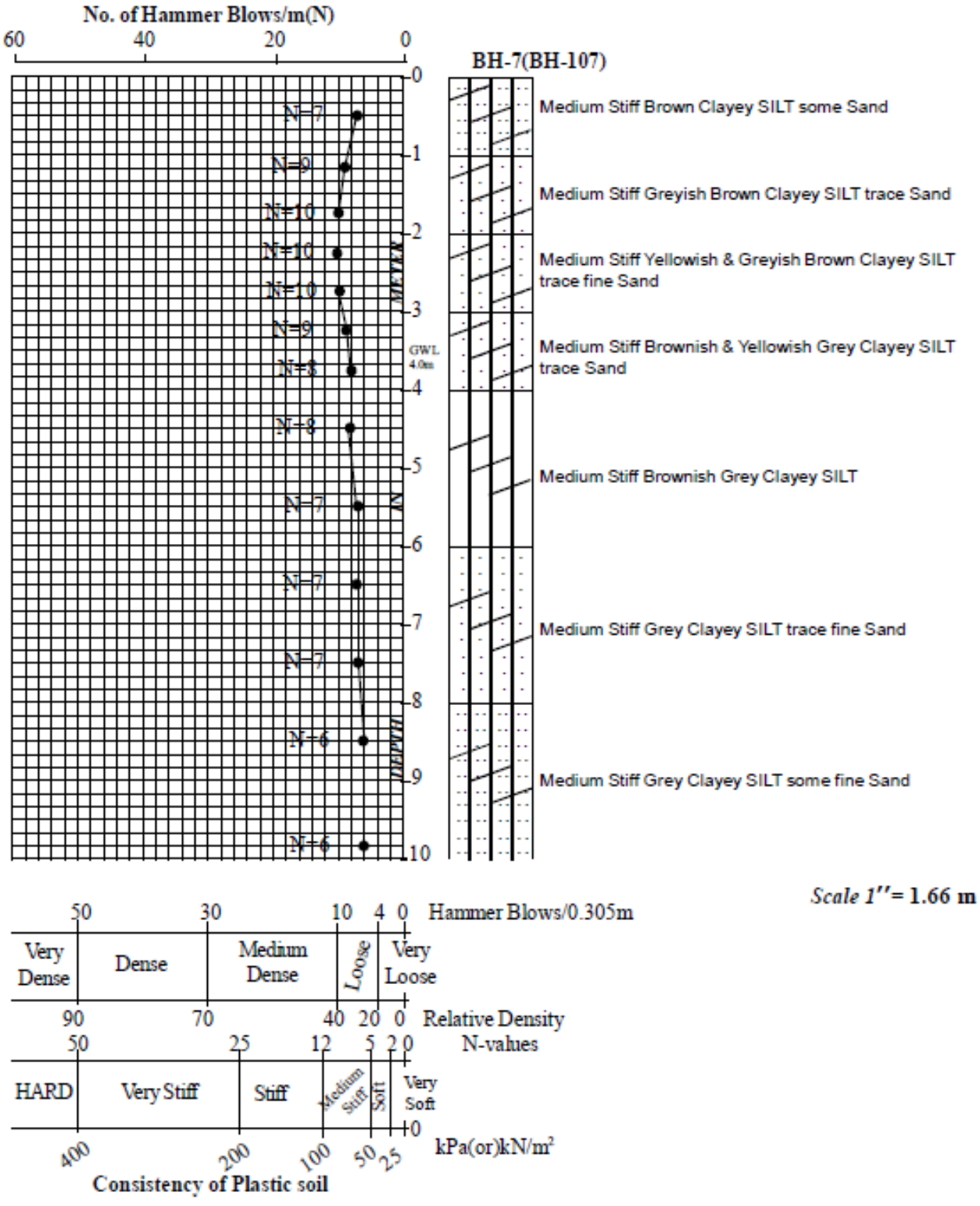


Figure 3.3-18 BH 107 Boring Log

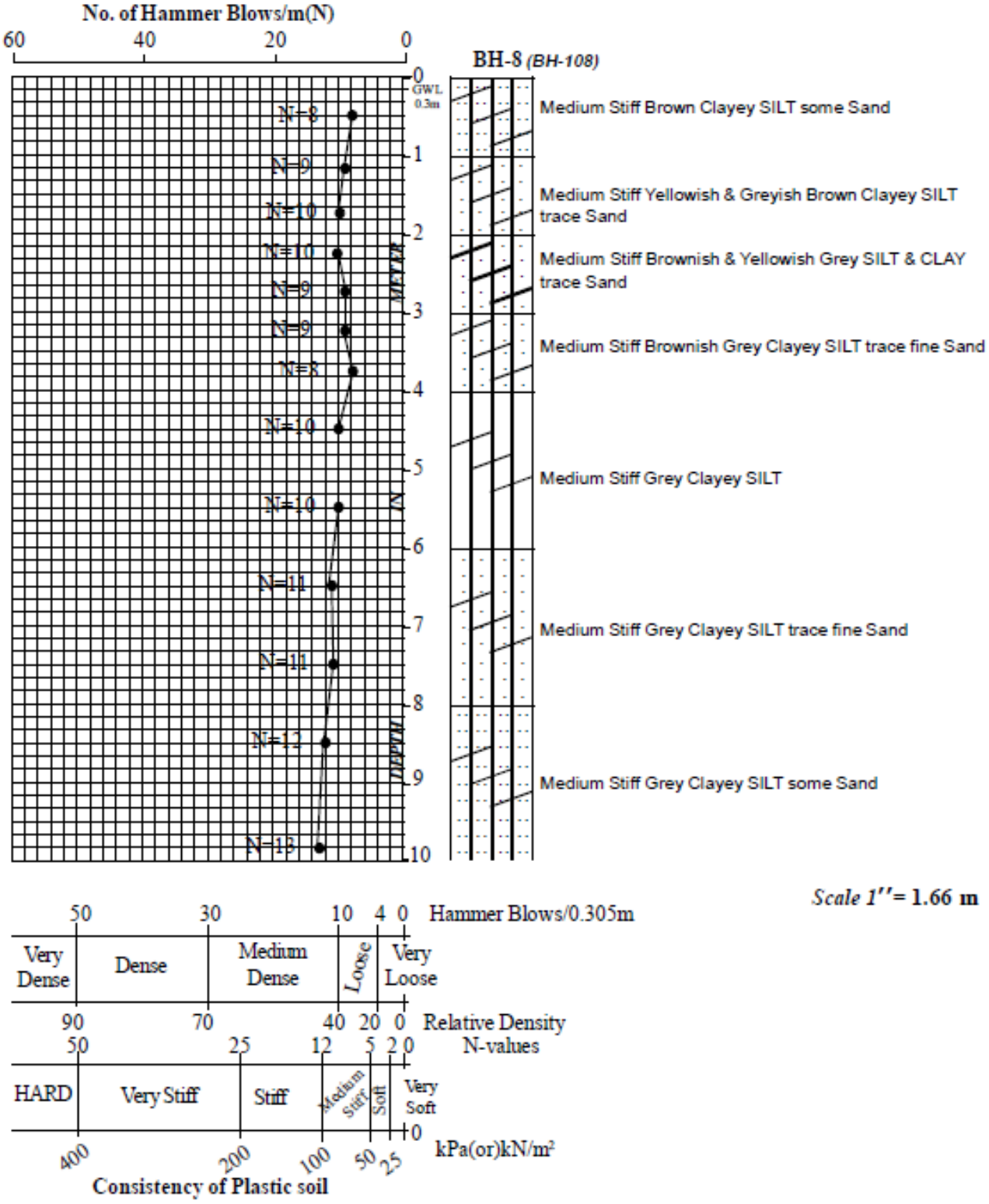


Figure 3.3-19 BH 108 Boring Log

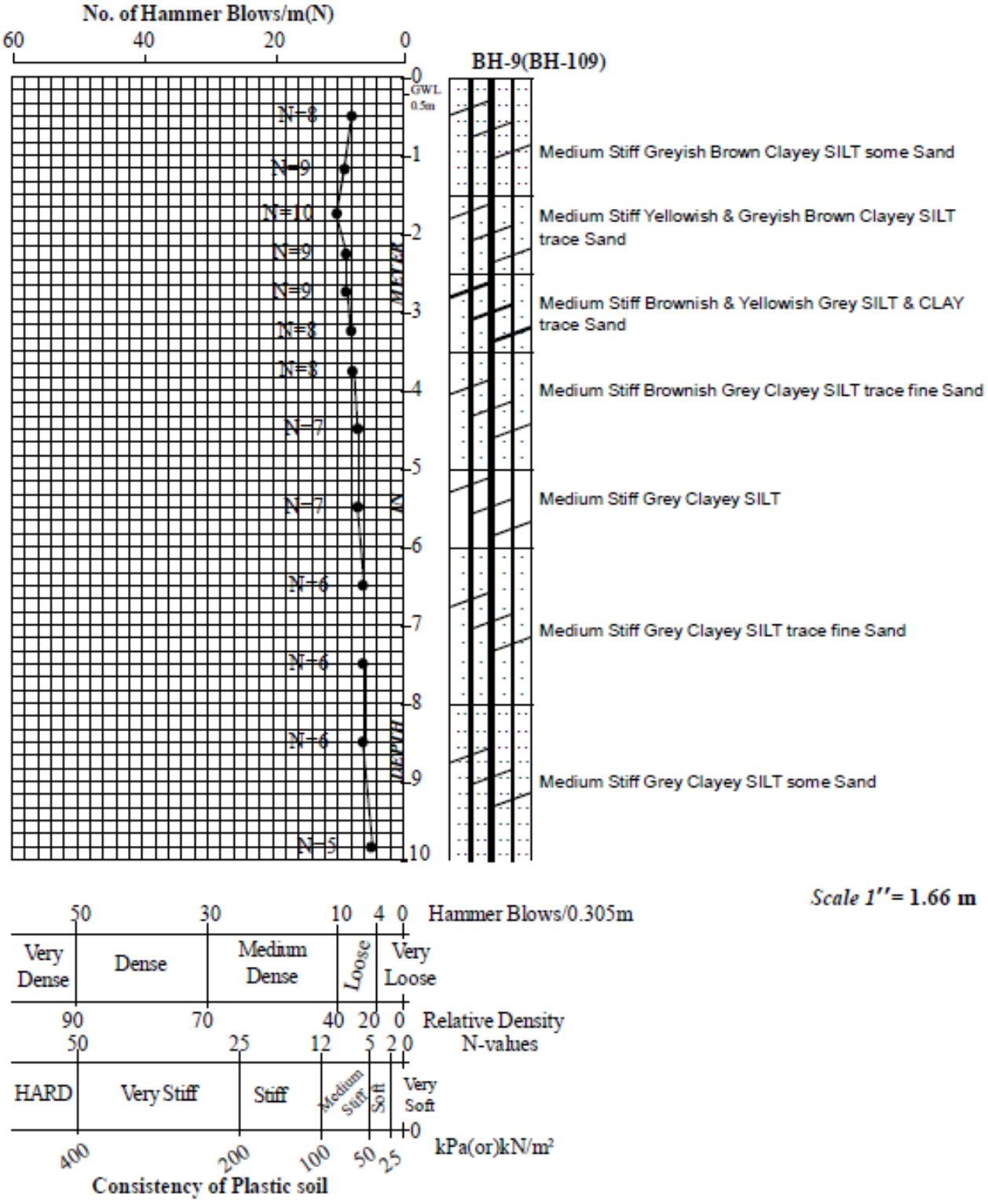


Figure 3.3-20 BH 109 Boring Log

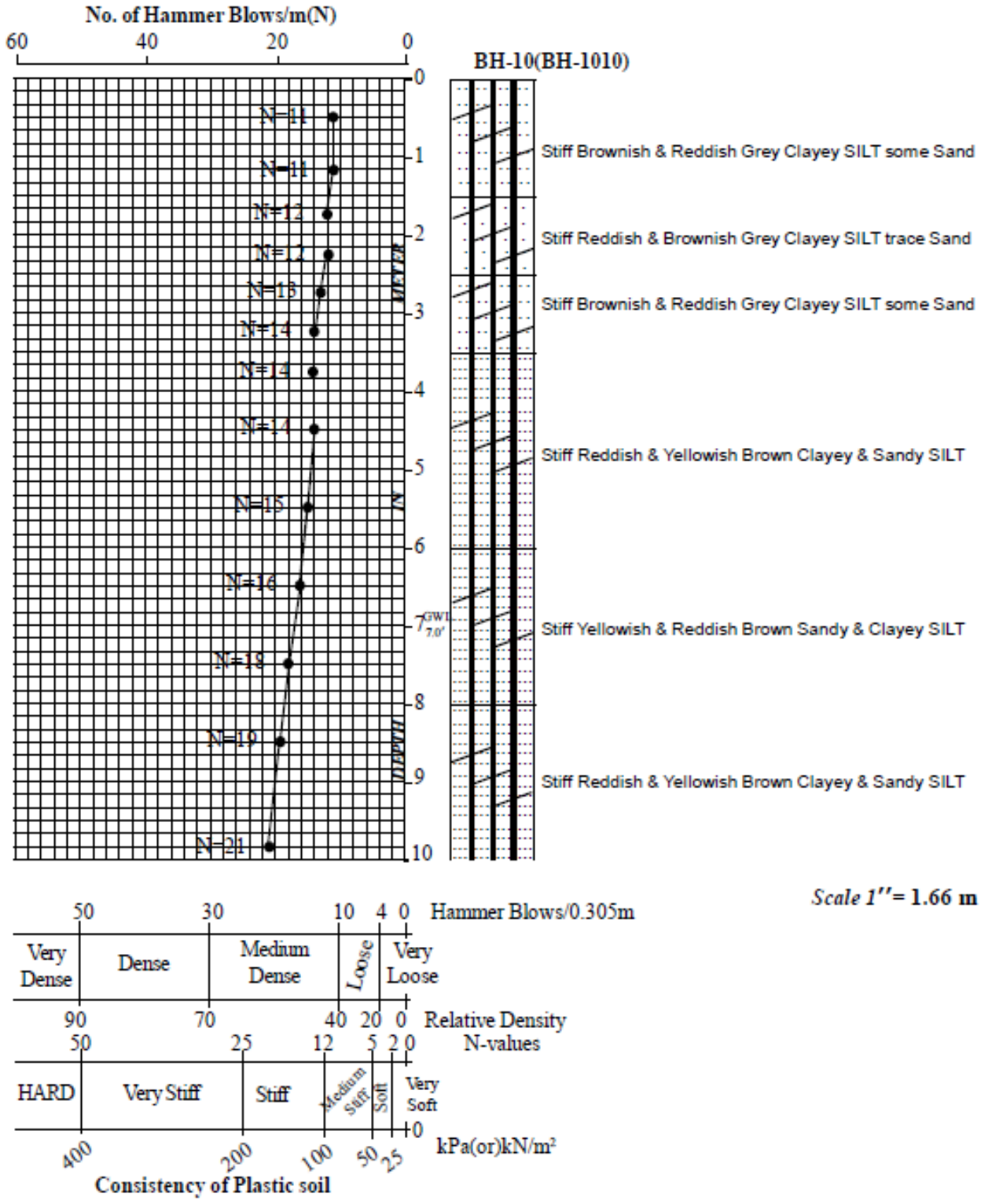


Figure 3.3-21 BH 1010 Boring Log

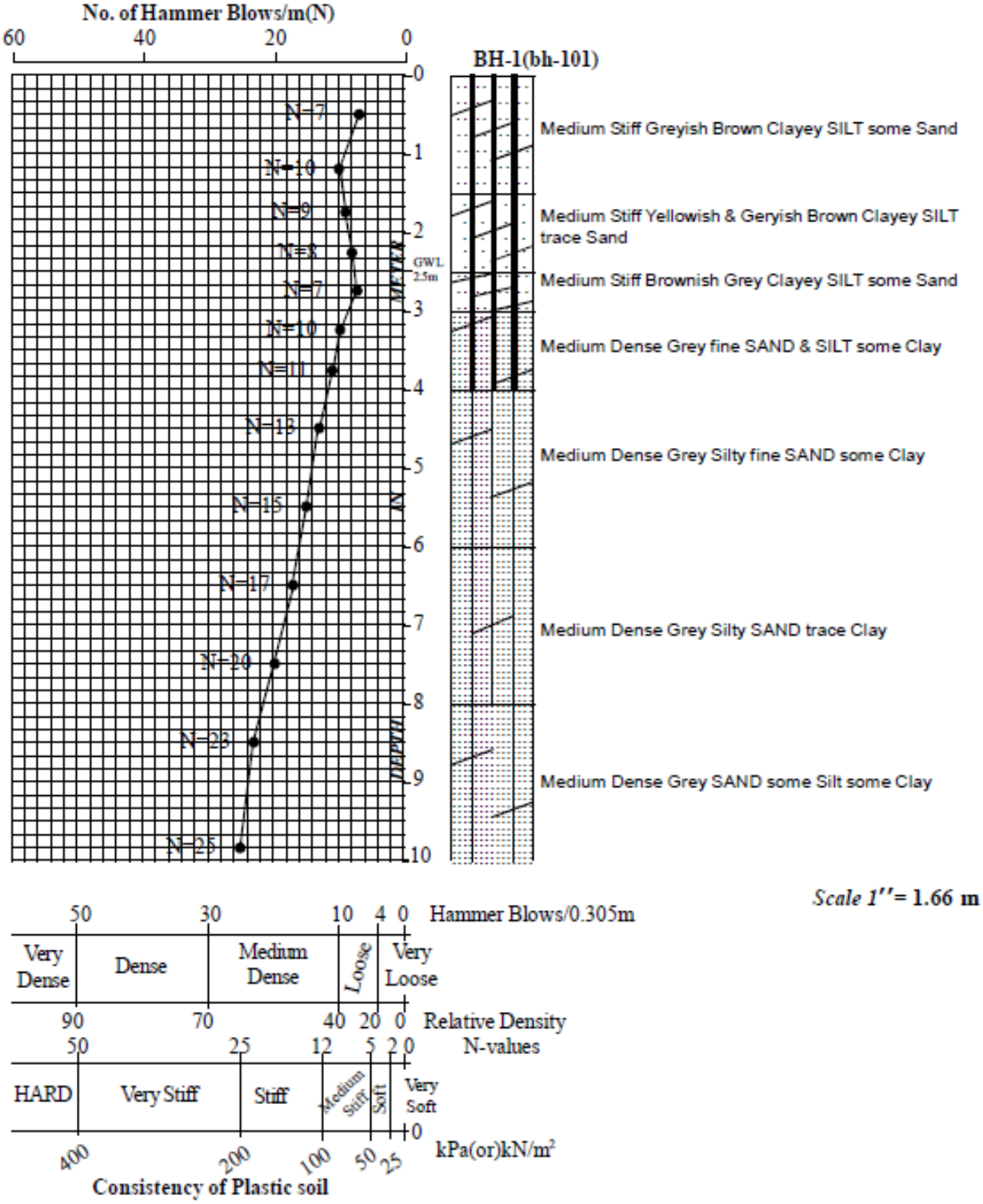


Figure 3.3-22 bh 101 Boring Log

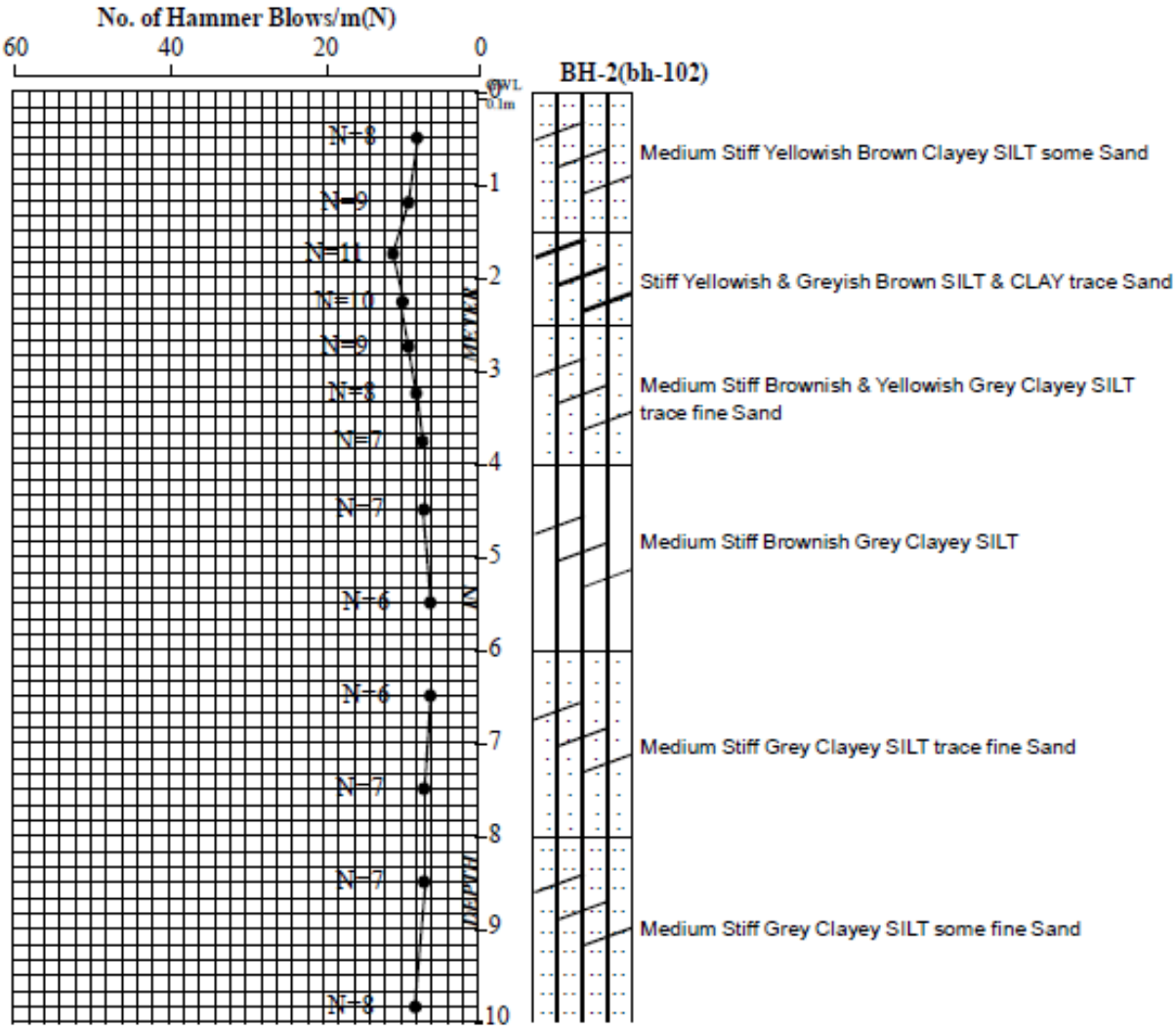


Figure 3.3-23 bh 102 Boring Log

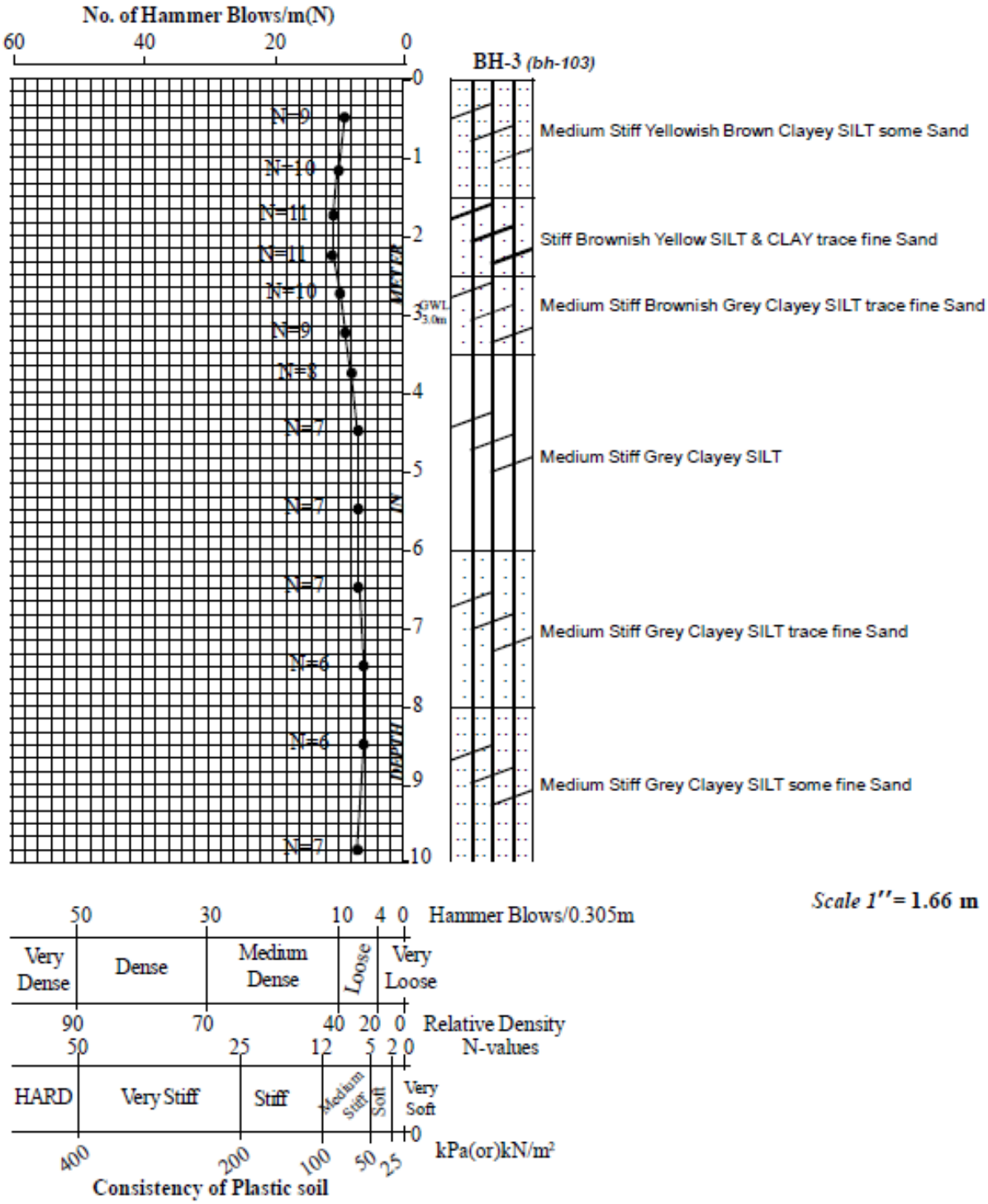


Figure 3.3-24 bh 103 Boring Log

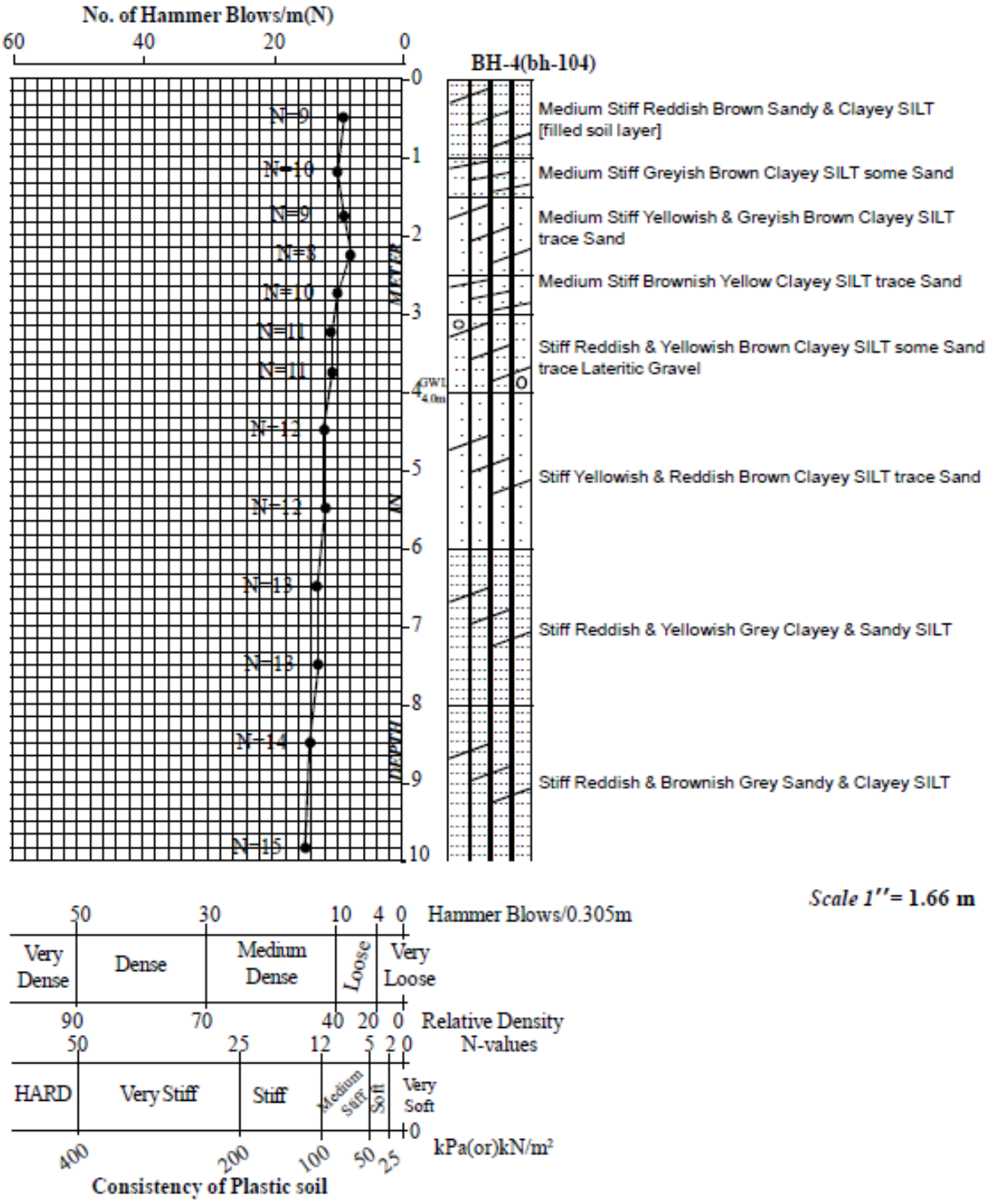


Figure 3.3-25 bh 104 Boring Log

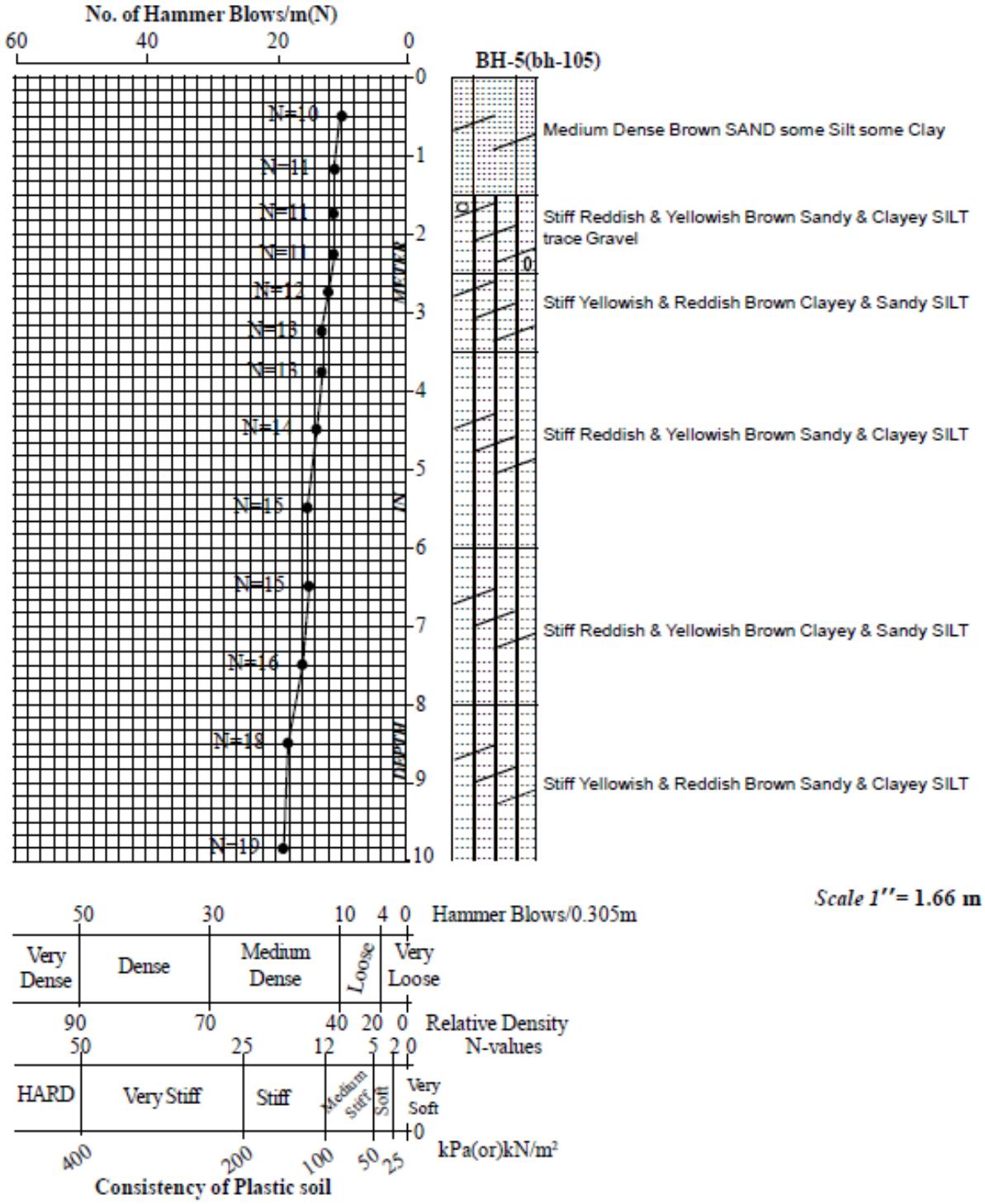


Figure 3.3-26 bh 105 Boring Log

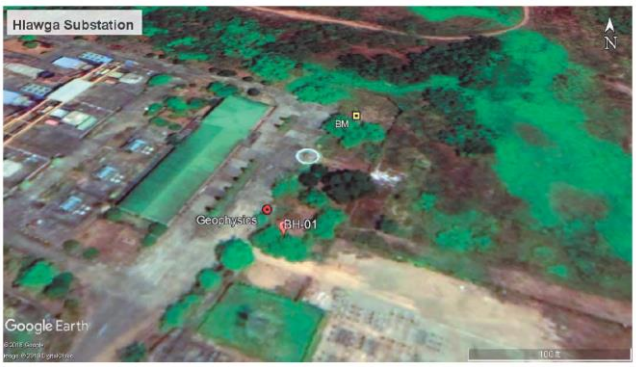


Figure 3.3-27 Location of Soil Investigation in Hlawga S/S

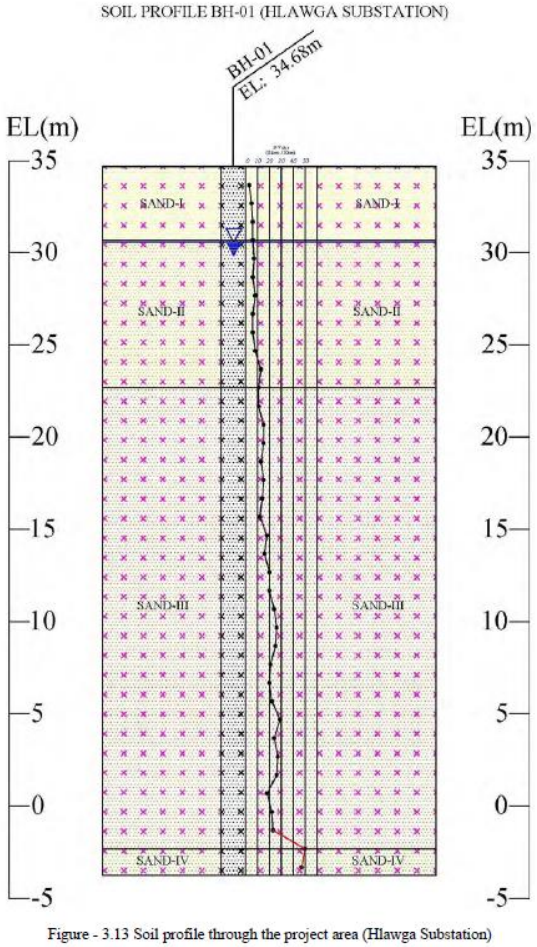


Figure - 3.13 Soil profile through the project area (Hlawga Substation)

Figure 3.3-28 Boring Log of Hlawga S/S

Figure 3.3-29 Location of Soil Investigation in East Dagon S/S

BORE HOLE LOG (BH-1)

MYA YAR PIN COMPANY LIMITED
GEOTECHNICAL ENGINEERING BRANCH

PROJECT:	Substation	**LOCATION:**	East Dagon
BORE HOLE NO:	BH.1	**GWL:**	Full
TOTAL DEPTH:	100' Feet	**DATE:**	16.8.2013

DEPTH (FT)	SOIL TYPE	COLOUR	DENSITY (g/cm³)	MOISTURE (%)	SPT 'N'	FSF
0	Clayey SILT	Yellowish to Grey	1.83	38.39	7	0.88
5			1.83	38.39	13	1.86
10			1.82	51.25	10	1.31
15			1.82	51.25	14	1.59
20	Clayey SILT	Grey	1.78	49.79	3	0.31
25			1.78	49.79	3	0.28
30			1.80	59.25	4	0.35
35			1.80	59.25	8	0.65
40			1.81	56.09	10	0.77
45			1.81	56.09	7	0.51
50			1.83	58.38	14	0.97
55			1.83	58.38	5	0.33
60	Sandy SILT	Grey	1.88	41.12	4	0.25
65			1.88	41.12	10	0.61
70	Clayey SILT	Grey	1.84	58.02	6	0.35
75			1.84	58.02	13	0.74
80			1.83	58.53	9	0.50
85			1.83	58.53	12	0.64
90	Silty SAND	Yellowish to Grey	1.98	22.43	28	1.46
95			1.98	22.43	33	1.66
100						

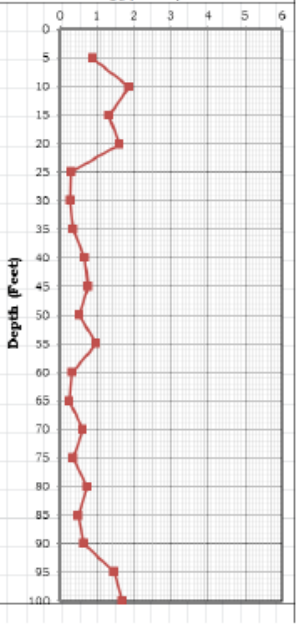
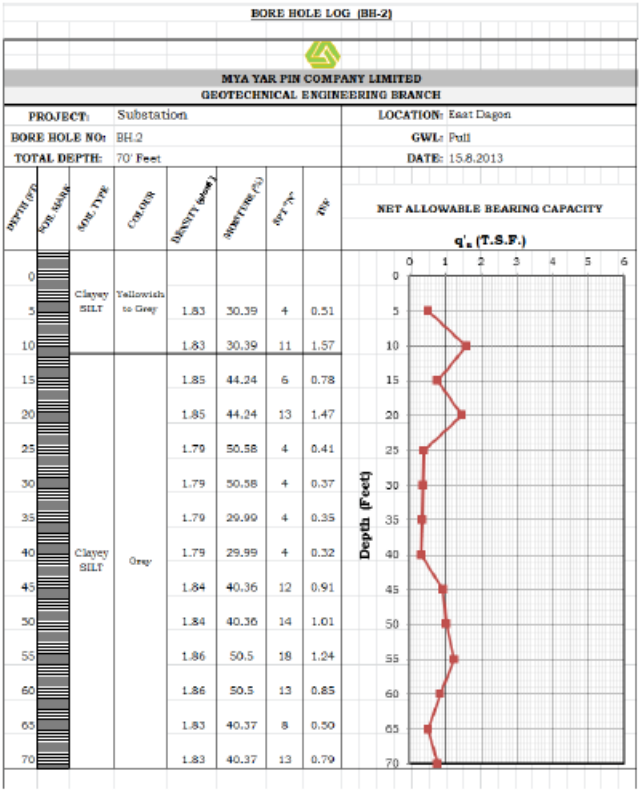


Figure 3.3-30 Boring Log of East Dagon S/S (BH.1)



BORE HOLE LOG (BH-2)

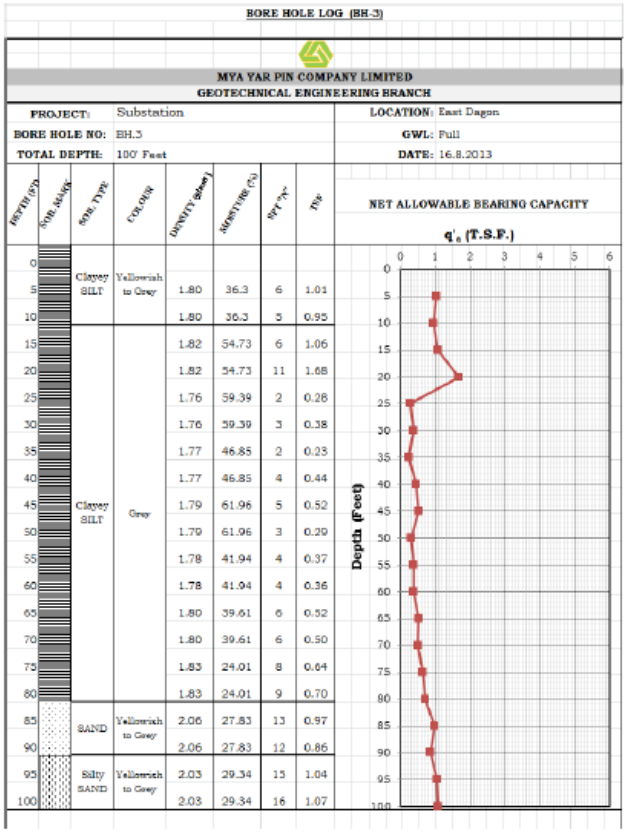
MYA YAR PIN COMPANY LIMITED
GEOTECHNICAL ENGINEERING BRANCH

PROJECT: Substation
BORE HOLE NO: BH.2
TOTAL DEPTH: 70' Feet
LOCATION: East Dagon
GWL: Full
DATE: 15.8.2013

DEPTH (FT)	SOIL MARK	SOIL TYPE	COLOUR	DENSITY (g/cm³)	MOISTURE (%)	SPT "N"	FS
0		Clayey SILT	Yellowish to Grey	1.83	30.39	4	0.51
5				1.83	30.39	11	1.57
10		Clayey SILT	Grey	1.85	44.24	6	0.78
15				1.85	44.24	13	1.47
20				1.79	50.58	4	0.41
25				1.79	50.58	4	0.37
30				1.79	29.99	4	0.35
35				1.79	29.99	4	0.32
40				1.84	40.36	12	0.91
45				1.84	40.36	14	1.01
50				1.86	50.5	18	1.24
55				1.86	50.5	13	0.85
60				1.83	40.37	8	0.50
65				1.83	40.37	13	0.79
70							

NET ALLOWABLE BEARING CAPACITY
q'_a (T.S.F.)
Depth (Feet)

Figure 3.3-31 Boring Log of East Dagon S/S (BH.2)



BORE HOLE LOG (BH-3)

MYA YAR PIN COMPANY LIMITED
GEOTECHNICAL ENGINEERING BRANCH

PROJECT: Substation
BORE HOLE NO: BH.3
TOTAL DEPTH: 100' Feet
LOCATION: East Dagon
GWL: Full
DATE: 16.8.2013

DEPTH (FT)	SOIL MARK	SOIL TYPE	COLOUR	DENSITY (g/cm³)	MOISTURE (%)	SPT "N"	FS
0		Clayey SILT	Yellowish to Grey	1.80	36.3	6	1.01
5				1.80	36.3	5	0.95
10		Clayey SILT	Grey	1.82	54.73	6	1.06
15				1.82	54.73	11	1.68
20				1.76	59.39	2	0.28
25				1.76	59.39	3	0.38
30				1.77	46.85	2	0.23
35				1.77	46.85	4	0.44
40				1.79	61.96	5	0.52
45				1.79	61.96	3	0.29
50				1.78	41.94	4	0.37
55				1.78	41.94	4	0.36
60				1.80	39.61	6	0.52
65				1.80	39.61	6	0.50
70				1.83	24.01	8	0.64
75				1.83	24.01	9	0.70
80		SAND	Yellowish to Grey	2.06	27.83	13	0.97
85				2.06	27.83	12	0.86
90		Silty SAND	Yellowish to Grey	2.03	29.34	15	1.04
95				2.03	29.34	16	1.07
100							

NET ALLOWABLE BEARING CAPACITY
q'_a (T.S.F.)
Depth (Feet)

Figure 3.3-32 Boring Log of East Dagon S/S (BH.3)

3.4. Details of Selection for 500kV Overhead Transmission Line Route

① Several locations for the new 500kV substation (Sar Ta Lin) were indicated from the first survey to the third survey. Similar to the substation, an evaluation was also performed for the 500 kV transmission line. There is no precedent for selecting a 500kV transmission line route. It was proposed as Option 5 (outside the YCDC development area) with good access from the main road (No. 2) at the end of third survey. From the perspective of future development, the candidate site for the new 500 kV substation (Sar Ta Lin) became Option 5. At that time, the route from the Pharyargyii substation was the east side. For the transmission line route, both the east route and the west route were proposed. A comparison table is shown below.

Table 3.4-1 Comparison Table: Sar Ta Lin SS and Route of 500kV OHTL

	Option 1 (Inside of D.A.)	Option 5 East Transmission Line Case (Outside of D.A.)	Option 5 West Transmission Line Case (Outside of D.A.)
Cost of Transmission Lines	53.9	53	54.8
Land Acquisition	0.5	5.3	5.3
	54.4	58.3	60.1

② During the 4th survey, the east route and the west route for the 500 kV transmission line from Pharyargyii to Sar Ta Lin SS were compared. The east route passes through routes such as forest areas and rubber gardens. Considering the ROW, the east route was selected, although it is soft ground. This figure shows the east and west routes.

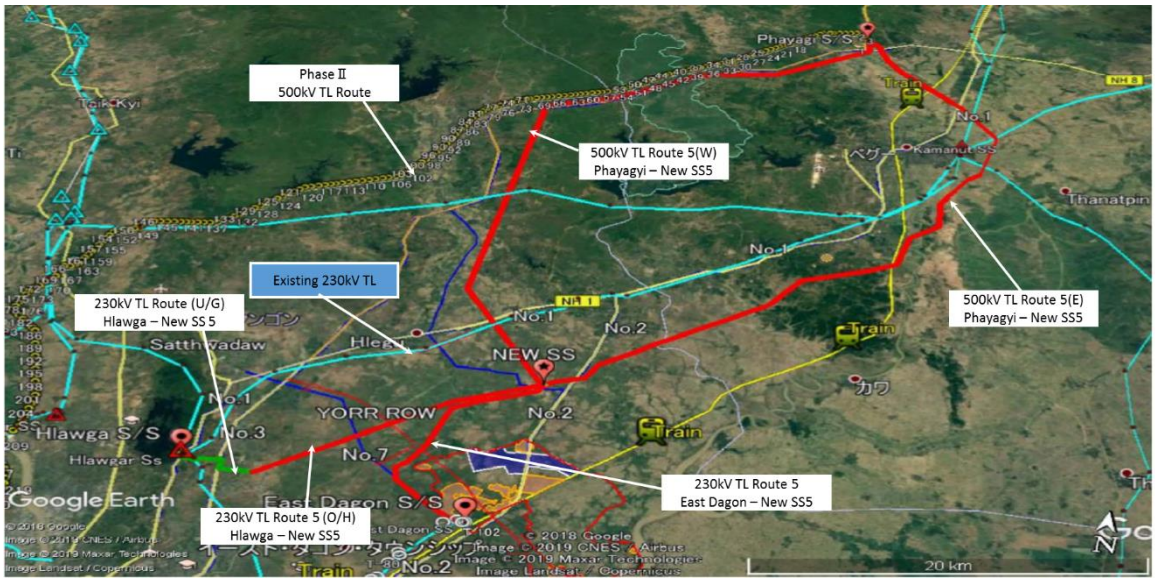


Figure 3.4-1 East and West Route from Pharyargyii to Sar Ta Lin

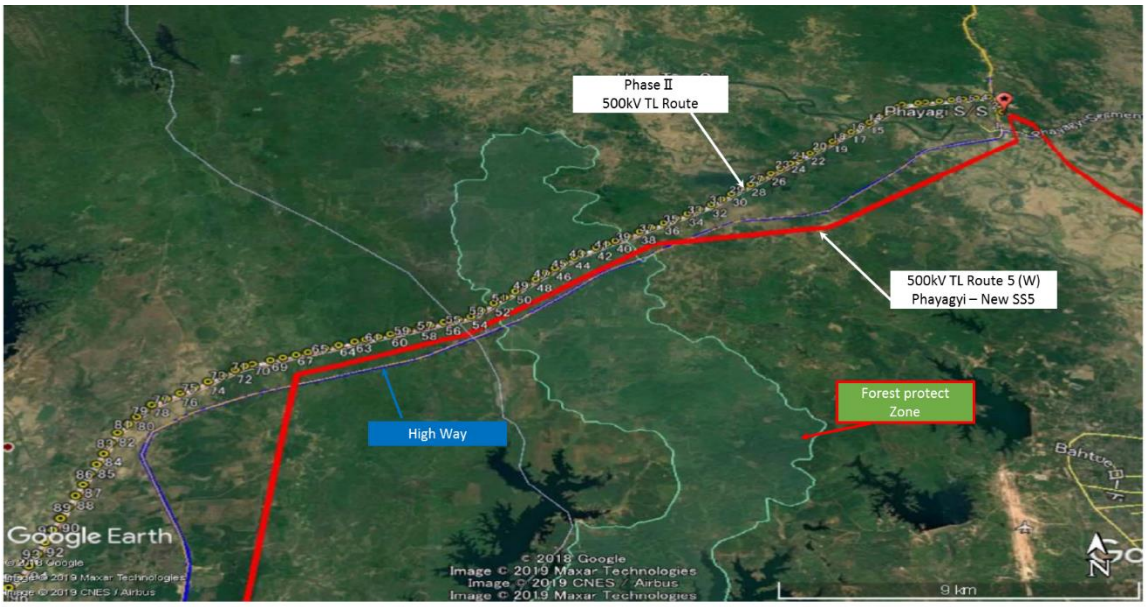


Figure 3.4-2 West Route (Forest Area) of Pharyargyii to Sar Ta Lin

③ Following this, DPTSC indicated that the route from Pharyargyii to the new 500 kV substation had been changed from the eastern route to a well-grounded route parallel to the planned Phase 2 route. In the fifth survey, the final decision was made on the eastern route after discussions with DPTSC. An outline of the eastern and western routes is shown below.

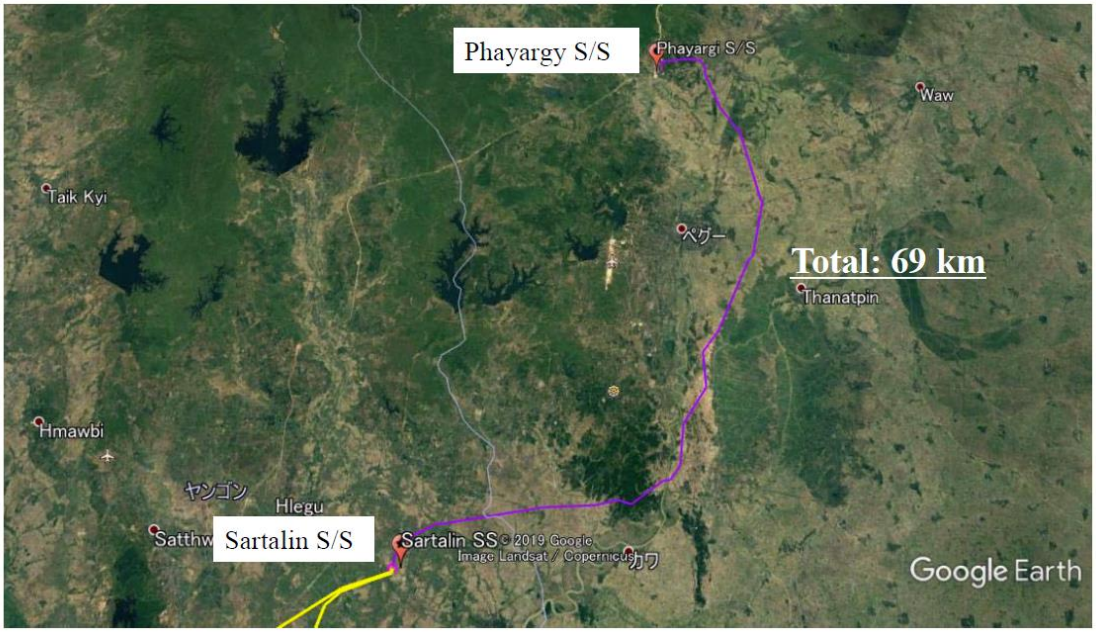


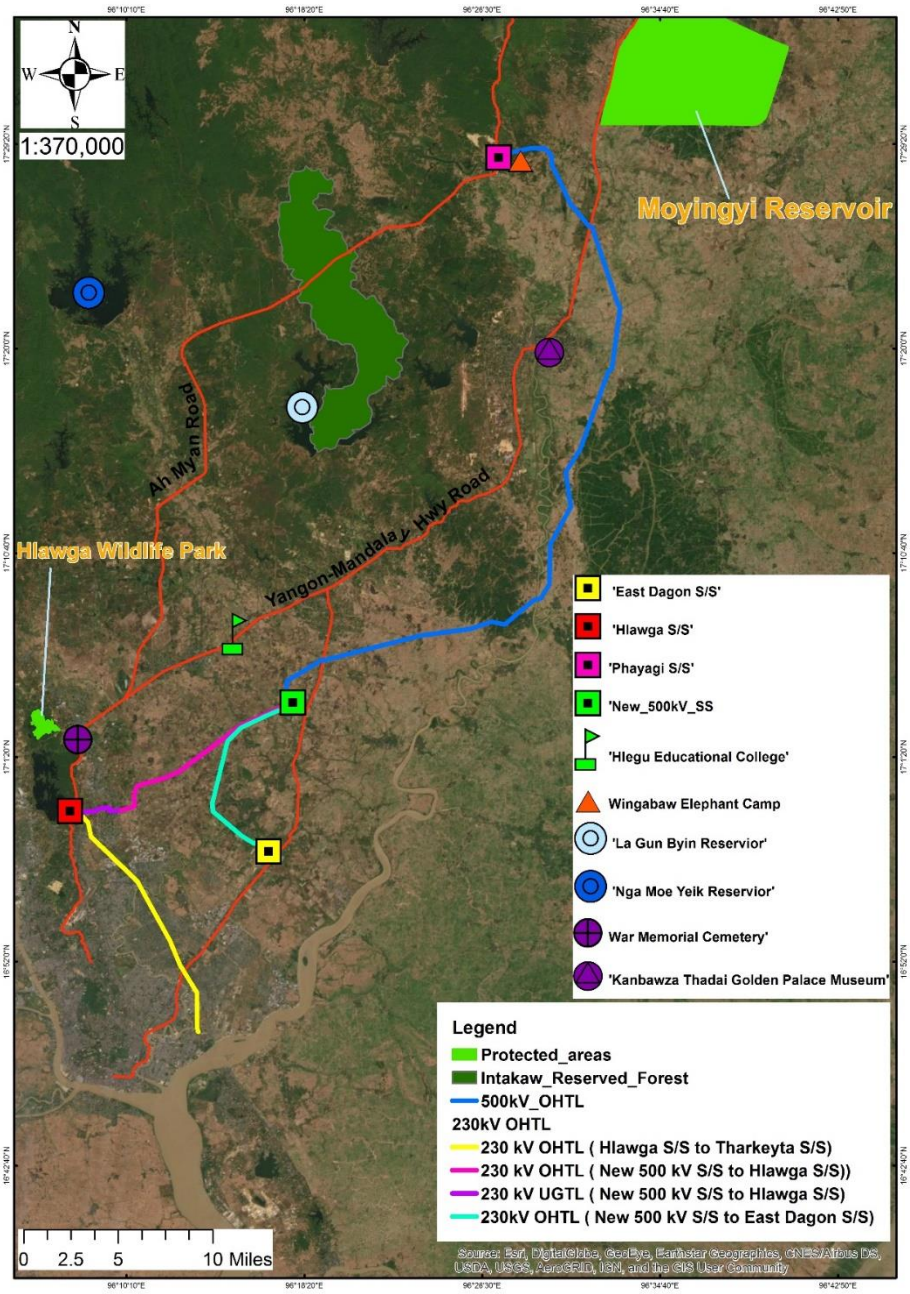
Figure 3.4-3 Map of Pharyargyii - Sar Ta Lin East Route

4. Environmental and Social Considerations

4.1. Environmental and Social Considerations

4.1.1. Outline of the Project Components with Environmental and Social Impacts

An outline of the Project components and the target location is given above. Figure 4.1-1 shows protected areas related to environmental and social considerations in and around the Project site.



Source: JICA Study Team

Figure 4.1-1 The Project and Protected Areas related to Environmental and Social Considerations

For the implementation of projects over a specific scale in Myanmar, it is necessary to implement an Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) in accordance with the Environmental Impact Assessment Procedure (EIAP) (Notification No. 616/2015). The scale requirements are described in Annex 1 of EIAP, and the Project components that have environmental and social impacts are outlined below according to the type and scale in EIAP Annex 1.

1) Type of Project: Energy Sector Development especially

2) Type of Economic Activities: 27. Electrical Power Transmission Line ≥230kV
28. High Voltage (230kV and 500kV) Transformer Substations

3) Main Infrastructure & Utilities: Scope of the engineering work includes analysis of facilities, new construction of substation (25ha), expansion/improvement of existing substation, new 500kV overhead transmission line, new 230kV overhead transmission line, and new 230 kV underground transmission line.

4) EIA/ IEE/ EMP* Requirement: EIA or IEE is required

* EIA: Environmental Impact Assessment
IEE: Initial Environmental Examination
EMP: Environmental Management Plan

In accordance with Appendix-1: Project Categorization for Assessment Purposes of EIA Procedures, stipulated in December 2015, as prepared by the Ministry of Environmental Conservation and Forestry (the former name of the Ministry of Natural Resources and Environmental Conservation (MONREC)), the Project can be categorized as "EIA or IEE is required", as shown inTable 4.1-1. Judging by examples of transmission line projects implemented by DPTSC/MOEE, such as transmission lines longer than the Project, and interviews with the Environmental Conservation Department (ECD)/Ministry of Natural Resources and Environmental Conservation (MONREC), which is the EIAP implementation organization, no transmission line projects have required an EIA so far. In addition, the transmission line route and project area will not pass through land/facilities that are important in terms of environmental considerations, thus the study team expected the project to be categorized as an IEE project. However, according to the screening results received at the end of December 2020, the project has been categorized as two IEE projects.

Table 4.1-1 Screening for EIA/IEE/EMP Requirements related to the Project

No.	Type of Investment Project	Size of Project which requires IEE	Size of Project which requires EIA	Notes
ENERGY SECTOR DEVELOPMENT				
27	Electrical Power Transmission Lines ≥ 230 kV	All sizes	All activities where the Ministry requires that the Project shall undergo EIA	-
28	High Voltage (230 kV and 500 kV) Transformer Substations	≥ 4 ha	All activities where the Ministry requires that the Project shall undergo EIA	The size of the Project is less than 25 ha, including Staff dormitories.

Source: Extract from EIA Procedures (2015)

As described above, the planned transmission line route for the Project does not pass through important areas in terms of environmental and social considerations. Therefore, it is considered that negative impacts on the environment will not be significant. In addition, as described in 4.2.4. "Location and Scale of Land Acquisitions and Resettlement" concerning the Project-affected people, no direct resettlement will occur due to the construction of the substation. Furthermore, with regard to the development of the transmission lines, it is expected that no residents, businesses or commercial premises will need to be relocated due to land acquisition. Therefore, this Project is assumed to be a category B project based on the "JICA Environmental and Social Considerations Guidelines (April 2010)" because it is not classified as "Sectors and characteristics that are easily affected"/"Sensitive areas" and undesirable environmental and social impacts were determined not to be significant.

4.1.2. Basic environmental and social conditions

(1) Overview of the Environment and Social Situation around the Project Site

Information on items expected to be affected during the construction and operation of the project (pollution, natural environment, protected areas, socio-economic situation) were reviewed by collecting existing information and data, as shown inTable 4.1-2. Details are described in Chapter 4 of the attached IEE report (draft).

Table 4.1-2 Current Environmental and Social Conditions in and around the Project Area

Item	Description
Natural Environment	
Meteorology/ Temperature and Rainfall	Upper east of Yangon region and lower east of Bago region has three seasons. Summer season is from March to May, the rainy season is from June to October, and winter is from November to February. According to the records of Kaba aye Meteorological station, the highest temperatures occurring in Yangon and Bago are 30.7 and 30.9 in April, and the lowest temperatures 24.9 and 24.4, respectively. Except in January, the monthly temperatures in both cities are above 25.0 °C. The southwest monsoon wind is the main source of rain, and the Yangon and Bago area receives rain during the period from May to October. The average annual amount of rainfall is 241 mm and 278 mm in Yangon and Bago cities. Rainfall sharply decreases from November and continues at nearly 10 mm from December to February.
Hydrological Situation	Main river around the project area is the Bago River, the source of which is near Thikkyi in Bago Yoma, and it runs from Phayagyi substation and Hlegu substation. The total length of the river is about 260 km (162 miles), and it flows into the Yangon River. Pazundaung Creek (upstream as Ngamoeyeik creek) can be found around the project area, and it also flows into the Yangon River. There are also two main reservoirs, called Ngamoeyeik and Lagunbyin, around the project area.
Topography	This Project will pass through eight cities: East Dagon, Hlegu, Mingaladon, Bago, North Okkalapa, North Dagon, South Dagon, and Therkhata. A flat, lowland, and clay type soil can be found in East Dagon and this is located about 9m above sea level. North-West and North area of Hlegu Tsp are the edge of Pegu Range end, with a flat plain situated at the bottom of mountain ranges. A flat plain descends from north to south, situated about 45.5 m above the sea level. Except for the Ngweyar mountain and Hlawga Lake, which are located in the western region of the township, the rest of the Mingalardon Tsp are plains. Bago township is the drainage area of Pegu Range and the western part of the township is a highland area. Reserved forests with merchantable trees are located in the northern part of the township. The township is 21 miles from east to west and 43 miles from north to south by area, and about 30 m above sea level. North Okkalapa and North Dagon have a plain land mass topography. Therkata Township is located on the peninsula and it has a flat plain topography. Silty soil can be found in this township. A landmass of plain and clay soil can be found in Dagon Myothit (south).
Geographical Features	Myanmar Central Belt (MCB) exists between the Indo-Burman Ranges and Shan Plateau. Bago Yoma Range sits in the northwest (NW) of the Project area. This area is in a north-south trending sedimentary deposit of Minbu Basin and Pegu Yoma Sittaung Basin. All of the mineral deposits in the Minbu Basin are 23.7 Million Years Ago to Present Day. This is related to the Sagaing Fault and also has Unconformity, Folds and Faults in Myanmar Central Belt. Most of the deposits are Sedimentary Rock in Myanmar Central Belt, mostly formed by Irrawaddy Formation and Recent Alluvial deposits.

Item	Description
Soil Erosion	In the Project area, different varieties of soil deposited are from Central Basin of Minbu Basin (Pegu Group) and Pegu-Yoma Sittaung Basin. The rocks mainly found in Pegu Group are located in the north and northwest from the center of the project area. The project area is covered mainly with gravel, sand, silt and clay, of grained size and several colors, and it also has forest soil. Mostly in this area, soil erosion can occur from north to south due to wind and water, depending on the weather.
Flora, Fauna, and Biodiversity	Flora and Fauna lists for Bago, Hlegu, Mingaladon and East Dagon are collected as secondary data for the GAD department. The protected areas of Hlawga Wildlife Park (about 7 km from the nearest project transmission line; created to protect evergreen, mixed deciduous and swamp forest and for environmental education), Moeyungyi Wetland Sanctuary (about 5.5 km from the nearest project transmission line; established in 1988 and gained the status of an Important Bird Area) and Intagaw Reserved Forest (about 16 km from the nearest project transmission line; just for reserved forest) are located around the project site.
Emergency Risk	Floods, cyclones, and earthquakes are identified as notable natural hazards around the project area.
Social Conditions	
Population	According to the October 2018 Township General Administration Office, Dagon Myothit (East, South and North) District Data, there are about 157,785 people in Dagon Myothit (East), 155,611 people in Dagon Myothit (South), 92,774 people in Dagon Myothit (North), 234,229 people in Hlegu, 257,250 people in Mingalardon, 436,022 people in Bago, 135913 people in North Okkalapa and 114,202 people in Thaketa.
Ethnicity	In 2018, most of the people who live in Dagon Myothit (East), Hlegu, Mingalardon, Bago, North Okkalapa, Dagon Myothit (North), Dagon Myothit (South), Thaketa townships are Bamar, followed by Kayin, Mon and Rakhine.
Religion	More than 90% of the people living in Dagon Myothit (East), Hlegu, Mingalardon, Bago, North Okkalapa, Dagon Myothit (North), Dagon Myothit (South), and Thaketa townships are Buddhists.
Local Economy and Livelihood	The main sources of livelihood in the townships are trading, factories and official employment in the government.
Access Road	Around the project area, the related main roads are Ygn-Mdy expressway, Ygn-Mdy highway, No. 2 main road, No. 3 main road and No. 7 road. The two main roads that connect from Pharyargyii Substation to Yangon City are Ygn-Mdy expressway in the west and Ygn-Mdy highway in the east. The proposed new Hlegu substation can be reached from Yangon City by using No. 2 main road. The 230 kV transmission line, which is a combination of overhead and underground lines and which connects Hlawga Substation and the proposed new Hlegu substation, will pass across the No. 7 road, No. 3 main road and Ygn-Mdy expressway.
Water Source/ Usage	In Dagon Myothit (East), 87.2 per cent of households use improved sources of drinking water (tap water/piped, tube well, borehole, protected well/spring and bottled water/water purifier). Some 38.8 per cent of the households use water from bottled water/water purifier and 38.7 per cent use water from tube well/borehole. Some 12.8 per cent of the households use water from unimproved sources. In rural areas, 93.6 per cent of the households use water from unimproved sources for drinking water.
School	There are a number of schools, including basic education primary schools (B.E.P.S.), basic education middle schools (B.E.M.S), basic education high schools (B.E.H.S) and universities, in these eight cities.
Cultural Heritage/ Assets	Two cultural heritage sites designated by the Myanmar Government - namely Kanbawzathadi Palace (about 6 km from the nearest project area) and Htaunt Kyant War Memorial Cemetery (about 5 km from the nearest project area) - are located near the project area.
Landscape	Most of the area along the 500 kV OH line and 230 kV lines is covered with green spaces, such as Intagaw Forest, cultivated lands and other forests near river and creek banks and residential areas on the outskirts of Yangon.
Environmental Baseline Situation	
Air Quality	The monitoring survey for SO_2, NO_2, Ozone, PM2.5 and PM10 for the ambient air quality was conducted in the Project site for a continuous 24 hours during the dry season. The concentration of NO_2 results was lower than the NEQG guideline (results: 70.11µg/m^3/h, NEQG: 200µg/m^3/h), while the value of SO_2 (results: 200µg/m^3/24h, NEQG: 20µg/m^3/24h), PM2.5 (results: 55.14µg/m^3/24h, NEQG: 25µg/m^3/24h), PM10 (results: 75.67µg/m^3/24h, NEQG: 50µg/m^3/24h) and ozone (results: 109µg/m^3/8h, NEQG: 100µg/m^3/8h) at the monitoring point were higher than the NEQG value. Possible emission sources are from transportation on Hlegu-Dar Pein road and natural origins such as dust from unpaved vacant areas and the brick manufacturing process.
Water Quality	The field survey on water quality was conducted from Sar Ta Lin Creek. The water quality results were compared with the guideline values for effluents for the Electric Power Transmission and Distribution sector in the NEQG Guidelines in Myanmar. The results for total coliform (results: 92,000 MPN/100mL, NEQG: 400MPN/100mL) and iron (results: 13.21 mg/L, NEQG: 3.5mg/L) exceeded the NEQG values.

Item	Description
	Two expected reasons for the exceedance of coliform in water would be existing natural bacteria and delivery from upstream areas. A possible reason for iron may be the influence of natural origins (iron can reach out from soil due to run-off). In Yangon, soil is naturally rich in iron.
Soil Quality	The results of soil quality analysis showed significantly lower levels than the standards examined for Vietnam and Thailand. Therefore, the soil quality in the area surrounding the Project is good.
Noise and Vibration Level	Noise and vibration measurements were carried out for one location on a 24-hour basis. Compared with the guideline value for noise level prescribed in the NEQG Guidelines, the day time results were under the guideline values and the night time results were slightly higher than the guideline value. The vibration level value was compared with the target value for Thilawa Special Economic Zone B, which is set based on the Japanese standard. Compared with the target vibration level for the operation stage in the EIA report for Thilawa Special Economic Zone development project Zone B, all of the results were under the target values.

Source: JICA Study Team

(2) Summary of Baseline Survey

The baseline survey is implemented to collect the necessary data and information on environmental conditions that are required to assess the environmental impact of substations and transmission lines. Moreover, the survey data collected will be utilized to evaluate the current situation and predict future perspectives, and serve as baseline levels for comparison in the future. The outline of the field survey for environmental monitoring in this Project is described below.

1) Outline of Field Survey

The following table shows an outline of the environmental baseline survey.

Table 4.1-3 Outline of Environmental Baseline Survey

No.	Item	Survey Items	Methodology
1	Air Quality	1) PM2.5, 2) PM10, 3) NO_2, 4) SO_2, 5) Ozone, 6) Wind Speed & Direction	Using Haz-Scanner (US EPA approved)
2	Water Quality	1) Temp., 2) pH, 3) EC,4) BOD_5, 5) COD_{CrO}, 6) Oil & Grease, 7) Total Coliform, 8) TN, 9) TP, 10) TSS, 11) Cr-Total, 12) Cd, 13) As, 14) Zn, 15) Pb, 16) Hg, 17) Cu, 18) Fe, 19) Mn	Using reliable laboratory in Yangon
3	Soil Quality	1) Cr-Total, 2) Cd, 3) As, 4) Zn, 5) Pb, 6) Hg, 7) Cu, 8) Fe, 9) Mn	Using reliable laboratory in Yangon
4	Noise and Vibrations	Noise Level (LAeq dB) Vibration (dBs)	International standard method

Source: JICA Study Team

2) Monitoring Locations

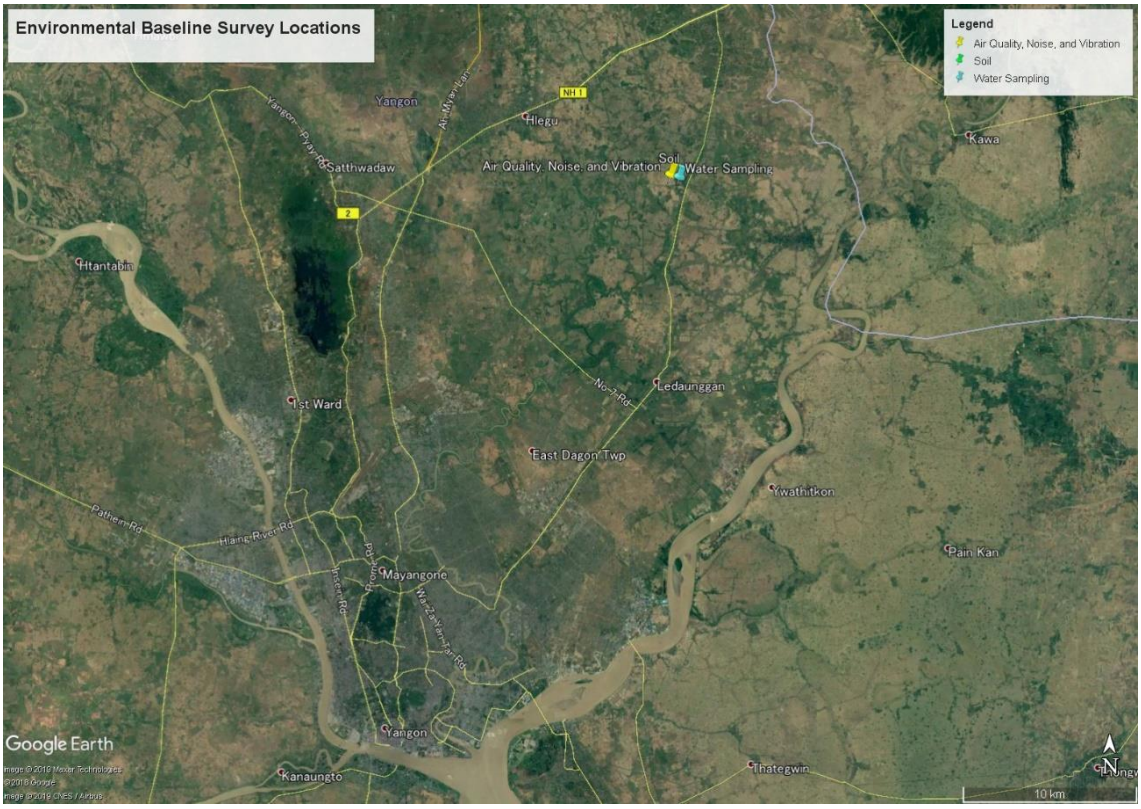
The JICA Study Team, together with the field survey team, conducted a site visit to decide the exact location of the field survey for the new Substation area and the route for the transmission line. The team went to a monastery which is located near the Substation area. It is 1 km from the boundary of the new substation area. Therefore, the location of the monastery was not selected as a monitoring location. An outline of the baseline survey locations is shown in Table 4.1-4, and the location maps are shown in Figure 4.1-2 and Figure 4.1-3.

Table 4.1-4 Locations for Environmental Baseline Survey

No.	Items	Area/point	Rationale	Period
1	Air Quality	1 point around the project site	-To consider the closest receptor from the new Substation area as a representative point with other places, including the route of transmission line - To avoid emissions from normal life activities at houses	24 hours continuously in dry season (1 weekday)

No.	Items	Area/point	Rationale	Period
2	Water Quality	1 point around the project site	-To consider the closest water receiving a body from the new Substation area	1 time in dry season
3	Soil Quality	1 point inside or around the project site	-To consider the new substation area as a representative point with other places, including the route of transmission line	1 time in dry season
4	Noise and Vibrations	1 point around the project site	-To consider the closest receptor from the new Substation area as a representative point with other places, including the route of transmission line - To avoid sounds and vibrations from normal life activities at houses	24 hours continuously in dry season (1 weekday)

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1-2 Environmental Baseline Locations (Distant View)

Source: JICA Study Team

Figure 4.1-3 Environmental Baseline Locations (Near View)

(3) Results of the Field Survey

The field survey and the environmental and social evaluation were performed based on the Scoping results. The results of the field survey on air quality, water quality, soil, noise and vibrations are shown below.

a) Air Quality

The 24 hour average value of air quality survey results for PM10, PM2.5, NO2, SO2, and Ozone during the dry season is described in Table 4.1-5. The value of NO2 is under the NEQG guideline values. However, the values of SO2, PM2.5 PM10, and ozone at the monitoring point are higher than the National Environmental Quality Emission Guideline (NEQG) values. Possible emission sources for PM2.5 and PM10 are natural origins such as dust from the unpaved land area around the Project area and transportation around the Hlegu - Dar Pein Road, and dust emissions from brick manufacturing processes. Possible emission sources for SO2 are the combustion of fuel for vehicles from nearby roads and operational activities from brick manufacturing processes.

Table 4.1-5 Air Quality Survey Results (Daily Average)

Date	NO2	PM2.5	PM10	SO2	Ozone
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
02 ~ 03 May, 2019	70.11	55.14	75.67	200.83	108.63
One Day Average Value	70.11	55.14	75.67	200.83	108.63
NEQG Guideline Value	200 (1 hour)	25 (24 hours)	50 (24 hours)	20 (24 hours)	100 (8 hours)

NEQG: National Environmental Quality Emission Guideline (MJTD)
Source: JICA Study Team

b) Water Quality

The results of the water quality survey are summarized inTable 4.1-6. The water quality results were compared with the guideline values for effluents in the Electric Power Transmission and Distribution sector in the National Environmental Quality (Emission) Guidelines (NEQG) in Myanmar. The results for total coliform and iron exceeded the NEQG guideline values. The results at the surface water monitoring point exceeded the target value due to two expected reasons: i) natural bacteria existed because there are various kinds of vegetation and creatures, such as birds and small animals and ii) delivery from upstream areas such as natural origins and wastewater from residences. The results for iron exceeded the target value. A possible reason may be the influence of natural origins (iron can emanate from the soil via run-off). In Yangon, the soil is naturally rich in iron.

Table 4.1-6 Water Quality Survey Results

No.	Parameters	Unit	WQ 1	NEQG Guideline Value
1	Water Temperature	℃	25.23	-
2	pH	-	6.67	-
3	Electrical Conductivity	m³/cm	0.11	-
4	BOD (5)	mg/L	5.53	30
5	COD (Cr)	mg/L	25	125
6	Oil and Grease	mg/L	< 3.1	10
7	Total Coliform	MPN/100ml	92,000	400
8	Total Nitrogen (T-N)	mg/L	3.1	10
9	Total Phosphorous (T-P)	mg/L	0.165	2
10	Suspended Solid (SS)	mg/L	84.00	50
11	Chromium	mg/L	0.018	0.5
12	Cadmium	mg/L	≤ 0.002	0.1
13	Arsenic	mg/L	≤ 0.01	0.1
14	Zinc	mg/L	0.08	2
15	Lead	mg/L	≤ 0.002	0.1
16	Mercury	mg/L	≤ 0.002	0.01
17	Copper	mg/L	≤ 0.002	0.5
18	Iron	mg/L	13.212	3.5
19	Manganese	mg/L	0.718	-

Note: Target values are taken from NEQG Guideline for General Wastewater.
Source: JICA Study Team

c) Soil Quality

The results of the soil quality analysis are presented in the below table. All parameters showed significantly lower levels than the standards examined in Vietnam and Thailand.

Table 4.1-7 Results of Soil Quality Survey

No.	Parameter	Unit	SQ 1	Environmental Standard	
				Vietnam (Industrial land)	Thailand (Not for habitat or agriculture)
1	Arsenic (As)	mg/kg	≤ 0.34	12	27
2	Cadmium (Cd)	mg/kg	≤ 0.068	10	810
3	Chromium (Cr)	mg/kg	50.7	-	640
4	Copper (Cu)	mg/kg	20.8	100	-
5	Iron (Fe)	mg/kg	1.7%	-	-
6	Lead (Pb)	mg/kg	6.052	300	750
7	Manganese (Mn)	mg/kg	355.8	-	32,000
8	Mercury (Hg)	mg/kg	≤ 0.068	-	610
9	Zinc (Zn)	mg/kg	0.66	300	-

Source: Vietnam: QCVN 03:2008/BTNMT, "industrial land" class, Thailand: Notification of National Environmental Board No. 25, B.E. (2004), "other purpose" class
Note: The remaining laboratory results are to be obtained from DOWA Lab and Government Lab.

d) Noise and Vibrations

Noise measurement results are separated into daytime (07:00 to 22:00) and night time (22:00 to 07:00) time frames respectively, based on the NEQG setting. Noise measurement was carried out for one location on a 24-hour basis. The survey results are summarized inTable 4.1-8. Compared with the guideline values for noise level prescribed in the NEQG Guidelines, the day time results were under the guideline values, and the night time results were slightly higher.

Table 4.1-8 Results of Noise Level (LAeq) Monitoring

Date	Equivalent Noise Level (LAeq, dB)	
	Day Time (7:00 AM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
8 – 9 January 2020	46	46
Target Value	55	45

Note: Target value is applied to the noise level in the NEQG Guideline (Dec 2015), Myanmar
Source: JICA study team

Vibration monitoring results are separated into daytime (07:00 to 19:00), evening time (19:00 to 22:00), and night time (22:00 to 07:00) time frames. Vibration measurement was carried out for one location on a 24-hour basis. The results of the vibration level (Lv10) monitoring are shown inTable 4.1-9. There are no guideline values for vibration level in Myanmar's NEQG, or in Southeast Asian or International organizations such as WHO and IFC. Therefore, the vibration level values are compared with the Japanese standards. All of the results were under the target values.

Table 4.1-9 Results of Vibration Level (Lv10) Monitoring

Date	Equivalent Vibration Level (Lv10, dB)	
	Day Time (7:00 AM – 10:00 PM)	Night time (10:00 PM – 7:00 AM)
3 – 4 May 2019	31	28
Target Value	65	60

Note: Vibration Regulation Act, Japan (Law No. 62, 1976, Amended 2004)
Source: JICA Study Team

(4) Protected Areas and other areas near the Project Site

The status of endangered species and rare species based on the IUCN (International Union for Conservation of Nature) category in Hlawga Wildlife Park and Moeyungyi Wetland Sanctuary, which are described in Table 4.1-10, are shown below. Each area is more than 5 km away from the Project

Site.

Table 4.1-10 List of Bird Species in Hlawga Wildlife Park, Yangon

No	Scientific Name	Common Name	Family	IUCN (2020-2)
1	*Acridotheres tristis*	Common Myna	Sturnidae	LC
2	*Aegithina tiphia*	Common Iora	Aegithinidae	LC
3	*Anas poecilorhyncha*	Indian Spot-billed Duck	Antidae	LC
4	*Anastomus oscitans*	Asian Openbill	Podicipedidae	LC
5	*Aviceda leuphotes*	Black Baza	Accipitridae	LC
6	*Bubulcus coromandus*	Eastern Cattle Egret	Ardeidae	NE
7	*Centropus sinensis*	Greater Coucal	Cuculidae	LC
8	*Cinnyris jugularis*	Olive-backed Sunbird	Nectariniidae	LC
9	*Coracias benghalensis*	Indian Roller	Coraciidae	LC
10	*Coracina melascbistos*	Black-winged Cuckooshrike	Campephagidae	NE
11	*Corvus splendens*	House Crow	Corvidae	LC
12	*Crypsirina temia*	Racket-tailed Treepie	Corvidae	LC
13	*Cypsiurus balas*	Asian Palm Shwift	Apodidae	LC
14	*Dendrocygna javanica*	Lesser Whistling Duck	Antidae	LC
15	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	Dicaeidae	LC
16	*Dicrurus leucophaeus*	Dusky Warbler	Dicruridae	LC
17	*Dicrurus leucophaeus*	Hair-crested Drongo	Dicruridae	LC
18	*Dicrurus macrocercus*	Black Drongo	Dicruridae	LC
19	*Elanus caeruleus*	Black-shouldered Kite	Falconidae:	LC
20	*Eumyias thalassina*	Verditer Flycatcher	Muscicapidae	LC
21	*Garrulax leucolophus*	White-crested Laughingthrush	Leiothrichidae	LC
22	*Halcyon smyrnensis*	White-throated Kingfisher	Alcedinidae	LC
23	*Hirundo rustica*	Barn Swallow	Hirundinidae	LC
24	*Lanius cristatus*	Brown Shrike	Laniidae	LC
25	*Megalaima haemaccephala*	Coppersmith Barbet	Ramphastidae	NE
26	*Merops leschenaulti*	Chestnut-headed Bee-eater	Meropidae	LC
27	*Metopidius indicus*	Bronze-winged Jacana	Jacanidae	LC
28	*Oriolus chinensis*	Black-naped Oriole	Oriolidae	LC
29	*Orthotomus sutorius*	Common Tailordbird	Cisticolidae	LC
30	*Pandion baliaetus*	Ospery	Coraciidae	NE
31	*Pbalacrocorax niger*	Little Cormorant	Phalacrocoracidae	NE
32	*Pericrocotus cantonensis*	Brown-rumped Minivet	Campephagidae	LC
33	*Pericrocotus divaricatus*	Ashy Minivet	Campephagidae	LC
34	*Phylloscopus fuscatus*	Dusky Warbler	Phylloscopidae	LC
35	*Pellomeum ruficeps*	Puff-throated Babbler	Pellorneidae	LC
36	*Pycnonotus blanfordi*	Streak-eared Bulbul	Pycnonotidae	LC
37	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	LC
38	*Pycnonotus jocosus*	Red-whiskered Bulbul	Pycnonotidae	LC
39	*Pycnonotus melanicterus*	Black-capped Bulbul	Pycnonotidae	LC
40	*Streptopelia chinensis*	Spotted Dove	Columbidae	NE
41	*Streptopelia tranquebarica*	Red Turtle-Dove	Columbidae	LC
42	*Tacbybaptus ruficollis*	Little Grebe	Podicipedidae	NE
43	*Treron phocenicoptera*	Yellow-fronted Green Pigeon	Columbidae	NE
44	*Turdoides gularis*	White-throated Babbler	Timaliidae	LC

Note: NE = Not Evaluated, LC = Least Concern

Source: Announcement letter from MONREC

Table 4.1-11 List of Mammal Species in Hlawga Wildlife Park, Yangon

No	Scientific Name	Common Name	Family	IUCN (2020-2)
1	*Panolia eldii*	Eld's Deer	Cervidae	EN
2	*Hyelaphus porcinus*	Golden Deer	Cervidae	NE
3	*Rhesus macaque*	Monkey	Cercopithecidae	LC
4	*Manis javanica*	Sunda Pangolin	Manidae	CR

Note: LC = Least Concern, EN = Endangered, CR = Critically Endangered

Source: Announcement letter from MONREC

Table 4.1-12 List of Reptile Species in Hlawga Wildlife Park, Yangon

No.	Scientific Name	Common Name	Family	IUCN (2020-2)
1	*Bungarus fasciatus*	Banded Krait	Elapidae	LC
2	*Varanus albigularis*	Monitor Lizard	Varanidae	NE
3	*Naja kaouthia*	Cobra	Elapidae	LC
4	*Python bivittatus*	Burmese Python	Pythonidae	VU

Note: LC = Least Concern, VU = Vulnerable

Source: Announcement letter from MONREC

Table 4.1-13 List of Flora in Hlawga Wildlife Park in Yangon

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
1	*Albizia procera*	Sit	Mimosaceae	Tree	LC
2	*Anisoptera scaphula*	Kaung mu	Dipterocarpaceae	Tree	EN
3	*Anogeissus acuminata*	Yon	Combretaceae	Tree	NE
4	*Anthocephalus cadamba*	Ma U let tan she	Rubiaceae	Tree	NE
5	*Bambusa Polymorpha*	Kya thaung	Poaceae	Bamboo	NE
6	*Carallia brachiata*	Maniawga	Rhizophoraceae	Tree	NE
7	*Cephalostachy pergracile*	Tin	Poaceae	Bamboo	NE
8	*Dipterocarpus grandiflorus*	Kanyin	Dipterocarpaceae	Tree	EN
9	*Dipterocarpus tuberculatus*	In	Dipterocarpaceae	Tree	NT
10	*Homalium tomentosum*	Myauk chaw	Salicaceae	Tree	NE
11	*Lagerstroemia speciosa* *	Pyin ma	Lythraceae	Tree	NE
12	*Pentacme siamensis*	Ingyin	Dipterocarpaceae	Tree	NE
13	*Pterocarpus macrocarpus* *	Thit Padauk	Fabaceae	Tree	EN
14	*Shorea oblongifolia*	Thit ya	Dipterocarpaceae	Tree	CR
15	*Simarouba gluca*	Sithapyay	Simaroubaceae	Tree	NE
16	*Sterculia campanulata*	Shaw pyar	Malvaceae	Tree	NE
17	*Swintonia floribunda*	Taung tha yet	Heliconiaceae	Tree	NE
18	*Tectona grandis* *	Kyun (Teak)	Verbenaceae	Tree	NE
19	*Terminalia bellerica*	Thit seint	Combretaceae	Tree	NE
20	*Terminalia chebula*	Phan kha	Bombacaceae	Tree	NE
21	*Terminalia tomentosa*	Htuk kyant	Combretaceae	Tree	NE
22	*Xylia xylocarpa* *	Pyin ka doe	Mimosaceae	Tree	LC

Note: NE = Not Evaluated, LC = Least Concern, CR = Critically Endangered, EN = Endangered
Note: * = Protected Tree Species in The Whole Region of Myanmar
Source: Announcement letter from MONREC

Table 4.1-14 Bird Species List in Moeyungyi Wildlife Sanctuary

No	Scientific Name	Common Name	Family	IUCN (2020-2)
1	*Accipiter badius*	Shikra	Accipitridae	LC
2	*Acridotheres fuscus*	Jungle Myna	Sturnidae	LC
3	*Acridotheres grandis*	Great Myna	Sturnidae	LC
4	*Acridotheres tristis*	Common Myna	Sturnidae	LC
5	*Acrocephalus aedon*	Thick-billed Warbler	Acrocephalidae	LC
6	*Acrocephalus agricola*	Paddy-field Warbler	Acrocephalidae	LC
7	*Acrocephalus bistrigiceps*	Black browed reed Warbler	Acrocephalidae	LC
8	*Acrocephalus concinens*	Blunt Winged Warbler	Acrocephalidae	LC
9	*Acrocephalus orientalis*	Oriental Reed Warbler	Acrocephalidae	LC
10	*Actitis hypoleucos*	Common Sandpiper	Scolopacidae	LC
11	*Aegithina tiphia*	Common Iora	Aegithinidae	LC
12	*Alauda gulgula*	Oriental Skylark	Alaudidae	LC
13	*Alcedo atthis*	Common Kingfisher	Alcedinidae	LC
14	*Amaurornis phoenicurus*	White-breasted Waterhen	Rallidae	LC
15	*Anas acuta*	Northern Pintail	Anatidae	LC
16	*Anas poecilorhyncha*	Indian Spot-billed Duck	Anatidae	LC
17	*Anas querquedula*	Garganey	Anatidae	LC
18	*Anastomus oscitans*	Asian Openbill	Ciconiidae	LC
19	*Anhinga melanogaster*	Oriental Dater	Anhingidae	NT
20	*Anthus cervinus*	Red-throated Pipit	Motacillidae	LC

No	Scientific Name	Common Name	Family	IUCN (2020-2)
21	*Anthus rufulus*	Paddy field Pipit	Motacillidae	LC
22	*Ardea cinerea*	Grey-Heron	Ardeidae	LC
23	*Ardea purpurea*	Purple-Heron	Ardeidae	LC
24	*Ardeola bacchus*	Chinese Pond-Heron	Ardeidae	LC
25	*Ardeola grayi*	Indian pond Heron	Ardeidae	LC
26	*Ardeola speciosa*	Javan Pond -Heron	Ardeidae	LC
27	*Artamus fuscus*	Ashy Wood Swallow	Artamidae	NA
28	*Bubulcus ibis*	Cattle Egret	Ardeidae	LC
29	*Casmerodius albus*	Great White Egret	Ardeidae	LC
30	*Centropus bengalensis*	Lesser Coucal	Cuculidae	LC
31	*Centropus sinensis*	Greater Coucal	Cuculidae	LC
32	*Charadrius dubius*	Little Ringed Plover	Charadriidae	LC
33	*Charadrius leschenaultii*	Greater Sand-Plover	Charadriidae	LC
34	*Charadrius mongolus*	Lesser Sand-Plover	Charadriidae	LC
35	*Chlidonias hybridus*	Whiskered Tern	Laridae	LC
36	*Chlidonias leucopterus*	White-winged Tern	Laridae	LC
37	*Circus aeruginnosus*	Western Marsh-Harrier	Accipitridae	NA
38	*Circus cyaneus*	Hen-Harrier	Accipitridae	LC
39	*Circus melanoleucos*	Pied Harrier	Accipitridae	LC
40	*Circus spilonotus*	Eastern Marsh-Harrier	Accipitridae	LC
41	*Cisticola juncidis*	Zitting Cisticola	Cisticolidae	LC
42	*Columbia livia*	Rock Pigeon	Columbidae	NA
43	*Copsychus saularis*	Oriental Magpic Robin	Muscicapidae	LC
44	*Corvus splendens*	House crow	Corvidae	LC
45	*Cypsirurs babs*	Asian palm-Swift	Apodidae	NA
46	*Delichon dasypus*	Asian House Martin	Hirundinidae	LC
47	*Dendrocygna javanica*	Lesser Whistling - Duck	Anatidae	LC
48	*Dendronanthus indicus*	Forest Wagtail	Motacillidae	LC
49	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	Dicaeidae	LC
50	*Dicrurus macrocercus*	Black Dongo	Dicruridae	LC
51	*Egretta garzetta*	Little Egret	Ardeidae	LC
52	*Elanus caeruleus*	Black-winged Kite	Accipitridae	LC
53	*Ficedula parva*	Red-breasted Flycatcher	Muscicapidae	LC
54	*Fulica atra*	Common coot	Rallidae	LC
55	Gallicrex cinerea	Watercock	Rallidae	LC
56	*Gallinago gallinago*	Common Snipe	Scolopacidae	LC
57	*Gallinula chloropus*	Common Moorhen	Rallidae	LC
58	*Gallirallus striatus*	Salty-breasted Rail	Rallidae	LC
59	*Gcomantis merulimus*	Plaintive Cuckoo	Cuculidae	NA
60	*Glareola maldivarum*	Oriental Pratincole	Glareolidae	LC
61	*Grus antigone*	Sarus Crane	Gruidae	VU
62	*Halycon pileala*	Black-capped Kingfisher	Alcedinidae	NA
63	*Halycon smyrnensis*	White-throated Kingfisher	Alcedinidae	NA
64	*Himantopus himantopus*	Black winged Stilt	Recurvirostridae	LC
65	*Hirundo rustica*	Barn Swallow	Hirundinidae	LC
66	*Hirundo striolata*	Straited Swallow	Hirundinidae	NA
67	*Hirundo tabitica*	Pacific Swallow	Hirundinidae	NA
68	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	Jacanidae	LC
69	*Ictinaetus malayensis*	Black Eagle	Accipitridae	LC
70	*Ixobrychus cinnamoneus*	Cinnamon Bitten	Ardeidae	NA
71	*Ixobrychus sinensis*	Yellow Bittern	Ardeidae	LC
72	*Lanius cristatus*	Brown Shrike	Laniidae	LC
73	*Lanius schach*	Long-tailed Shrike	Laniidae	LC
74	*Larus brunnicephalus*	Brown-headed Gull	Laridae	LC
75	*Leptoptilos javanicus*	Lesser adjutant	Ciconiidae	VU
76	*Lonchura punctulata*	Scaly-breasted Munia	Estrildidae	LC
77	*Lonchura striata*	White-rumped Munia	Estrildidae	LC
78	*Megalurus palustris*	Striated Grassbird	Locustellidae	LC
79	*Merops orientalis*	Asian Green Bee-eater	Meropidae	LC
80	*Merops philippinus*	Blue-tailed Bee-eater	Meropidae	LC
81	*Mesophoyx intermedia*	Intermediate Egret	Ardeidae	NA
82	*Metopidius indicus*	Bronze-winged Jacana	Jacanidae	LC

No	Scientific Name	Common Name	Family	IUCN (2020-2)
83	*Milvus mgrans*	Black-Kite	Accipitridae	NA
84	*Motacil flava*	Yellow Wagtail	Motacillidae	NA
85	*Motacil citreola*	Citrine Wagtail	Motacillidae	NA
86	*Motacill alba*	White Wagtail	Motacillidae	NA
87	*Motacill cinerea*	Grey Wagtail	Motacillidae	LC
88	*Mycteria leucocephala*	Painted Stork	Ciconiidae	NT
89	*Nettapus coromandelianus*	Cotton Pygmy-goose	Anatidae	LC
90	*Nycticorax nycticorax*	Black-crowned Night-Heron	Ardeidae	LC
91	*Oriolus chinensis*	Black-naped Oriole	Oriolidae	LC
92	*Orthotomus sutorius*	Common Tailorbird	Cisticolidae	LC
93	*Passer domesticus*	House sparrow	Passeridae	LC
94	*Passer montanus*	Eurasian Tree-Sparrow	Passeridae	LC
95	*Pelecanus philippensis*	Spot-billed Pelican	Pelecanidae	NT
96	*Phalacrocorax carbo*	Great Cotmorant	Phalacrocoracidae	LC
97	*Phalacrocorax niger*	Little Cormorant	Phalacrocoracidae	LC
98	*Phylloscopus fuscatus*	Dusky Warbler	Phylloscopidae	LC
99	*Plegadis falcinellus*	Glossy Ibis	Threskiornithidae	LC
100	*Ploceus hypoxanthus*	Asian Golden Weaver	Ploceidae	NT
101	*Ploceus manyar*	Streaked Weaver	Ploceidae	LC
102	*Ploceus philippinus*	Baya Weaver	Ploceidae	LC
103	*Pluvialis fulva*	Pacific Golden Plover	Charadriidae	LC
104	*Porphyrio porphyrio*	Purple Swamphen	Rallidae	LC
105	*Porzana fusca*	Ruddy-breasted Crake	Rallidae	LC
106	*Prinia inornata*	Plaing Prinia	Cisticolidae	LC
107	*Pycnonotus blanfordi*	Streak-eared Bulbul	Pycnonotidae	LC
108	*Pycnonotus cafer*	Red-Vented Bulbul	Pycnonotidae	LC
109	*Pycnontus jocosus*	Red-whiskered Bulbul	Pycnonotidae	NA
110	*Rallus aquaticus*	Western Water Rail	Rallidae	LC
111	*Riparia paludicola*	African Plain Martin	Hirundinidae	LC
112	*Riparia riparia*	Collared Common sand Martin	Hirundinidae	LC
113	*Saxicola caprata*	Pied Bushchat	Muscicapidae	LC
114	*Saxicola leucura*	White tailed Stonechat	Muscicapidae	LC
115	*Saxicola maura*	Siberian Stonechat	Muscicapidae	NA
116	*Sterna acuticauda*	Black-bellied Tern	Laridae	EN
117	*Sterna albifrons*	Little Tern	Laridae	LC
118	*Sterna hirundo*	Common Tern	Laridae	LC
119	*Streptopelia chinensis*	Spotted dove	Columbidae	NA
120	*Streptopelia teanquebarica*	Red Collared-Dove	Columbidae	NA
121	*Sturnus contra*	Asian Pies Starling	Sturnidae	NA
122	*Sturnus malabricus*	Chestnut-tailed Starling	Sturnidae	NA
123	*Sturnus sinensis*	White Shoulder Sterling	Sturnidae	LC
124	*Tachybaptus ruficollis*	Little Grebe	Podicipedidae	LC
125	*Threskiornis melanocephalus*	Black-headed Ibis	Threskiornithidae	NT
126	*Todorna ferruginea*	Ruddy Shelduck	Anatidae	NA
127	*Tringa erythropus*	Spotted Redshank	Scolopacidae	LC
128	*Tringa glareola*	Wood Sandpiper	Scolopacidae	LC
129	*Tringa ochropus*	Green Sandpiper	Scolopacidae	LC
130	*Tringa stagnatilis*	Marsh Sandpiper	Scolopacidae	LC
131	*Tringa totanus*	Common Redshank	Scolopacidae	LC
132	*Turdoides gularis*	White-throated Babbler	Leiothrichidae	LC
133	*Vanellus cinereus*	Grey-Headed Lapwing	Charadriidae	LC
134	*Vanellus indicus*	Red-Wattled Lapwing	Charadriidae	LC

Note: NA = Not Applicable, LC = Least Concern, NT = Nearly Threatened, VU = Vulnerable, EN = Endangered,
Source: District Forest Management Plan (DFMP), Forest Department, Bago Region

Table 4.1-15 List of Endangered, Vulnerable and Nearly Threatened Bird Species in Moeyungyi Wildlife Sanctuary

No	Scientific Name	Common Name	Family	IUCN (2020-2)
1	*Anhinga melanogaster*	Oriental Dater	Anhingidae	NT

No	Scientific Name	Common Name	Family	IUCN (2020-2)
2	*Grus antigone*	Sarus Crane	Gruidae	VU
3	*Leptoptilos javanicus*	Lesser adjutant	Ciconiidae	VU
4	*Mycteria leucocephala*	Painted Stork	Ciconiidae	NT
5	*Pelecanus philippensis*	Spot-billed Pelican	Pelecanidae	NT
6	*Ploceus hypoxanthus*	Asian Golden Weaver	Ploceidae	NT
7	*Sterna acuticauda*	Black-bellied Tern	Laridae	EN
8	*Sterna albifrons*	Little Tern	Laridae	LC
9	*Threskiornis melanocephalus*	Black-headed Ibis	Threskiornithidae	NT

Note: VU = Vulnerable, EN = Endangered, NT = Nearly Threatened, LC = Least Concern
Source: District Forest Management Plan (DFMP), Forest Department, Bago Region

The Intagaw reserved Forest is a reserved forest of about 102km^2, but according to the Bago Township Forestry Department, this reserved forest is for rubber plantation purposes and it is not an area for animal and plant conservation. Table 4.1-16shows the land use status of Intagaw Reserved Forest.

Table 4.1-16 Land Use Status of Intagaw Reserved Forest

No.	Land Use Item	Area (Acres)
1	Forest Department to the Agricultural Department (Rubber) Transfer Area	15,457
2	Current Reserved Forest Area	3,235
4	Private Rubber Plantation in Reserved Forest Area	608
5	Private Hardwood Plantation in Reserved Forest Area	1,717
6	Community Forestry Plantation in Reserved Forest Area	115
7	Remaining Area in Reserved Forest Area	794
8	Total Reserved Forest Area	18,692

Source: Pegu Township Forest Department

(5) Status of Flora and Fauna at Township around the Project Site

The status of endangered species and rare species based on the IUCN (International Union for Conservation of Nature) category in the township where the project site is located is shown below. This is information on the entire township, not on the target Project site. Details are shown in Table 4.1-17 but in terms of species related to CR (critically endangered) and EN (endangered), the Study Team contacted flora and fauna experts and the Forestry Department under MONREC, but there were no records at the project site.

Table 4.1-17 List of Flora in Bago Township

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
1	*Albizzia lebbek*	Kokko	Mimosaceae	Tree	NA
2	*Albizzia odotatissima*	Thit mangyi	Fabaceae	Tree	NA
3	*Albizzia procera*	Sit	Mimosaceae	Tree	NA
4	*Amoora wallichii*	Aukchinasa ni	Meliaceae	Tree	LC
5	*Anisoptera scaphula*	Kaunghmu	Dipterocarpaceae	Tree	EN
6	*Anogeissus acuminata*	Yon	Combretaceae	Tree	NA
7	*Artocarpus chaplasha*	Taung Peinne	Moraceae	Tree	NA
8	*Bombax ceiba*	Let pan	Bombacaceae	Tree	LC
9	*Calophyllum kunstleri*	Tharapi	Calophyllaceae	Tree	NA
10	*Carallia brachiiata*	Maniawga	Rhizophoraceae	Tree	NA
11	*Castaneopsis tribulides*	Thie e	Fagaceae	Tree	NA
12	*Cedrela toona*	Thitkado	Meliaceae	Tree	LC
13	*Cedrla serrata*	Taung Tama	Meliaceae	Tree	NA
14	*Chukrasia tabularis*	Yinma	Meliaceae	Tree	LC
15	*Cinnamomum iners*	Hman Thin	Lauraceae	Tree	LC

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
16	*Cinnamomum inunctum*	Karawe	Lauraceae	Tree	NA
17	*Cordia fragantissima*	Sanda wa	Boraginaceae	Tree	NA
18	*Dalbergia cultrata*	Yin daik	Fabaceae	Tree	NT
19	*Dalbergia oliveri*	Tamalan	Fabaceae	Tree	EN
20	*Diospyros oblonga*	Thit khaya	Ebenaceae	Tree	NA
21	*Diospyros pendula*	Magyi pway	Ebenaceae	Tree	NA
22	*Dipterocarpus dyeri*	Kanyin	Dipterocarpaceae	Tree	EN
23	*Dipterocarpus tuberculatus*	In	Dipterocarpaceae	Tree	NT
24	*Duabanga grandiflora*	Myauk ngo	Lythraceae	Tree	LC
25	*Eugenia jambolana*	Tha byay	Myrtaceae	Tree	NA
26	*Fagraea fragrans*	Anan	Gentianaceae	Tree	LC
27	*Gardenia coronaria*	Yin gat	Rubiaceae	Tree	NA
28	*Garuga pinnata*	Chin yoke	Burseraceae	Tree	NA
29	*Gmelina arborea*	Ye ma ne	Lamiaceae	Tree	LC
30	*Heritiera fomes*	Kanaso	Malvaceae	Tree	EN
31	*Lagerstroemia speciosa*	Pyin ma	Lythraceae	Tree	NA
32	*Lannea coromandelica*	Nabe	Anacardiaceae	Tree	NA
33	*Madhuca longifolia*	Talaing gaung	Sapotaceae	Tree	NA
34	*Mangifera caloneura*	Taw thayet	Anacardiaceae	Tree	NA
35	*Melanorrhoea usitata*	Thitse	Anacardiaceae	Tree	NA
36	*Mellettia pendula*	Thinwin	Fabaceae	Tree	NA
37	*Mesua ferrea*	Gan gaw	Calophyllaceae	Tree	NA
38	*Michelia champaca*	Saga wa	Magnoliaceae	Tree	LC
39	*Mytragyna rotundifolia*	Binga	Rubiaceae	Tree	NA
40	*Paloquium polyanthum*	Peinne bo	Sapotaceae	Tree	NA
41	*Parashorea stelata*	Thingadu	Dipterocarpaceae	Tree	NA
42	*Pentace burmanica*	Kashit	Malvaceae	Tree	DD
43	*Pentace graffithii*	Thit sho	Malvaceae	Tree	NA
44	*Pentacme siamensis*	Ingyin	Dipterocarpaceae	Tree	NA
45	*Pinus species*	Htin yu	Pinaceae	Tree	-
46	*Protium settatum*	Tha di	Burseraceae	Tree	NA
47	*Pterocarpus macrocarpus*	Padauk	Fabaceae	Tree	EN
48	*Quercus species*	Thit cha	Fagaceae	Tree	-
49	*Sesbania paludosa*	Nyan	Fabaceae	Tree	NA
50	*Shorea assamica*	Kyilan	Dipterocarpaceae	Tree	LC
51	*Shorea obtusa*	Thit ya	Dipterocarpaceae	Tree	NT
52	*Shorea thorelii*	Ka nyaung	Dipterocarpaceae	Tree	VU
53	*Spondias pinnata*	Gwe	Anacardiaceae	Tree	NA
54	*Swietenia floribunda*	Taung Thayet	Anacardiaceae	Tree	NA
55	*Tectona grandis*	Kyun (Teak)	Verbenaceae	Tree	NA
56	*Terminalia chebula*	Phan kha	Combretaceae	Tree	NA
57	*Terminalia tomentosa*	Taukkyan	Combretaceae	Tree	NA
58	*Tetrameles nudiflora*	Baing	Tetramelaceae	Tree	LC
59	*Xulocarpus molluccensis*	Kyana	Meliaceae	Tree	NA
60	*Xylia xylocarpa*	Pyin ka do	Fabaceae	Tree	LC

Note: NA = Not Applicable, LC = Least Concern, DD = Data Deficient, VU = Vulnerable, EN = Endangered, NT = Nearly Threatened
Source: General Administration Departments of the related township

Table 4.1-18 List of fauna in Bago Township

No.	Scientific Name	Local Name	Family	IUCN (2020-2)
1	*Cuon alpinus*	Asiatic Wild Dog	Canidae	EN
2	*Bubalus arnee*	Asian buffalo/water buffalo	Bovidae	EN
3	*Elephant species*	Elephant	Elephantidae	DD
4	*Bos gaurus*	Gaun Indian bison	Bovidae	VU
5	*Lutra sumatrana*	Hairy-nosed Otter	Mustelidae	EN
6	*Neofelis nebulosa*	Leopad	Felidae	VU
7	*Monkey species*	Monkeys	-	DD
8	*Sus scrofa*	Wild boar	Suidae	LC

Note: LC = Least Concern, VU = Vulnerable, EN = Endangered, DD = Data Deficient
Source: General Administration Departments of related township

Table 4.1-19 List of flora species in Thanatpin Township

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
1	*Acacia pennata*	Suboke gyi	Mimosaceae	Climber/Creeper	NA
2	*Erythrina fusca*	Kathit	Fabaceae	Tree	NA
3	*Tamarindus indica*	Mangyi	Caesalpiniaceae	Tree	NA
4	*Albizia lebbek*	Kokko	Mimosaceae	Tree	LC
5	*Ziziphus jujuba*	Zi	Rhamnaceae	Tree	LC
6	*Mangifera indica*	Thayet	Anacardiaceae	Tree	DD
7	*Cocas nucifera*	Ohn	Arecaceae	Tree	NA
8	*Borassus flabellifer*	Htan	Arecaceae	Tree	EN
9	*Psidium guajava*	Malaka	Myrtaceae	Small Tree	LC
10	*Musa sapientum*	Nget pyaw	Musaceae	Herb	NA

Note: NA = Not Applicable, LC = Least Concern, DD = Data Deficient, VU = Vulnerable, EN = Endangered, NT = Nearly Threatened
Source: General Administration Departments of related township, IUCN red list

Table 4.1-20 List of fauna species in Thanatpin Township

No	Scientific Name	Local Name	Family	IUCN (2020-2)
1	*Bandicota bengalensis*	Lesser Bandicoot Rat	Muridae	LC
2	*Fejervarya limnocharis*	Paddy frog	Dicroglossidae	LC
3	*Ptyas mucosa*	Indian Rat Snake	Colubridae	NA
4	*Anguilliformes*	Eel	Actinopterygii	NA
5	*Macrobrachium rosenbergil*	Fresh Water Prawn	Palaemonidae	NA
6	*Brachyura*	Fresh Crab	Malacostraca	-
7	*Bubalus bubalis*	Water Buffalo	Bovidae	NA
8	*Bos taurus*	Ox	Bovidae	NA
9	*Gallus gallus domesticus*	Chicken	Phasianidae	NA
10	*Anas platyrhynchos*	Duck	Anatidae	LC
11	*Sus scrofa scrofa Linnaeus*	Pig	Suidae	NA
11	*Ovis aries*	Sheep	Bovidae	NA
12	*Capra aegagrus hircus*	Goat	Bovidae	NA
13	*Coturnix japonica domestica*	Quail	Phasianidae	NA
14	*Canis lupus familiaris*	Dog	Canidae	-
15	*Felis catus*	Cat	Felidae	NA

Note: LC = Least Concern, VU = Vulnerable, EN = Endangered, NA = Not Applicable
Source: General Administration Departments of related township, IUCN red list

Table 4.1-21 List of Flora Species in Kawa Township

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
1	*Albizia lebbek*	Kokko	Mimosaceae	Tree	LC
2	*Lagerstroemia reginae*	Pyin ma	Lythraceae	Tree	NA
3	*Baccaurea sapida*	Kanazo	Euphorbiaceae	Tree	NA
4	*Ficus rumphii*	Nyaung	Moraceae	Tree	NA
5	*Syzygium grande*	Thabye gyi	Myrtaceae	Tree	NA
6	*Cocas nucifera*	Ohn	Arecaceae	Tree	NA
7	*Borassus flabellifer*	Htan	Arecaceae	Tree	EN
8	*Mangifera indica*	Thayet	Anacardiaceae	Tree	DD
9	*Delonix regia*	Sein pan	Caesalpiniaceae	Tree	LC
10	*Nypa fruticans*	Dani	Arecaceae	Small Tree	LC
11	*Senna siamea*	Mazali	Caesalpiniaceae	Tree	LC
12	*Eragrostis brownii*	Thaman myet	Poaceae	Grass	NA

Note: NA= Not Applicable, LC = Least Concern, DD = Data Deficient, VU = Vulnerable, EN = Endangered, NT = Nearly Threatened
Source: General Administration Departments of related township, IUCN red list

Table 4.1-22 List of Fauna Species in Kawa Township

No	Scientific Name	Local Name	Family	IUCN (2020-2)
1	*Felis chaus*	Jungle Cat	Felidae	LC

No	Scientific Name	Local Name	Family	IUCN (2020-2)
2	-	Squirrels	Sciuridae	NA
3	-	Mongoose	Herpestidae	LC
4	-	Various kind of snakes	Serpentes	NA
5	-	Various kind of birds	-	NA
6	*Dendrocygna javanica*	Lesser Tree Duck	Anatidae	LC

Note: LC = Least Concern, NA = Not Applicable
Source: General Administration Departments of related township, IUCN red list

Table 4.1-23 List of Flora Species in Hlegu Township

No	Scientific Name	Local Name	Family	Habitat	IUCN (2020-2)
1	*Carallia brachiiata*	Maniawga	Rhizophoraceae	Tree	NA
2	*Dipterocarpus baudii*	Ka nyin	Dipterocarpaceae	Tree	VU
3	*Garuga pinnata*	Chin yoke	Burseraceae	Tree	NA
4	*Gmelina arborea*	Ye ma ne	Lamiaceae	Tree	LC
5	*Lagerstroemia tomentosa*	Leza	Lythraceae	Tree	NA
6	*Microcos paniculata*	Mya ya	Malvaceae	Tree	LC
7	*Protium settatum*	Tha di	Burseraceae	Tree	NA
8	*Swintonia floribunda*	Taung Thayet	Anarcardiaceae	Tree	NA
9	*Tectona grandis*	Teak (Kyun)	Verbenaceae	Tree	NA
10	*Xylia xylocarpa*	Pyin ka doe	Fabaceae	Tree	LC

Note 1: NA = Not Applicable, LC = Least Concern, VU = Vulnerable
Source: General Administration Departments of related township, IUCN red list

Table 4.1-24 List of Fauna Species in Hlegu Township

No.	Scientific Name	Local Name	Family	IUCN (2020-2)
1	*Sus scrofa*	Wild boar	Suidae	LC
2	*Rusa unicolor*	Samban sambar deer	Cervidae	VU
3	*Cuon alpinus*	Dhole Asiatic Wild Dog	Canidae	EN
4	*Petinomys vordermanni*	Vordermann's flying squirrel (Shu pyan)	Sciuridae	VU
5	*Manispenta dactyla*	Chinese pangolin	Manidae	CR
6	*Aceros nipalensis*	Rufous-necked hornbill (Aung Laung)	Bucerotidae	VU

Note: LC = Least Concern, CR = Critically Endangered, VU = Vulnerable, EN = Endangered
Source: General Administration Departments of related township, IUCN red list

4.1.3. System and Organization for Environmental and Social Considerations in Myanmar

The following summarizes the environmental and social considerations system and related organizations in Myanmar.

(1) Fundamental Laws and Regulations Related to Environmental and Social Considerations

The fundamental laws and regulations related to environmental and social considerations and health in Myanmar are shown in Table 4.1-25. In addition, major international agreements and treaties that the Myanmar government has ratified related to environmental and social considerations are shown in Table 4.1-26.

Table 4.1-25 Fundamental Laws and Regulations Related to Environmental and Social Considerations and Health in Myanmar

No.	Laws and Regulations as of October 2020
Environmental Framework	
1	The National Environmental Policy (2019)

No.	Laws and Regulations as of October 2020
2	The Climate Change Policy (2019)
3	Myanmar Agenda 21 (1997)
4	National Sustainable Development Strategy (2009)
5	The Environmental Conservation Law (2012)
6	The Environmental Conservation Rules (2014)
7	EIA Procedures (December 2015)
8	National Environmental Quality (Emission) Guidelines (December 2015)
9	Draft Guideline on Public Participation in Myanmar's EIA Processes (2017)
Water Environment	
10	The Underground Water Act (1930)
11	The Territorial Sea and Maritime Zone Law (2017)
12	The Law on Aquaculture (1989)
13	The Conservation of Water Resources and Rivers Law (2006)
14	The Conservation of Water Resources and Improvement of River Systems Rules (2013)
Forestry/Biodiversity/Agriculture	
15	The Pesticide Law (1990, Amendment in 2016)
16	The Forest Law (2018)
17	The Forest Rules (1995)
18	The Plant Pest Quarantine Law (1993)
19	The Protection of Biodiversity and Protected Areas Law (2018)
20	The Animal Health and Development Law (1994, Amendment in 2010)
21	The Fertilizer Law (2002)
Land Use	
22	The Land Acquisition, Resettlement and Rehabilitation Act (2019)
23	The Farmland Law (2012)
24	The Farmland Rules (2012)
25	The Vacant, Fallow and Virgin Lands Management Law (2012)
26	The Vacant, Fallow and Virgin Lands Management Rules (2012)
Heritage	
27	The Protection of Preservation of Cultural Heritage Region Law (1998, Amendment in 2009)
28	The Heritage Goods Protection Law (or) The Protection and Preservation of Ancient Monuments Law (2015)
Public Health and Safety	
29	The Penal Code of Offences Affecting Public Health, Safety, Convenience, Decency and Morals (1961)
30	The Public Health Law (1972)
31	The National Drug Law (1992)
32	The Narcotic Drugs and Psychotropic Substances Law (1993)
33	The Prevention and Control of Communicable Diseases Law (1995, Amendment in 2011)
34	The Traditional Drug Law (1996)
35	The National Food Law (1997)
36	The Control of Smoking and Consumption of Tobacco Products Law (2006)
37	The Law related to Private Health Care Services (2007, Amendment in 2013)
38	The Automobile Law (2015)
Industrial Law	
39	The Occupational Explosive Materials Act (2018)
40	The Explosive Substances Act (1908/Amendment in 2001)
41	The Law relating to the Fishing Rights of Foreign Fishing Vessels (1989, Amendment in 1993)
42	The Private Industrial Enterprise Law (1990)
43	The Marine Fisheries Law (1990/Amendment in 1993)
44	The Freshwater Fisheries Law (1991)
45	The Salt Enterprise Law (1992)
46	The Science and Technology Development Law (1994)
47	The Myanmar Mines Law (1994)
48	The Myanmar Pearl Law (1995, Amendment in 2014)
49	The Myanmar Gemstone Law (1996)
50	The Prevention of Hazards from Chemicals and Related Substances Law (2013)
51	The Business for Ozone Depleting Substances: Notification No. 37/2014
52	The Prevention of Hazards from Chemicals and Related Substances Rules (2016)
53	The Petroleum and Petroleum Products Law (2017)
Working Environment	
54	The Worker's Compensation Act (1923)

No.	Laws and Regulations as of October 2020
55	The Payment of Wages Act (2016)
56	The Factory Act (1951/Amendment in 2016)
57	The Shops and Establishment Act (1951)
58	The Leave and Holiday Act (1951, partially Amendment in 2014)
59	The Labor Organization Law (2011)
60	The Social Security Law (2012)
61	The Labor Organization Rules (2012)
62	The Labor Dispute Settlement Law (2012/Amendment in 2016)
63	The Employment and Skill Development Law (2013)
64	The Minimum Wage Law/Rules (2013)
65	The Social Security Rules (2014)
66	The Occupational Health and Safety Law (2019)
67	The Payment of Wages Law (2016)
Infrastructure/Economic Development/ Administration	
68	The Town Act (1907)
69	The Village Act (1907)
70	The Ports Act (1908)
71	The Myanmar Insurance Law (1993)
72	The Myanmar Hotel and Tourism Law (1993)
73	The Constitution of the Union of Myanmar (2008)
74	The Ward or Village Tracts Administration Law (2012/Amendment in 2012/2016)
75	The Export and Import Law (2012)
76	The Myanmar Investment Law (2016)
77	The Myanmar Investment Rules (2017)
78	The Electricity Law (2014)
79	The Boiler Law (2015)
80	The Foreign Investment Law (2012/Amendment in 2015)
81	The Foreign Investment Rules (2013)
82	The Myanmar Citizen Investment Law (2013/Amendment in 2012/2016)
Emergency	
83	The Natural Disaster Management Law (2013)
84	The Myanmar Fire-brigade Law (2015)

Source: JICA Study Team

Table 4.1-26 Major International Agreements and Treaties that the Myanmar Government has Ratified Related to Environmental and Social Considerations

No.	International Agreements and Treaties	Date Ratified
1	Ramsar Convention (Convention on Wetlands of International Importance Especially as Waterfowl Habitat), 1971	2005
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979	1997
3	Vienna Convention for the Protection of the Ozone Layer, 1985	1993
4	Basel Convention, 1989	2015
5	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
6	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	1993
7	United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992	1994
8	Convention on Biological Diversity, Rio de Janeiro, 1992	1994
9	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)

Source: The Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan (2011), Website of the Basel Convention (http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx)

The following are summaries of the key laws, NEQG and EIAP, related to the natural and social environment in Myanmar that will likely be relevant to the Project.

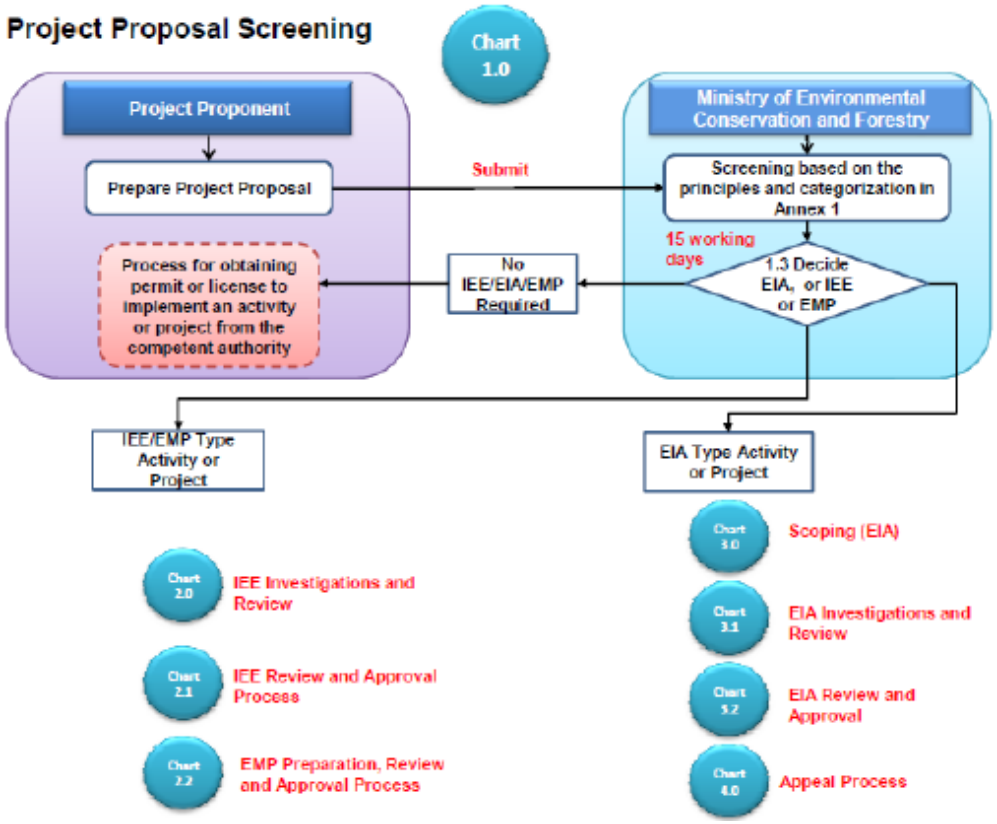
National Environmental Quality (Emission) Guidelines (2015)

The Ministry of Natural Resources and Environmental Conservation (MONREC) formulated the

National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emissions, such as air emissions, wastewater, noise levels, and odors, and those for sector-specific emissions such as emissions from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.

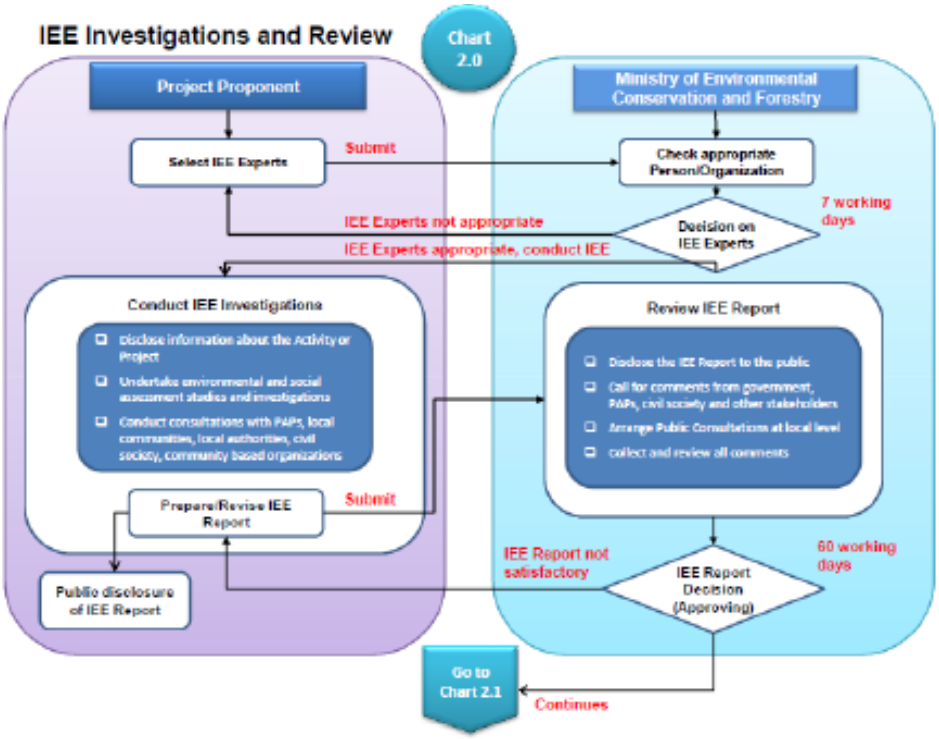
The EIA Procedure (2015)

The first full-scale legal framework for EIA was established by "Environmental Assessment Procedure, Notification No. 616/2015", which came into force on 29 December 2015, by MONREC. The first step in the EIA procedure is to submit a project proposal to the Environmental Conservation Department (ECD) of MONREC. Then, ECD will decide on an EIA, IEE, or EMP according to the project description. After the decision by ECD, the project proponent must propose expert lists (3rd party consultants) for ECD approval. After the approval, the experts/consultants can start to conduct the EIA/IEE/EMP investigation and submit the report to ECD for approval. A detailed description of EIA/IEE procedures, which the Project is expected to require, is given in the following charts step by step, from Figure 4.1-4 toFigure 4.1-14.



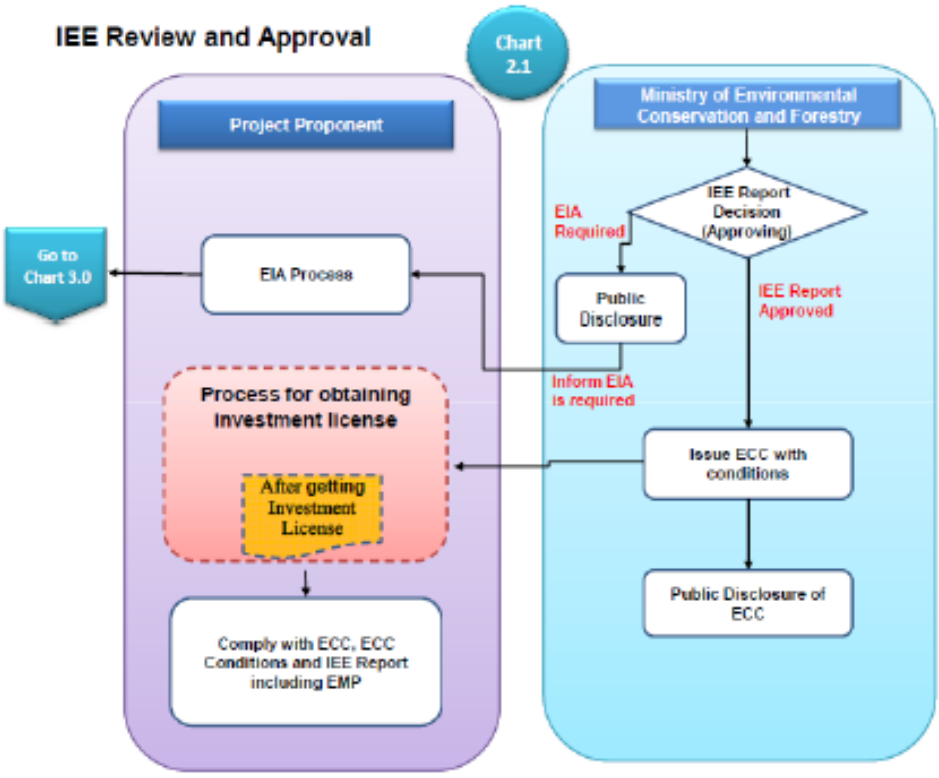
Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-4 Myanmar EIA/IEE Procedures (1/6)



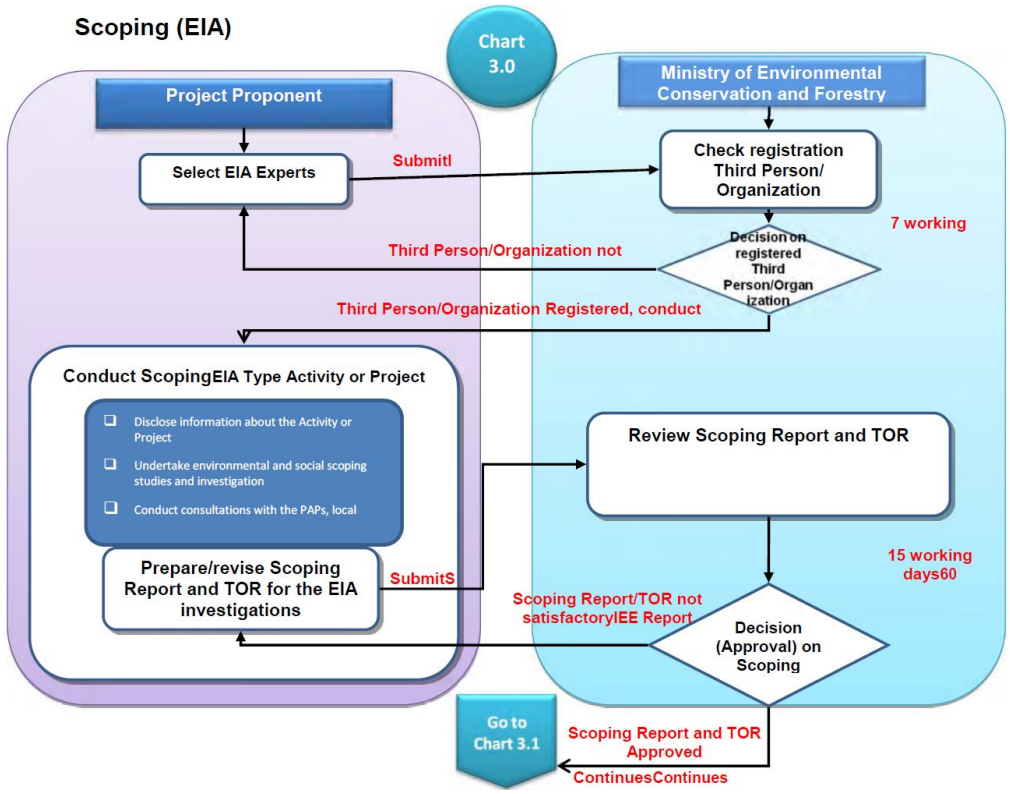
Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-5 Myanmar EIA/IEE Procedures (2/6)



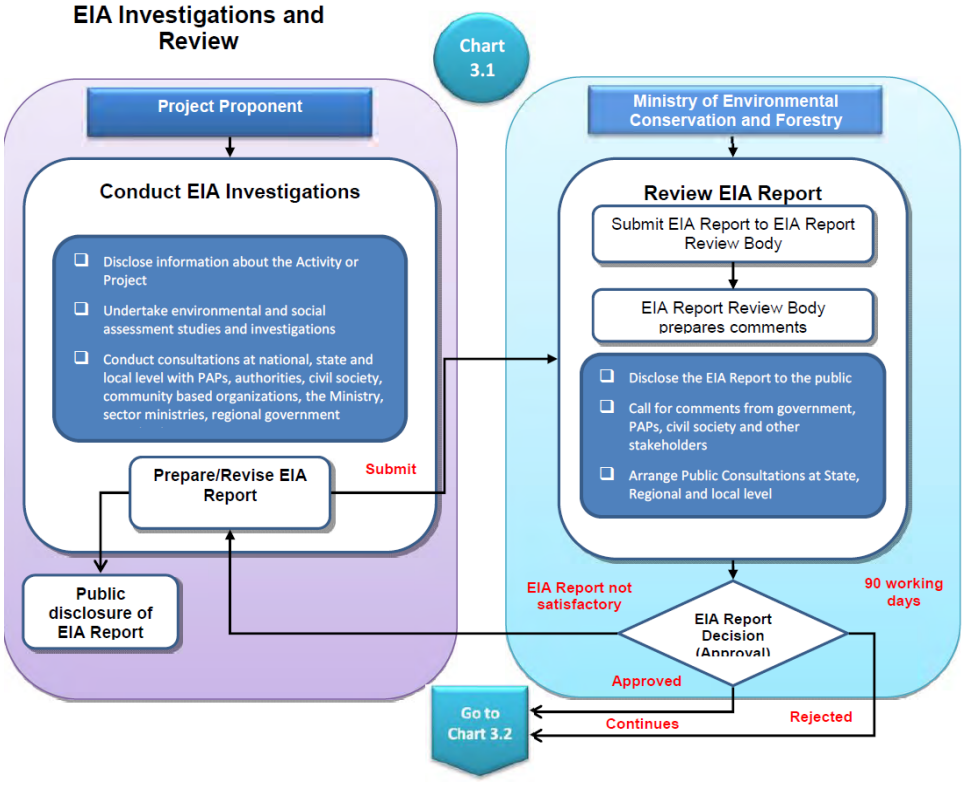
Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-6 Myanmar IEE Procedures (3/6)



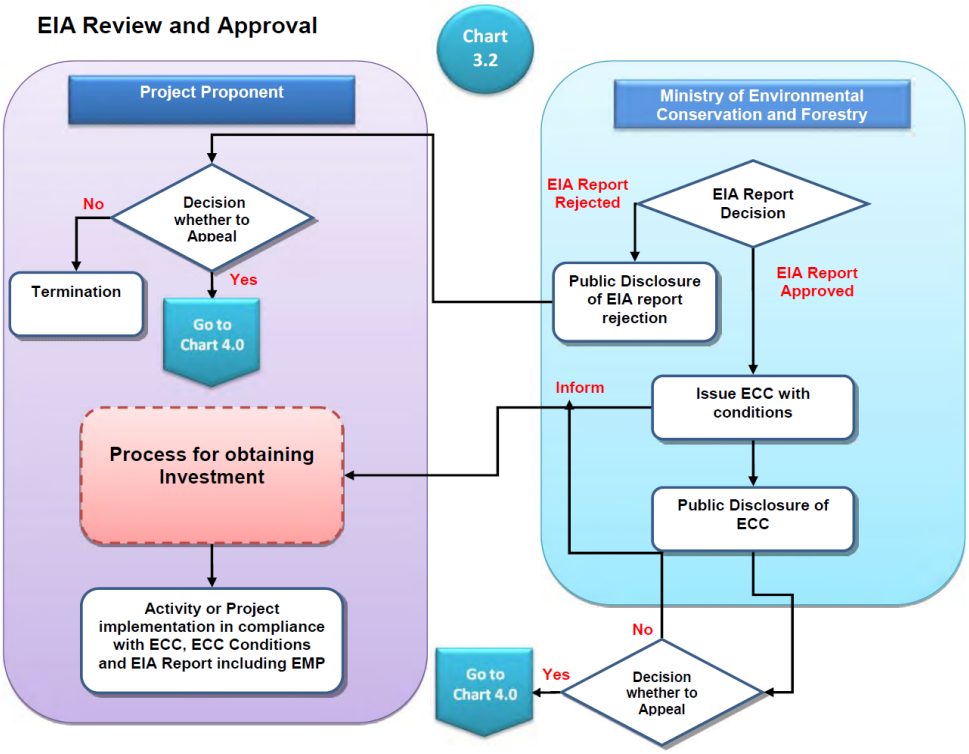
Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-7 Myanmar IEE Procedures (4/6)



Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-8 Myanmar IEE Procedures (5/6)

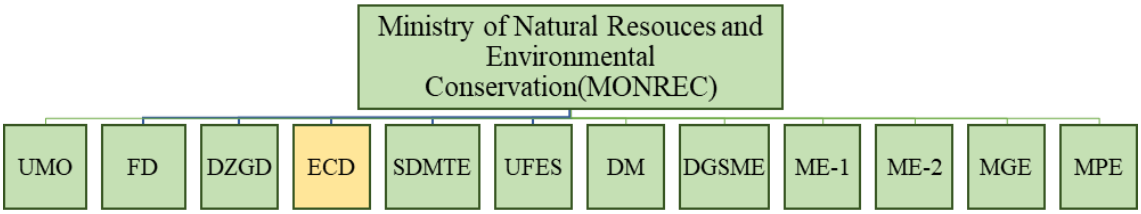


Source: Annex 2 of EIA Procedure (2015), ECD, MONREC

Figure 4.1-9 Myanmar IEE Procedures (6/6)

(2) Environmental and Social Considerations System and Related Organizations

The lead ministry in charge of environmental and social considerations is the Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation (MONREC), which was reorganized with the former Ministry of Environmental Conservation and Forestry (MOECAF) and Ministry of Mines (MOM) in April 2016. MONREC acts as the main ministry for the preparation of environment-related laws/rules/procedures/policies/guidance, the management of environmental issues, and the development of environmentally-friendly businesses and sustainable projects in Myanmar. The organization structure of MONREC is described in Figure 4.1-10.

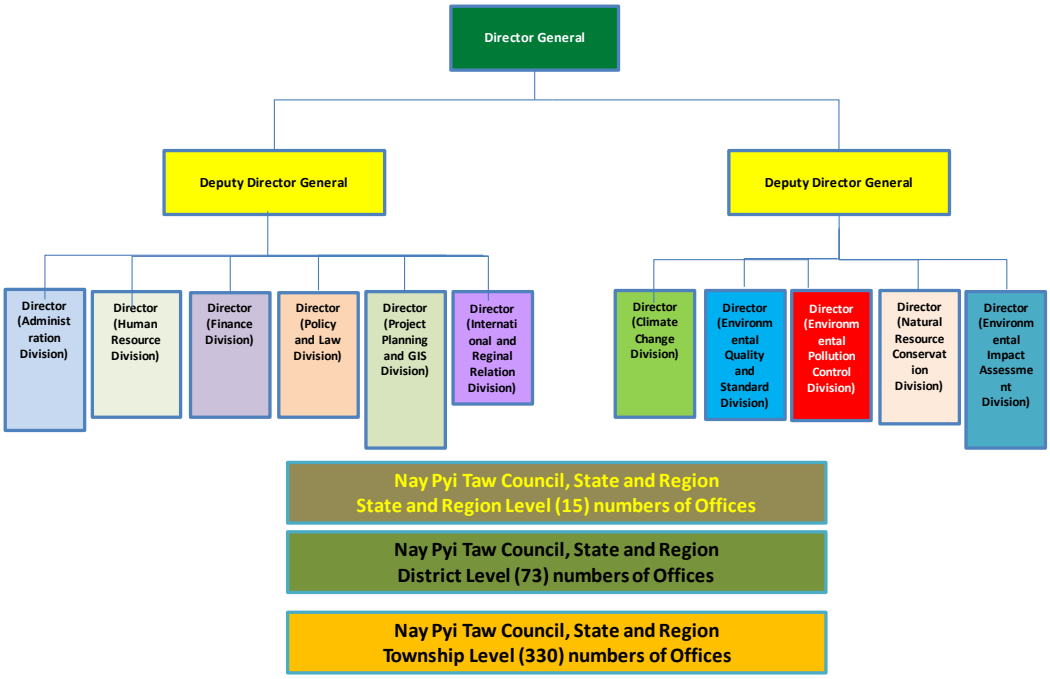


UMO = Union Minister Office
FD = Forest Department
DZGD = Dry Zone Greening Department
ECD = Environmental Conservation Department
SDMTE = Survey Department & Myanmar Timber Enterprise
UFES = University of Forestry and Environmental Science
DM = Department of Mines
DGSME = Department of Geological Survey and Mineral Exploration
ME-1 = No. 1 Mining Enterprise
ME-2 = No. 2 Mining Enterprise
MGE = Myanmar Gems Enterprise
MPE = Myanmar Pearl Enterprise

Source: MONREC

Figure 4.1-10 Organizational Structure of Ministry of Natural Resources and Environmental Conservation (MONREC)

In MONREC, the Environmental Conservation Department (ECD) has 11 Divisions and State & Regional Offices, as shown in Figure 4.1-10. Among these Divisions, the EIA Division is in charge of EIA issues, i.e., screening, review, and evaluation of EIA, IEE or EMP, as well as issuing Environmental Compliance Certificate (ECC) as evidence of environmental approval. If the project proponent is one of the Line Ministries of the Central Government, such as MOEE, ECD, Nay Pyi Taw is responsible for EIA issues, and if the proponent is located in a regional area, the regional office of ECD is responsible for the EIA issues.



Source: ECD, MONREC

Figure 4.1-11 Organizational Structure of Environmental Conservation Department (ECD)

(3) Gap Analysis between Myanmar Law and JICA Guidelines for Environmental and Social Considerations (April 2010)

The results of the gap analysis between the policies of Myanmar's legislation, including the EIAP, and the Guidelines for JICA Environment and Social Considerations, are described in 4.2 Land Acquisition and Resettlement with countermeasures for the Project.

The gap analysis between the Myanmar Land Acquisition Law 2019 and the JICA Guidelines is described in 4.2. "Land Acquisition and Resettlement" of this report.

Table 4.1-27 Gaps between JICA Guidelines for Environmental and Social Considerations and EIAP/Myanmar Legislation

Item	JICA Guidelines	EIAP and Myanmar Legislation	Countermeasures for the Project
Underlying Principles	Environmental impacts that may be caused by projects must be accessed and examined at the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	Article 3 of the EIA Procedure stipulates that all Projects and Project expansions which have the potential to cause Adverse Impacts are required to undertake IEE or EIA or to develop an EMP to obtain an ECC. Article 58 of the EIA Procedure stipulates that EIA investigation shall also include an analysis of Alternatives. Such analysis shall include a description of each Alternative, and an assessment and comparison of the Adverse Impacts, required mitigation measures and Residual Impacts of the Alternatives, but there is no line which stipulates the timing of the above implementation.	There is no significant difference between JICA Guidelines and Myanmar legislation. The Project will be screened as EIA or IEE and will submit the environmental report, including Alternative investigation and mitigation measures.
Examination of Measures	Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to the avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures.	Article 58 of the EIA Procedure stipulates that EIA investigation shall also include an analysis of Alternatives. Such analysis shall include a description of each Alternative, and an assessment and comparison of the Adverse Impacts, required mitigation measures and Residual Impacts of the Alternatives, but the conducting of compensation measures is not stipulated in the EIA procedures. Article 63 of the EIA Procedure stipulates that the project proponent is responsible for preparing an EIA report which contains Impact and Risk Assessment and Mitigation Measures.	There is no significant difference between JICA Guidelines and Myanmar legislation. The study team investigated the alternatives and described them in the draft IEE report to be submitted to ECD/MONREC.
Scope of Impacts to be Assessed	The impacts to be accessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accident, water usage, climate change, ecosystem, fauna and flora, including transboundary or global scale impacts. These also include	Article 63(6) of the EIA Procedure stipulates (I) identification and assessment of potential Environmental Impacts including (i) physical, biological, social, socio- economic, health, cultural, and visual impacts; (ii) potential impacts on climate change such as greenhouse gas emissions and loss of carbon sinks or stocks; and (iii) identification of impacts on climate change in the Project based on available climate change predictions from designated national authorities or international scientific research bodies,	There is no significant difference between JICA Guidelines and Myanmar legislation. The study team investigated the alternatives and described them in the draft IEE report to be submitted to ECD/MONREC.

Item	JICA Guidelines	EIAP and Myanmar Legislation	Countermeasures for the Project
	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 infrastructure 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.	(II) Identification and assessment of the likelihood and severity of natural and industrial hazards relevant to the Project are necessary in EIA report. However, social impacts, local economy, social institution and social infrastructure are not determined.	
Compliance with Laws, Standards, and Plans	Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social considerations policies and plans of the governments that have such jurisdiction.	Article 28 of The Environmental Conservation Law prescribes that "No one shall, without prior permission, operate business, work-site or factory, or workshop which is required to obtain prior permission under this Law" Article 29 of the law stipulates that "No one shall violate any prohibition contained in the rules, notifications, orders, directives, and procedures issued under this Law."	No law directly prescribes that projects must comply with laws, ordinances, and standards related to environmental and social considerations. There are National Environmental Quality (Emission) Guidelines, and the JICA Study team referred to these values.
Social Acceptability	Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.	Article 36 (g) of the EIA procedures stipulates that public consultation and public participation processes, recommendations received from the public, and the Project Proponent's written responses to comments received during that process are necessary in IEE report. Article 50 of the EIA Procedure stipulates that as part of the Scoping, the Project Proponent shall ensure the following public consultation and participation process: a) disclose information about the proposed Project to the public and civil society through posting on the Project or Project Proponent's website(s) and local media, including by means of the prominent posting of legible sign boards and advertising boards at the Project site which are visible to the public; and b) arrange the required complement of consultation meetings as advised by the Ministry, with local communities, potential PAPs, local authorities, community-based organizations, and civil society, and provide appropriate and timely explanations in press conferences and media interviews.	There is no significant difference between JICA Guidelines and Myanmar legislation. The study team had public consultation meetings and public disclosures at all target townships.

Item	JICA Guidelines	EIAP and Myanmar Legislation	Countermeasures for the Project
		Article 52 of the EIA Procedure stipulates that EIA investigations shall include all necessary data collection, technical studies, modeling, field surveys, field sampling, laboratory analysis, engineering designs and calculations, and consultations to determine and document that all feasible measures are taken to ensure that all Residual Impacts are within applicable limits and are acceptable to the Ministry and interested and affected persons. Article 63 (9) of the EIA Procedure stipulates that the project proponent is responsible for the preparation of an EIA report which contains 9.0 Public Consultation and Disclosure.	
Ecosystem and Biota	Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.	The Environmental Conservation Law prescribes that relevant government departments/organizations shall implement conservation, management, beneficial use, sustainable use and enhancement of regional cooperation of environmental natural resources. Article 40 of the Forest Law (1992) prescribes that the causing of any damage to reserved forest and its environment is prohibited and will be punished. Article 36 of The Protection of Wildlife and Conservation of Natural Areas Law prescribes that the causing of any damage to protected areas is prohibited and will be punished.	There is no significant difference between JICA Guidelines and Myanmar legislation. The project avoids passing through protected and conservation areas.
Involuntary Resettlement	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.	Article 7 of the EIA Procedure describes that projects that involve Involuntary Resettlement or which may potentially have an Adverse Impact on Indigenous People shall comply with specific procedures separately issued by the ministries responsible. Prior to the issuance of any such specific procedures, all such Projects shall adhere to international good practice (as accepted by international financial institutions including the World Bank Group and Asian Development Bank) on Involuntary Resettlement and Indigenous Peoples. However, the details of actions are not provided in the draft procedures.	There is no significant difference between JICA Guidelines and Myanmar legislation. The Project, at the F/S stage, will confirm with DPTSC that the requirements of the 2019 Land Acquisition Law will be duly implemented, and DPTSC will monitor the process and outcome in the implementation phase of the RAP.
Indigenous People	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.	Article 7 of the EIA procedures describes that projects that involve Involuntary Resettlement or which may potentially have an Adverse Impact on Indigenous People shall comply with specific procedures separately issued by the responsible ministries. Prior to the issuance of any such specific procedures, all such Projects shall adhere to international good practice on Involuntary Resettlement and Indigenous Peoples.	There is no significant difference between JICA Guidelines and Myanmar legislation. The project will take the necessary actions when needed.
Monitoring	After projects begin, project proponents etc. are to monitor whether any unforeseeable	Article 100 of the EIA Procedure stipulates that the Project Proponent shall incorporate all relevant environmental	There is no significant difference between JICA

Item	JICA Guidelines	EIAP and Myanmar Legislation	Countermeasures for the Project
	situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring	commitments and requirements set forth in the EIA Report, Construction Phase EMP and/or Operational Phase EMP as the case may be, and in the ECC, applicable Emission Limit Values and Environmental Quality Standards, into detailed designs, construction contract specifications, and contracts on Project operations related to any part of the Project. Article 106 of the EIA Procedure stipulates that the Project Proponent shall, during all phases of the Project (pre-construction, construction, operation, decommissioning, closure and post-closure), engage in continuous, proactive and comprehensive self-monitoring of the Project and activities related thereto, all Adverse Impacts, and compliance with applicable laws, the Rules, this Procedure, standards, the ECC, and the EMP.	Guidelines and Myanmar legislation. The project will have environmental management, including environmental monitoring as described in the IEE report.

Source: JICA Study Team

4.1.4. Consideration of Alternatives

The alternatives assessment is made based on (a) Natural Environment (b) Social Considerations and (c) technical factors, in comparison with the zero option, location alternatives for the new substation, and route alternatives for 500 kV.

(1) Zero Option

An alternatives assessment was made between Option-A (without the Project) and Option-B (with the Project). The results are shown in Table 4.1-28.

Table 4.1-28 Results without and with the Project (Option A and B)

Item	Option A (Without the Project)	Option B (With the Project)
Environmental considerations	Existing environment is kept in natural condition. No impact on natural environment.	Existing trees within the project area might be cut. Temporary impacts on water quality of some rivers and creeks along the proposed project area will occur due to construction work.
Social Considerations	Land acquisition and resettlement will not be required as there will be no land use. Economic development limitations can lead to lack of power supply.	Land acquisition and resettlement will be required. More employment opportunities would be created. Most of the area along a 500kV/230kV OH line is covered with green spaces such as forest, cultivated lands and residential areas on the outskirts of Yangon and there will be no or negligible impact on landscape.
Facility Development in Power Supply Sector	There will be potential limitations to future urban development because there will be an insufficient electricity supply.	There will be potential for positive contribution to future urban development because there will be sufficient electricity. Greater electricity volumes could be provided, and existing electricity will be improved.

Source: JICA Study Team

(2) Alternatives for Substation

An alternatives assessment was made between Option-A (upgrading the existing substation) and Option-B (construction of new substation). Although upgrading the existing substation has less impact in terms of environmental and social considerations, when the Myanmar side assumed future

electricity demand in the country many were of the opinion that it would be difficult to choose to upgrade the existing substation because it will be impossible to expand in the future due to land restrictions. In the case of constructing a new substation, it is necessary to consider cutting down some trees and acquiring land for land preparation, but the scale would be limited and it is possible to deal with this, meaning that the substation could be expanded in the future. Option B (construction of a new substation) was selected. The results are shown in Table 4.1-29.

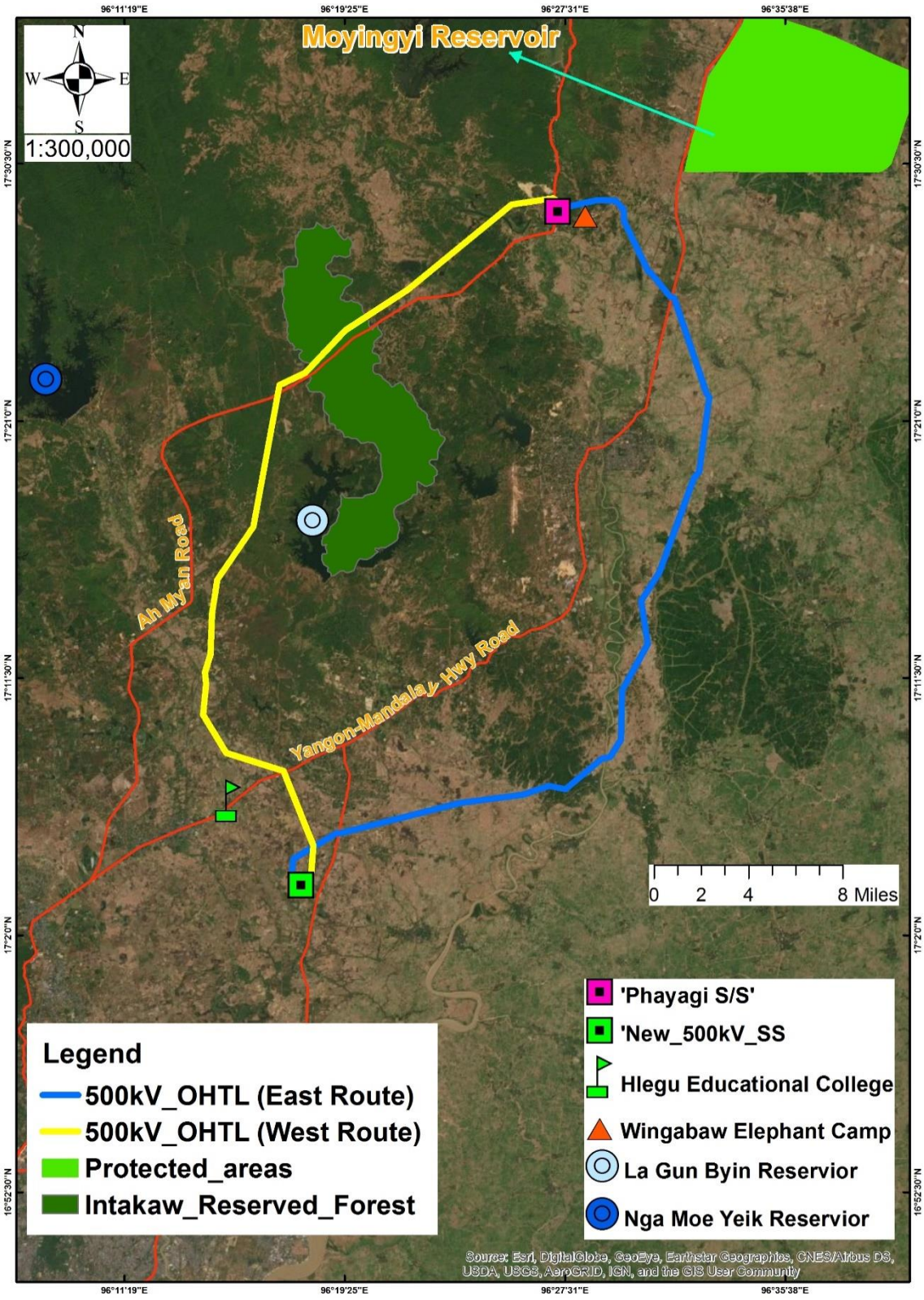
Table 4.1-29 Results between Upgrading the Existing S/S (Option A) and Construction of New S/S (Option B)

Item		Option A (Upgrading the Existing Substation)	Option B (Construction of New Substation)
Environmental considerations	Air quality, noise and vibrations	No site cleaning is required so air quality impacts due to dust generation, and noise and vibration impacts from construction work will be reduced compared to Option B. Some air quality impact, noise and vibration generation are expected from installation of new 500 kV equipment.	Site cleaning will be required for the construction of the new substation, so air quality, noise, and vibration impacts are expected. Compared to Option A, greater air quality impacts and noise and vibration generation are expected due to the construction of the new substation and installation of new 500 kV equipment.
	Cutting trees and Site Clearance	No tree cutting is required. Some weeds will have to be cleared for installation of new equipment.	Some tree cutting will be required for site cleaning. Approximately 80 acres of paddy field will have to be cleared for the construction of the new substation.
	Water pollution	Water quality impact on nearby fish ponds is expected due to construction work.	There will be a greater water quality impact on nearby creeks and fish ponds due to construction work compared to Option A.
Social considerations	Land acquisition	There will be no requirement for land acquisition to upgrade the existing facilities.	A total area of approximately 80 acres of land will have to be acquired for the installation of 500 kV substation.
	Livelihoods	There will be no impacts on the livelihoods of local people.	Because of the land requirement for substation, 80 acres of paddy fields need to be removed. Therefore, the livelihoods of local people would be affected, and local living standards would be improved due to the sufficient power supply.
Technical issues	Future Expansion	Future expansion cannot be undertaken due to land limitations.	With Option B, future expansion can be undertaken because there is a large amount of space for the construction of the new substation.

Source: JICA Study Team

(3) Route Alternatives for 500 kV

An alternatives assessment was made between Option-A (West route) and Option-B (East route), as shown in Table 4.1-31. There were no big differences in technical issues and costs between Option A (west route) and Option B (east route), but Option A (west route) has a large number of rubber plantations to be cut down on the route, and compensation and negotiations were considered difficult. Therefore, Option B (East Route) was selected. The results are shown in Table 4.1-12.



Source: JICA Study Team

Figure 4.1-12 Alternative Transmission Line Route for 500kV (West/East route (Option A/Option B))

Table 4.1-30 Results between East Route (Option A) and West Route (Option B) for 500 kV Transmission line

Item		Option A (West Route)	Option B (East Route)
Environmental issues	Air quality, noise and vibrations	Compared to Option B, there are more receptors such as houses on the route and impacts on air quality, noise and vibration are anticipated.	Air quality, noise and vibration impacts are expected due to construction work
	Cutting trees and Site Clearance	Compared to Option B, the cutting of more trees and more land clearance will be required due to site conditions.	Trees within the alignment of TL are required to be cut down. Some land clearance will be required.
	Natural Environment	TL alignment will cross Intagaw Reserved Forest and near the Nga Moe Yeik Reservoir.	There are no direct crossings of protected areas or reserved forest. Wingabaw Elephant Camp is located near the TL alignment.
Social Considerations	Traffic disruption and inconvenience to pedestrians, including access	Traffic along the Number 2 Main Road, Yangon-Mandalay Highway is expected while transmission line facilities and construction materials are transported to the construction site.	Traffic along the Number 2 Main Road, Yangon-Mandalay Highway, and Yangon-Mandalay Expressway is expected while transmission line facilities are transported to the construction site.
	Impact on residential, commercial, government, and heritage structures	The transmission line route will be designed to avoid residential areas themselves but the route crosses through Tha Nat Pyin village. The transmission line route also crosses near five (5) villages. There are three (3) pagodas, ten (10) monasteries and seven (7) churches near the transmission line route. The transmission line route also crosses over two (2) livestock areas (fish ponds). The first crossing is approximately 0.5 km in distance and the second crossing is approximately 0.1 km in distance.	The transmission line route will be designed to avoid residential areas themselves but it crosses near three (3) villages. There are three (3) pagodas and one (1) monastery near the transmission line route. There are no crossings over livestock areas.
Technical issues	Cost	Lower cost than the eastern route (Option B).	30-40% increase in construction costs compared to the western route (Option A).
	Construction of the transmission lines	Compared to Option B, construction of the transmission lines would be more constrained by the route through the forest area and rubber plantations, and the change in the positions of the bays at Pharyargyi substation. The ground along Number 2 Main Road is relatively firm. It is assumed that low-cost pad foundations can be partially applied.	There is no change in the positions of the bays at Pharyargyi substation, and the route passes through flat rice fields and riverbeds and does not pass through rubber forests and mango orchards, making access to the construction sites easy. The construction work for the transmission lines is relatively easy. Most of the route passes through riverbed and rural areas, where the ground is soft, and therefore, pile foundations for steel tower are expected to be relatively expensive.

Source: JICA Study Team

4.1.5. Scoping and TOR for the Survey on Natural and Social Environments

(1) Draft Scoping Results

The outline of the Project components is as described above. According to Article 25 of EIA Procedure Notification No. 616/2015, the following conservation areas are categorized as sensitive environmental and conservation areas requiring special consideration in conserving the areas. The following conservation areas are NOT expected to exist in the area of the Project.

1) Forest conservation area (including biodiversity reserved area)
2) Public forest
3) Park (including marine parks)
4) Mangrove swamp
5) Any other sensitive coastal area
6) Wildlife sanctuary
7) Scientific reserve
8) Nature reserve

9) Geophysically significant reserve
10) Protected cultural heritage area
11) Protected archeological area or area of historical significance

Identification of potential impact is the first step in addressing the key environmental and social impacts of the Project. Anticipated potential impacts on the environment, society and health are identified based on the proposed design and facilities of the project, construction and operation activities, other assessment reports and professional experience.

According to the EIAP in Myanmar, the proposed project needs to be evaluated at three stages: i) construction stage (CS) ii) operation stage (OS) and iii) closure stage (CLS). Therefore, anticipated project-related impacts were also considered for the three stages. The construction stage and closure stage are assessed together with the impacts related to construction work and demolition work, which can be expected to follow almost a similar procedure. The draft Scoping results are shown in Table 4.1-31.

Table 4.1-31 Environmental and Social Impacts Related to the Project

Category	Assessment Item	Items	Assessment Phase			Sources of the impacts
			CS	OS	CLS	
Pollution	Air Pollution	Exhaust gas emissions		✓		OS: Exhaust gas will be emitted from diesel-using machines in a substation and vehicles used for maintenance activities.
		PM, Dust and exhaust gas emissions	✓		✓	CS/CLS: Dust and exhaust gas will be generated from construction activities such as site clearing, moving machines, transporting raw materials, etc.
	Water Pollution	Domestic wastewater		✓		OS: wastewater may be generated from the staff housing, toilet, canteen etc.
			✓		✓	CS/CLS: wastewater may be generated from the site cleaning activities, temporary toilets etc.
		Storm Water	✓	✓	✓	CS/CLS/OS: Stormwater runoff may contain muddy water, suspended sediments and erosion from construction activities.
	Solid Waste	Hazardous Solid Waste		✓		OS: If there are replacements of existing old equipment and devices or other items such as transformers, this would generate used oil and grease etc. as industrial solid waste.
			✓		✓	CS/CLS: Hazardous wastes such as used car batteries, broken glass, broken light fixtures, engine oil, etc. may be generated from construction/demolition activities.
		Non-hazardous Solid Waste		✓		OS: Non-hazardous solid wastes such as paper, food waste, plastic bags, drink cans, etc. may be generated.
			✓		✓	CS/CLS: There will be pieces of iron, electric wire, empty packages of material and vegetable debris from site cleaning etc. during construction stage. During the construction stage and closure stage, land excavation and demolition wastes such as debris, concrete, metal, timber, etc. and domestic waste such as garbage will be disposed of.
		Fuel and other hazardous materials	✓	✓	✓	CS/OS/CLS: Handling and storage of fuel and hazardous materials, such as diesel, petrol, thinner, paints, etc. can lead to spillage/leakage and accidents in the case of improper management.
	Soil Contamination	Spillage/ leakage of hazardous materials/waste and fuel		✓		OS: Releases of hazardous materials, wastes, or oil may result from historic or current site activities, including, but not limited to, accidents during their handling and storage, or due to their poor management or disposal.

Category	Assessment Item	Items	Assessment Phase			Sources of the impacts
			CS	OS	CLS	
			✓		✓	CS/CLS: Accidental releases of hazardous materials, wastes, or oil during their handling and storage, or due to their poor management or disposal.
	Noise and Vibrations	Operation of equipment and machinery		✓		OS: Operation of power transformers such as regulating transformers, reactors and emergency generators can generate continuously radiated audible discrete tones.
		Operation of machinery and vehicles	✓		✓	CS/CLS: Operation of machinery and vehicles, generators, demolition activities, and vehicle traffic will create noise and vibrations.
	Ground Subsidence	With-drawing of groundwater/ use of heavy machines				CS/OS/CLS: In substation areas, groundwater will be withdrawn during the construction and operation stages, but not to a great amount. Moreover, heavy machines will not be used for a long time.
	Offensive Odors	Odor emission		✓		OS: Offensive odors may be generated due to the improper management of sewage and domestic waste from staff housing etc.
			✓		✓	CS/CLS: Offensive odors may come from temporary septic tanks, solid waste and food waste from construction workers and so on.
	Sediment	Wastewater discharge				CS/OS/CLS: Wastewater drainage, including heavy metals or high-level organic substances, will not be discharged into water bodies.
Natural Environment	Protected areas	Land acquisition, site cleaning and facilities operation				As the project site is far from protected areas, the impacts on protected areas such as Intagaw reserved forest, Moeyungyi wetland wildlife sanctuary, and Hlawga wildlife park will be negligible.
	Flora and Fauna, Ecosystem		✓	✓	✓	CS/CLS /OS: There are rare or endangered species/ecosystems which are protected in above-mentioned forest and wildlife parks near the project. Vegetation clearing will take place along the side of ROW and access road for maintenance activities.
	Topography and Geography					There will only be vegetation clearing along the ROW and the Project does not require massive boring or excavation. Therefore, no significant impact on topography or geography is anticipated.
	Hydrological conditions					CS/OS/CLS: The proposed Project will not include activities that may cause hydrological conditions changes.
Social Environment	Involuntary Resettlement and Land Acquisition	Land acquisition, site cleaning and operation	✓	✓	✓	CS/CLS /OS: Land acquisition for the project is needed for construction of a new substation and installation of transmission towers and lines. Resettlement Action Plan for the landowners and farmers may be needed.
	Local Economy and Livelihood	Operation		✓		CS, OS & CLS: Due to power sector development, the project may develop the regional economy.
		Construction and Closure	✓		✓	CS/CLS: Local livelihoods will be disrupted temporarily during construction activities. However, due to power sector development and access road to substation and towers for maintenance activities, the project may create many job opportunities and develop local economy.
	Landscape	Operation				OS: Transmission line crosses human settlements, open fields, roads and croplands and there are no important landscapes or views to be considered around the project area.
		Construction and Closure				CLS: There are no important landscapes or views to be considered around the project area.
	Indigenous and Ethnic People	Construction and operation				CS/CLS/OS: No indigenous or minority people are around the Project site.
	Land use and local resources	Construction and operation				CS/CLS/OS: The project will not use local resources and there will be no impacts on land use & local resources.

Category	Assessment Item	Items	Assessment Phase			Sources of the impacts
			CS	OS	CLS	
	Existing Social Infrastructure and Social Services	Construction and closure	✓		✓	CS/CLS: There may be an impact on existing social infrastructure such as schools, hospitals etc., due to construction activities such as excavation for underground cables, and installation of distribution poles and lines.
		Operation				OS: The project has no further impact during operation phase because the transmission line is overhead and underground.
	Social Institutions (social capital & local decision-making institutions)	Construction, and closure	✓		✓	CS/CLS: Since the project is for the long-distance transmission and distribution of electricity, there will be impacts on social institutions such as education community, health community etc., due to traffic congestion during construction activities.
		Operation				There may not be any effect on social institutions, including government institutions, within the region because the electricity is in the national grid.
	Conflict of interests within the region	Construction and operation				CS/CLS/OS: There may not be conflict of interests within the region because the electricity is in the national grid.
	Cultural Heritage	Construction and closure				CS/CLS/OS: The impacts on cultural heritage sites such as Taukkyan war ceremony and Kanbawzathadi palace are negligible as these places are approximately 6 km and 5 km from the project site.
	Gender Discrimination	Appointment in work				CS/CLS/OS: The Project will not have any impact on gender discrimination because the electricity is in the national grid and distributed fairly.
	Children's Right	Appointment in work				CS/CLS/OS: The Project will not create any impact on children's rights and there are no schools in the ROW of transmission line.
	Risks of Infectious Diseases such as AIDS/HIV	Operation				OS: Because there are no large changes in traffic volume from the increasing inflow to the site from different regions, impacts related to infectious diseases are not anticipated.
		Construction and closure	✓		✓	CS/CLS: There may be risks of infectious diseases due to the influx of workers.
	Working conditions (including occupational safety)	Noise exposure, Heat exposure		✓		OS: Substation may generate radiated noise. These emissions can cause interference to television and radio signal reception on properties adjacent to the substation site.
			✓		✓	CS/CLS: Noise and vibrations may be generated from heavy construction machinery & demolition work. Hot working environment can cause heat-related stress in workers.
Other	Accidents	Fire and traffic accidents	✓	✓	✓	CS/CLS/OS: Behavior of workers, storage and use of hazardous materials and production processes, and work nature may cause fire accidents and other accidents such as traffic accidents during the construction, operation, and closure stages.
	Transboundary and global environmental	Climate change and other transboundary pollution				CS/CLS: CO_2 emissions from construction vehicles and transboundary pollution are not significant because the transmission line work is limited, and substations are also of a limited area and use limited amounts of machinery. OS: No activities that will affect global warming and transboundary pollutions are expected.

Note: ✓ symbol means the existence of impact and blank means no/very insignificant impact.
Source: JICA Study Team

(2) Terms of Reference for Investigation of Environmental and Social Impacts

The expected potential adverse impacts are listed below. The impacts of the following items are investigated and assessed, and a management framework, including mitigation measures, management plan, and monitoring plan will be established in the IEE study.

1) Health and Safety
2) Socio-Economic
3) Emergency Response
4) Construction activities (Air, Water, Solid Waste, Noise, and Vibrations)

For the above, a brief description of adverse impacts and the approach for the evaluation are summarized in the following table. The preparation of TOR for the survey on natural and social environments will be examined after the scoping preparation.

Table 4.1-32 Brief Description of Adverse Impacts and Approach for Evaluation

Type	Potential Adverse Impacts and Approach
Pollution Control	This project (new/expanded substation and 230kv/500kV transmission line) itself does not cause serious adverse impacts, and, in particular, there might be no impact during the operation stage. Even at the construction stage, the impact is limited.
Natural Environment	Area for the project development is limited, and it is not a special area (e.g. paddy field and/or areas not currently in use). To err on the side of caution, a Flora and Fauna survey will be conducted as a baseline survey through the IEE study.
Social Environment	There will be no or limited resettlement because transmission line routes can avoid residential areas. The expansion of the existing Hlawga has no social impact. The new substation in east Dagon was originally the planned area for Yangon Amata Smart and Eco City, which will be handed over from YCDC.

Source: JICA Study Team

Table 4.1-33 shows the TOR for the environmental and social considerations survey, including survey/forecast items and survey/forecast methods.

Table 4.1-33 TOR for Environmental and Social Considerations

Category	Assessment Item	Survey/Forecast Items	Survey/Forecast Methods
Pollution	Air Pollution	- PM, dust and exhaust gas generated from the construction or closure (demolition) activities - Exhaust gas will be emitted via the combustion of diesel-using machines/ vehicles used for maintenance activities during operation stage.	- Examine the impact of air pollution during the construction/closure stages by considering the construction/ demolition methods and schedule, the features of project site, and air quality management controls. - Examine the impact of air pollution during the operation stage by considering the substation design & operation manner. - Field Survey for ambient air quality near the Project site
	Water Pollution	- Construction runoff and domestic wastewater generated from the construction or closure (demolition) activities. - Domestic wastewater and surface runoff generated from the operation of proposed project (substation).	- Examine the impact of water pollution during the construction/closure stages by considering the construction/ demolition methods and schedule, the features of project site, and water quality management controls. - Examine the impact of water pollution during the operation stage by considering sewage effluent from the septic tanks of staff housing. - Field Survey for water quality near the Project site
	Solid Waste	- Hazardous waste such as rags contaminated with chemicals, petrol oil, diesel oil, paint, thinner and epoxy for finishing work during construction/closure stages.	- Examine the impact of hazardous and non-hazardous wastes during the construction and closure stages by considering the construction/closure work plan for the proposed project. - Examine the impact of hazardous and non-hazardous wastes during the operation stage by considering the operation work plan for the proposed project.
	Soil Contamination	- Possibility of soil contamination as a result of activities in construction, operation and closure stages.	- Examine the impact of soil contamination during the construction and closure stages by considering the possibility of soil contamination and distribution of contaminated soil as a result of the demolition work in the project area.

Category	Assessment Item	Survey/Forecast Items	Survey/Forecast Methods
			- Examine the impact of soil contamination during the operation stage by considering the possibility of soil contamination due to the discharging of wastewater (domestic), spillage/leakage of oil and fuel from onsite storage.
	Noise and Vibrations	- Noise and vibrations generated from the construction or closing (demolition) activities - Noise and vibrations generated from the operation of substation.	- Examine the impact of noise and vibrations during the construction/closure stages by considering the construction/ demolition activities, noise and vibration level baseline results, compared to the noise and vibration target levels. - Examine the impact of noise and vibrations during the operation stage by considering the noise and vibration level baseline results, compared to the noise and vibration target levels and noise level management controls. - Field Survey for noise and vibration conditions near the Project site
	Offensive Odors	- Offensive odors generated from improper management of sewage (septic tanks) and domestic waste storage from staff housing.	- Examine the impact of offensive odors during the construction, operation, and closure stage by considering the management of sewage (septic tanks) and organic waste storage in the staff housing area and temporary construction camp.
Natural Environment	Protected areas Flora and Fauna, Ecosystem	- The impacts on natural environment such as protected area, flora and fauna, ecosystem, etc., which might occur during the construction and closure phases for the substation and transmission lines. - The impacts on natural environment such as protected areas, flora and fauna, ecosystem, etc., which might occur during the operation phase for the substation and transmission lines.	- Examine the impact on natural environment caused during the construction and closure phases considering the construction/renovation and demolition work plan for the substation and transmission lines. - Implement survey with experts and specific organizations concerning flora and fauna in Myanmar, including ornithologists in Myanmar, to consider the impact on migratory birds and other important species, if any.
Social Environment	Involuntary Resettlement and Land Acquisition	- The impacts on Involuntary Resettlement and Land Acquisition which might occur during the construction and closure phases for the substation and transmission lines. - The impacts on Involuntary Resettlement and Land Acquisition which might occur during the operation phase for the substation and transmission lines.	- Examine the impact on Involuntary Resettlement and Land Acquisition caused during the construction and closure phases considering the construction/renovation and demolition work plan for the substation and transmission lines. - Examine the impact on Involuntary Resettlement and Land Acquisition caused during the operation phase considering the operation work plan for the substation and transmission lines.
	Local Economy and Livelihood	- The impacts on local economy and livelihoods which might occur during the construction and closure phases for the substation and transmission lines. - The impacts on local economy and livelihoods which might occur during the operation phase for the substation and transmission lines.	- Examine the impact on the local economy and livelihoods caused during the construction and closure phases considering the construction/renovation and demolition work plan for the substation and transmission lines. - Examine the impact on the local economy and livelihoods caused during the operation phase considering the operation work plan for the substation and transmission lines.
	Existing Social Infrastructure and Social Services	- The impacts on existing social infrastructure and social services which might occur during the construction and closure phase for the substation and transmission lines. - The impacts on existing social infrastructure and social services which might occur during the	- Examine the impact on existing social infrastructure and social services caused during the construction and closure phases considering the construction/renovation and demolition work plan for the substation and transmission lines. - Examine the impact on existing social infrastructure and social services caused during the operation phase considering the operation work plan for the substation and transmission lines.

Category	Assessment Item	Survey/Forecast Items	Survey/Forecast Methods
		operation phase for the substation and transmission lines.	
	Social Institutions (social capital & local decision-making institutions)	- The impacts on social institutions which might occur during the construction and closure phase for the substation and transmission lines. - The impacts on social institutions which might occur during the operation phase for the substation and transmission lines.	- Examine the impact on social institutions caused during the construction and closure phases considering the construction/renovation and demolition work plan for the substation and transmission lines. - Examine the impact on social institutions caused during the operation phase considering the operation work plan for the substation and transmission lines.
	Risks of Infectious Diseases such as AIDS/HIV	- The risks of infectious diseases such as AIDS/HIV, including community health and safety, which might occur during the construction and closure stages for the substation and transmission lines.	- Examine the risks to community health and safety, including infectious diseases such as AIDS/HIV, caused during the construction and closure stages by considering the construction and closure work plans for the substation and transmission lines.
	Working conditions (including occupational safety)	- The impacts on working conditions (including occupational safety) which might occur during the operation stage for the substation and transmission lines. - The impacts on working conditions (including occupational safety) which might occur during the construction and closure stages for the substation and transmission lines.	- Examine the impact on the working conditions (including occupational safety) caused during the operation stage by considering the operation work plan for the substation and transmission lines. - Examine the impact on the working conditions (including occupational safety) caused during the construction and closure stages by considering the construction and closure work plans for the substation and transmission lines.
Other	Accidents	- Accidents due to construction, operations and demolition work may increase the vulnerability of the project site to fire hazards and traffic accidents.	- Examine risk of potential fire accidents and other accidents during operation stage by considering the operation work plan for the proposed project. - Examine risk of potential fire accidents and other accidents during construction and closure stages by considering the construction and closure work plans for the proposed project.

Source: JICA Study Team

4.1.6. Results of the Survey on Environmental and Social Impact and Environmental and Social Impact Evaluation

(1) Results of the Survey on Environmental and Social Impact

The survey on environmental and social consideration and impact assessment were conducted based on the scoping results. A summary of the results of the survey is shown in Table 4.1-34. Details are described in the attached IEE report (draft).

Table 4.1-34 Results of the Survey on Environmental and Social Impact

Assessment Item	Results of Survey
Pollution	
Air Pollution	【Construction and Closure Stages】 The principal source of potential air quality impacts during the construction and closing stages will be dust, based on a consideration of general construction activities at the Project site, including Workshop, Foundations, Mechanical work, and Electrical work. Firstly, it will be generated from site preparation for both substation and transmission lines. Activities like site cleaning and levelling during site preparation could generate dust and particulate matter (PM10). Moreover, dust could also be generated from the transportation of construction material, movement of vehicles and machinery, and excavation activities during the construction of tower foundations and underground transmission

Assessment Item	Results of Survey
	lines. Exhaust gases (SO_2, NO_2, etc.) could also be emitted from the construction vehicles, machinery and generators used at the construction site. It is not expected that significant impact will occur for local residents or that emissions will not exceed regulatory permissible ground-level concentrations as the residential areas are far from the construction site, except for the underground transmission line construction area. Air pollution at the closing stage is the same as during construction, but the demolition activities could generate more dust than construction activities. 【Operation Stage】 The main source of air pollution will be limited to normal emissions from vehicular movement during the operation stage. As the substation and transmission areas are far from the residential area, it is not expected that impact will occur on local residents. There is no use of materials or facilities which emit exhaust gas from transmission lines and substation.
Water Pollution	【Construction and Closure Stages】 Potential sources of water quality impact associated with the proposed construction activities at the works areas of the Project have been identified and include: - Construction site runoff and drainage - General construction activities - Sewage effluent produced by on-site workforce, including a temporary camp for construction workers. During site clearance, runoff and drainage from the works area would be the main sources of potential water quality impact. Site runoff and drainage may contain increased loads of suspended solids and contaminants. Potential sources of pollution from site drainage include runoff and erosion from exposed soil surfaces, earth working areas and stockpiles; release of grouting and cement materials with rain wash; wash water from dust suppression sprays; and fuel and lubricants from the maintenance of construction vehicles and mechanical equipment. On-site construction activities may cause water pollution from "Uncontrolled discharge of debris and rubbish such as packaging, construction materials and refuse etc." and "Spillages of liquid stored on-site, such as oil, diesel and solvents etc." Also, domestic sewage would be generated from the workforce, including a temporary camp for construction workers. Temporary toilets will be provided for the site workers. The Contractor will have the responsibility of ensuring that temporary toilets are used and properly maintained, and that contractor is employed to collect and dispose of the waste off-site at approved locations. 【Operation Stage】 Activities related to water pollution are not anticipated with regard to the transmission line. Domestic wastewater could be generated from the staff housing area of the substation during the operation stage, but the volume will not differ from the toilets, kitchen/canteen of a normal house/dormitory. The proper design of drainage system, as per other areas, is included in the substation area.
Solid Waste	【Construction and Closure Stages】 Both hazardous and general solid waste can be generated from construction and demolition activities. Some examples of the activities which will generate hazardous waste are, i) cement storage bags and other packets from materials used during construction, ii) containers for oil and grease or other chemicals used in excavation, repair and maintenance and transportation activities. Solid waste of domestic nature would also be generated in the temporary worker camps at the construction site, but it is not likely to be significant in volume. Construction debris and waste generated during the construction phase would also include general waste scrap iron, steel, wooden frames, piping, and other solid waste. A proper waste management system, including segregation, recycling, etc., should be provided to reduce amounts as per the rules in each area. Solid waste will be received by the Township development committee. Solid waste, and both general and hazardous waste will be received by the Township development committee. 【Operation Stage】 The Project will utilize relevant electric equipment during Operation Stage. Improper storage and handling of waste may pose risks to the quality of air, water and soil, as well as the health of workers. Hazardous waste such as used coolant oil, oil-contaminated metal scraps, rags and soil, and expired stand-by batteries could be generated when there are replacement, maintenance or rehabilitation activities for existing equipment and devices, such as transformers. Also, non-hazardous solid waste such as paper, food waste, plastic bags, drink cans, etc. could be generated from staff housing areas within the substation. Solid waste will be received by the Township development committee. Solid waste, and both general and hazardous waste will be received by the Township development committee. Especially in the new substation area, the Hlegu Township Development Committee will manage the solid waste, and one of their dumping sites is Kyun Kone Gwae in Let Pan Village Tract, which is beside Sar Ta Lin Village Tracts, the new substation site.
Soil Contamination	【Construction and Closure Stages】 Oil leaks from machines, equipment and vehicles may lead to soil contamination. Oil spillages may arise from transferring oil to machines, equipment or vehicles or from equipment, machinery and vehicle maintenance work. Nevertheless, the potential to cause soil contamination will be minimal.

Assessment Item	Results of Survey
	The excavation activities for the construction of tower foundations and underground transmission lines are not anticipated to significantly impact the soil and geology of the project site, other than disturbances to soil which could subsequently result in erosion and soil contamination due to oil leaks from excavation and construction equipment. The construction work includes removal of topsoil and digging, and the presence of machinery and workers at the site will have a minor negative impact on soil quality. The identified impacts are, i) Mechanical impact on soil during excavation, ii) Soil pollution due to spilling or discharge of oil and oil derivatives, motor oil, and similar waste originating from machinery and vehicles on-site, iii) Soil pollution due to uncontrolled deposition of solid waste (spoil material) on the land. The impacts likely to occur in the construction activities include excavation work and the usage of various types of machinery but the significance of impact will be moderate since it involves a limited area and soil depth. 【Operation Stage】 Soil contamination in and around the Project area may occur due to the direct discharging of wastewater (domestic) into water bodies, spillage/leakage of oil and fuel from on-site storage, and on-site temporary storage of solid waste (hazardous and non-hazardous). PCBs usually reach the environment as a result of transformer oil leakage caused by transformer failures, poor handling of damaged electrical equipment, spilling during oil changes and improper waste disposal. Oil pits are also used to collect oil leakage from the transformer. They are located below the transformers. Each power transformer or device that individually contains more than 1,000 kg of oil must have an oil collecting pit for quick oil removal or collection. Transformer oils are found to contain some metals such as copper, iron, lead, aluminum, silver, tin and zinc. It is assumed that transformer oil contains the metals because of their presence in the materials of the transformer components. On the other hand, this can be appropriately managed as per other existing substations.
Noise and Vibration	【Construction and Closure Stages】 The major sources of noise and vibration will be construction equipment and vehicle movement. Construction equipment can be generally grouped into three (3) main categories – Heavy Equipment, Stationary Equipment and Impact Equipment. The impact is expected to be significant but short term, experienced only in cases where mechanized equipment is used. Moreover, direct impacts on residents will be rare as the construction site is far enough from the residential areas (about 100 m or more). However, care should be taken regarding noise and vibration impacts during the underground transmission line construction work as it will be conducted within the residential area. 【Operation Stage】 The noise generation during the operational phase can be from two sources, as below. - Noise from the operation of transformers will be in the form of buzzing and humming, which will be felt only up to 15 to 50 m from the substation area. - Noise from overhead transmission lines will be from the corona phenomenon, which is the ionization of the air around the conductors and heard as a cracking or hissing noise, particularly during rain or fog. Noise pollution especially occurs from transformer magnetostriction, which can emit a continuous 120 hertz hum with harmonics when connected to 60 Hz circuits. The fundamental frequency is the "hum" which annoys people primarily because of its continuous nature. Magnetostriction occurs when a strip of iron which is located in the transformer core system is magnetized to change iron's physical dimensions. Transformer cores are constructed by stacking layers of thin iron laminations, separated from their neighbors by a thin non-conducting layer of insulation. When the core becomes magnetized, the magnetic field acts between the adjacent plates, stretching and squeezing the adhesive and insulation between them. The vibration of these layers can produce the humming noise. Moreover, the load noise in a transformer is produced by the axial and radial vibration of the windings. It can also be caused by vibrations in the transformer tank walls and magnetic shields due to the electromagnetic forces produced by the load currents. Corona noise, which is the most common noise associated with transmission lines and heard as a crackling or hissing sound, can be generated only in 350 - 500 kV and above high voltage. This phenomenon is an electrical discharge brought on by the ionization of a fluid such as air surrounding a conductor that is electrically discharged. During relatively dry conditions, corona noise typically results in continuous noise levels of 40 to 50 dBA in close proximity to the transmission line, such as at the edge of the ROW. Moreover, corona noise levels typically increase during wet or high humidity conditions. Depending on conditions, wet weather corona noise levels could increase to 50 to 60 dBA and could increase to over 60 dBA under some conditions, but the area is limited. The impact will occur during the whole operation, but its magnitude will be low as it will be controlled within the substation area or ROW of transmission lines.
Offensive Odor	【Construction and Closure Stages】 Offensive odors may come from temporary septic tanks, solid waste and food waste from construction workers, but the magnitude will be limited because there is no significant construction work. 【Operation Stage】 Offensive odors can be generated from sanitary areas (e.g. toilets, showers, basins, etc.) and domestic wastewater (from showers, basins, etc.), discharge ponds and septic tanks. Sludge from septic tanks

<table>
<tr><th>Assessment Item</th><th>Results of Survey</th></tr>
<tr><td></td><td>can generate unpleasant odors due to leakage, overfill or mishandling procedures while transferring to third parties for disposal. The impact will be mostly temporary.</td></tr>
<tr><td colspan="2">Natural Environment</td></tr>
<tr><td>Protected area
Flora and Fauna,
Ecosystem</td><td>【Construction and Closure Stages】
Protected areas such as Intagaw reserved forest (16 km from TL), Moeyungyi wetland wildlife sanctuary (5.5 km from TL), and Hlawga wildlife park (7 km from TL) exist in this region. However, the nearest distance between these areas and the transmission line route is about 5.5 km and there are roads and villages between the project site and such areas. There will be some impacts on flora and fauna on the transmission line route. Some of the trees along the transmission line route will have to be cut down for construction of tower foundations and access road. The contractor should identify and prepare a list of the trees, including their specifications, location and ownership. The ownership of the trees should be identified with the help of the Township development committee and Forest Department (FD) under MONREC. If the trees are owned by FD, the compensation and the cost for cutting trees should be paid by the Contractor. The chopped stems shall be transferred to FD. If the trees are owned by TDC, the Contractor shall follow the rules and regulations of TDC for cutting down those trees. The team communicated with Flora and Fauna experts in Myanmar (the following 2 organizations) on the planned transmission line route, including ROW.
1) Friends of Wildlife Myanmar (FOW): FOW has experience implementing conservation projects across Myanmar since 2007 and has contributed to the protection of many globally threatened and endangered species, such as Asian elephant, gaur, star tortoise, and Eld's deer.
2) Biodiversity And Nature Conservation Association (BANCA) BirdLife Myanmar: BANCA BirdLife Myanmar is a non-profit, non-political, nonreligious and an environmental NGO in Myanmar. Although BANCA was officially recognized by the Ministry of Home Affairs, Union of Myanmar on 18 June 2004, BANCA has been active since 2002. The backbone of BANCA is its competent ornithologists, along with botanists, foresters, zoologists, social scientists, mammologists, geologists, environmental scientists, marine biologists and herpetologists among others.
It is expected that no significant irreversible changes in local biodiversity will occur as a result of the project. No specific unique wildlife habitats will be affected by the project, as the transmission line will not create any large barriers to wildlife or bird movements. The transmission line alignment does not pass through any significant wildlife habitat and it is not expected to cause any net loss of species. Any disruption of wildlife behavior will be temporary during construction, and animals, including birds, will be able to move around or over construction sites. Still, there is always the risk that avifauna vulnerable or endangered species may be affected due to a reduction in habitat size, or disturbance in their daily movements, and will be at risk from poaching (construction workers). The appropriate mitigation measures can minimize project impacts on rare, endangered or threatened species (if any) and for overall habitat management. With regard to the species related to CR (critically endangered) and EN (endangered), the Study Team contacted flora and fauna experts and the Forestry Department under MONREC, but there were no records at the project site except for *Cuon alpinus*, which was found in North Zamayi Wildlife Sanctuary, about 100km from the project site. It was also confirmed the project site does not belong to the Critical Habitat Definition (five definitions) of IFC Guidance Note 6, Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Table Comparison with "Critical Habitats" as defined by the World Bank ESS6
<table>
<tr><th>ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
"Critical Habitats" is defined as areas with high biodiversity importance or value, including:</th><th>Status of Project area</th></tr>
<tr><td>a) habitat of significance importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches</td><td>Secondary data on project townships environment was collected from the Government Administration Department (GAD) Data (2019) and Forest Department/MONREC. There were 2 species classified as CR, and several species classified as EN, or VU by the IUCN Status. Among these species, most are confirmed only in protected areas and the project does not touch any protected areas. Interviews with flora/fauna experts and government officers confirmed there are no records of finding such species around the transmission line route. Therefore, the Project site is not considered a critical habitat for threatened species.</td></tr>
<tr><td>b) habitat of significant importance to endemic or restricted-range species</td><td>According to the secondary data information and expert interview results, the project area is not considered a critical habitat for an endemic species or for a species whose distribution is limited.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Assessment Item</th><th colspan="2">Results of Survey</th></tr>
<tr><td></td><td colspan="2">
<table>
<tr><td>c) habitat supporting globally or nationally significant concentrations of migratory or congregatory species</td><td>Per a suggestion by an expert from the Biodiversity and Nature Conservation Association (BANCA), the transmission line has been routed across human settlements, open fields, roads and croplands. This took it about 7-8 km away from Moeyungyi Wetland wildlife Sanctuary, which is an internationally important wetland area. Therefore, the study team confirmed that there are no migratory or congregatory species or exosystems that would support such species in the project area.</td></tr>
<tr><td>d) highly threatened or unique ecosystems</td><td>Per the results for secondary data information and expert interviews, it was confirmed that there are no highly threatened or unique ecosystems in the project area. So, no specific unique wildlife habitats will be affected by the project, as the transmission line will not pass through such areas.</td></tr>
<tr><td>e) ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).</td><td>The project area is not considered an area with the functions or characteristics detailed in (e). See above for details.</td></tr>
</table>
Source: JICA Study Team

【Operation Stage】
As described above, there is no protected area on the project site, both the transmission line and substation. Also, roads and villages between the project site and such areas are existing.
According to FOW, there is only one moving route of a herd of wild elephants (about 3~4 individuals) in Hlegu township. These elephants mostly occurred near the Nga-moe-yeik reservoir which is located more than 30 km far from the closest Project site (Transmission line route). Additionally, there are Yangon-Mandalay Expressway and many local roads, rivers including Bago river, and several villages between the Project site and Nga-moe-yeik reservoir. Also, the study team confirmed with Head Office of Myanmar Timber Enterprise, which are operating Winkabaw Elephant Camp and re-confirmed about the same information.
There are nine global-scale flyways that migratory birds take around the world, and Myanmar has two of them. They are the Central Asian Flyway, and the East Asian Australasian Flyway. According to BANCA's review, the transmission line has been across the human settlement, open field, roads and croplands. It took about 7-8 km away from Moeyungyi Wetland wildlife Sanctuary. Moeyungyi is International important wetlands, the first Ramsar site in Myanmar as well as IBA (Important Bird and Biodiversity Area) and KBA (Key Biodiversity Area). It is one of the East Asian Australasian Flyway Site (EAAF119). If it does not pass through Moeyungyi Inn, the impact on migratory birds due to bird crush will be anticipated since there might be the detailed flyway for wintering birds that live there around the project site. As results of hearing of BANCA and literature survey, there is no information on the detailed flyway, so its route has not been confirmed. However, according to BANCA, the impact is limited because the Moeyungyi Wetland wildlife Sanctuary is 7-8km away from the project site, and there are structures in human settlement around the project site, thus birds are unlikely to fly at the height of the transmission line. Based on this consideration, BANCA also confirmed that mitigation measure such as increasing the visibility of transmission lines using markers and/or bird diverters if any impacts are identified through monitoring during operation is appropriate</td></tr>
<tr><td colspan="3">Social Environment</td></tr>
<tr><td>Involuntary Resettlement and Land Acquisition</td><td colspan="2">【Construction/Closure Stages, and Operation Stage】
During the feasibility study, an Abbreviated Resettlement Action Plan (ARAP) was prepared. The preliminary survey data for land acquisition, project affected persons (PAPs) and households (PAHs) and proposed compensation plan are addressed in that report. At the Detailed Design Stage, an additional socio-economic survey will be conducted to collect detailed information on PAPs and PAHs, and the ARAP report will be updated using these data.
Approximately 25~32 ha (about 80 acres) of permanent land, in which most of the land area is agricultural land, has to be acquired for construction of the substation. Therefore, there will be a permanent loss of land and income in those areas. The acquired land will be purchased directly from the landowner with the unit price set by the Government for paddy fields under the supervision of the Yangon Regional Government (YRG). A small number of houses is found within the land area, but those households will be avoided by the substation area so no resettlement will be necessary for the project. Therefore, there will be socio-economic impacts such as loss of income due to the construction of the substation, but this will be mitigated by purchasing the land with the proper amount of compensation.
Also, the total area of the tower base along the transmission line has to be acquired for installation of transmission lines. The majority of the total area will mainly occupy a plantation area and agricultural land. As most of the crop plantation can be resumed after the construction, there will not be any loss</td></tr>
</table>

Assessment Item	Results of Survey
	of permanent land or income due to the construction of transmission lines. The impact will only be temporary during the construction stage.
Local Economy and Livelihood	【Construction and Closure Stages】 During the construction phase, some business such as plantations, cultivation, etc. will be temporarily disrupted by construction activities for towers and transmission lines. An Abbreviated Resettlement Action Plan (ARAP) was prepared, which considered loss of income sources in the entitlement matrix. The Project will also temporarily increase sales at some local shops and vendors due to the increased demand for construction workers. The substation is located in Sar Ta Lin Village in Hlegu Township. The main sources of livelihood in Hlegu townships are odd jobs, livestock and agriculture. According to the statistical data of Hlegu Township, most of the people earn their livelihoods in Odd Jobs (32.31%) and Livestock (31.09%). A lot of job opportunities will be created as most of the general construction labor workforce will be derived from the local population from nearby Sar Ta Lin Village and surrounding villages for the construction of the new substation. During the closure phase, the work will be almost the same as the construction phase so the impacts will also be the same. Positive impacts will likely to occur in both stages, and will help to improve the livelihoods of local people by creating job opportunities. At the same time, land acquisition will have a negative impact on the livelihoods of the Project Affected People. 【Operation Stage】 Yangon City is a strategic economic location which can be recognized as the commercial capital of Myanmar. Nevertheless, with major plans for the future, Myanmar's energy demands are expected to grow concurrently with its development. The city used 1,548MW in 2018, which is expected to increase based on growth rates, historical data and new projects. The Project will implement the development of 500kV backbone system to solve the problem of an insufficient power supply network system in Yangon City. Therefore, it will help in regional infrastructure and economic development in Yangon City. As the substation compound is mostly agricultural land, it may create alternative livelihoods for laborers and landowners of affected agricultural land.
Existing social infrastructure and services	【Construction and Closure Stages】 For local people living in and around the Project area, the accessibility of social infrastructure is expected to change more or less because of the construction work. During the construction phase, an access road will be constructed for construction vehicle transportation and heavy machinery as necessary. It has also been confirmed based on the existing regional information that social infrastructure such as schools and hospitals is located in the populated area around the Project site. Therefore, traffic congestion might occur near the access road due to the temporary increase in construction vehicles. More traffic congestion is expected for the underground transmission line construction rather than overhead transmission line construction, as the transmission line will be constructed within the ROW of a narrow street in a residential area. The transmission line alignment will also pass through a railway, but the construction activities will not disrupt the operation of the railway system so the impact will be negligible. Moreover, the majority of the transmission line route is across plantations and agricultural land so no significant impact on public spaces is expected.
Social Institutions	【Construction and Closure Stages】 Due to the traffic congestion impact on social infrastructure and services, the community near the Project area will be affected. On the other hand, positive impact is expected on political institutions such as the Government. The Project will achieve power sector development in important commercial areas such as Yangon City.
Risks of Infectious Diseases such as AIDS/HIV	【Construction and Closure Stages】 There is a possibility of air pollutant emissions, including dust due to the operation of construction machines and vehicles, as well as construction work, which might cause some adverse effects on respiratory organs. Impacts on public health and communities, the dusty conditions of the construction site, exhaust gases from the machinery & vehicles, the discharge of site-generated wastewater, the generation of construction waste, demolition debris, domestic waste, hazardous waste, and the noise generated by construction machinery may affect the surrounding community. These impacts shall be managed by the construction contractor through the provision of safety education and training for workers based on the OHS training stipulated in international guidelines such as EHS Guidelines by IFC. Also, no large-scale construction/demolition work is planned. The spread of infectious diseases is estimated to some extent due to an influx of contract workers from outside of the community.
Working conditions (including occupational safety)	【Construction and Closure Stages】 The possibility of accidents and incidents is expected more or less during the implementation of the Project's construction (construction of site structures and facilities) and closing stages (demolition of the facilities). In order to prevent accidents and incidents, working conditions during the construction and closing stages shall be managed by the Contractor based on OHS training stipulated in international guidelines such as EHS Guidelines by the IFC. There are also national laws and regulations related to the working environment, such as the Occupational Health and Safety Law (2019) etc. It is evaluated that the impact will only be short term, with low intensity. However, the

Assessment Item	Results of Survey
	Contractor shall prepare and implement an appropriate HSE plan under the respective impact assessment to avoid potentially severe impacts on occupational health and safety. 【Operation Stage】 Workplace injuries are common on the job, and the majority of such random events can happen to anyone and at any time. Not only is it the employer's responsibility to ensure a safe work environment, but each employee also has a responsibility to themselves to exercise caution when on the job. Engineers, electricians and overhead line workers are most exposed to electrical hazards. Electric utility workers typically have a higher exposure than the general public due to working in proximity to electric power lines, such as through electrical installation and repairs, testing of fixtures and equipment and inspection and maintenance activities. The project proponent has great experience in avoiding such negative situations at other project sites. Unforeseen accidents such as road and traffic accidents, emergencies such as fires, explosions, heavy rain and flooding, earthquakes with loss of human life and damage to structures and facilities could have a high impact on the safety and health of the employees.
Other	
Accidents	【Construction and Closure Stages】 Although the construction and closure work for the proposed project will contain large-scale work using firearms and explosives, the risk of fire accidents could be considered low. However, risks are inevitable because some activities taken by the workers, such as smoking and cooking, could lead to fire accidents in the proposed project. Traffic accidents might also happen due to an increased number of vehicles related to the construction work. To eliminate the risks of fire accidents and traffic accidents, the behavior of the workers shall be managed by the construction contractor through the provision of safety education and training for workers based on the OHS training stipulated in international guidelines such as the EHS Guidelines by IFC. 【Operation Stage】 At the operation stage, there will be a risk of potential fire accidents from the substation and transmission lines. At the substation, transformer explosions and fires can result from a breakdown of insulation due to over-current, over-voltage or short circuit. Degradation of insulation, like the decay of transformer oil due to moisture or ageing or decomposition, is another cause of fire in substations. Once the insulation drops below a threshold value an electric arc is generated. The temperature of the oil increases and oil decomposes, leading to the generation of ignitable gases and pressurization of the oil tank, which may lead to transformer explosions. The most common causes of fire in transmission lines are weather-related events such as thunderstorms and strong winds etc. that cause damage to lines and equipment attached to them. Once the equipment is damaged or downed, wires may make contact with trees and other combustible materials resulting in sparks, smoke and fires. In other cases, animal or human contact, equipment failures and conductor slaps can also create fire hazards in transmission lines.

Source: JICA survey team

(2) Results of Environmental and Social Impact Assessment

The environmental and social impact assessment was conducted by examining the available data, interviewing stakeholders and carrying out field surveys. According to the results of the IEE, the project area is not included in an environmentally priority area as it does not exist in the conservation areas designated by the Myanmar Government. The area has been in common use, with paddy fields, commercial plantations, secondary forests, scrub land and human habitation areas. To err on the side of caution, a Flora and Fauna secondary baseline data collection was conducted through the IEE study. The individual results and evaluation methods are described in the draft IEE report. Consequently, it was concluded that the project (new/expanded substation and 230kV/500kV transmission line) would not cause serious adverse impacts during the operation stage and the majority of negative impacts are temporary and site-specific due to construction activities during the construction phase, and the expected impacts could be avoided or minimized by implementing mitigation measures.

A summary of anticipated potential adverse impacts and proposed mitigation measures is tabulated in Table 4.1-35.

Table 4.1-35 Summary of Impact Assessment

Category	Assessment Item	Items	Evaluation			Sources of the Impacts and reason for the Evaluation
			CS	OS	CLS	
Pollution	Air Pollution	Exhaust gas emissions		D		OS: There is no use of materials or facilities which emit exhaust gases from transmission lines or substation. Therefore, the significance of impact can be assessed as negligible.
		PM, Dust and exhaust gas emissions	B-		B-	CS/CLS: The principal source of potential air pollutants will be dust from construction/demolition work. Exhaust gases (SO_2, NO_2 & PM_{10}) will be emitted from the construction vehicles, generators and machinery but the construction work is not large. Therefore, the significance of impact can be assessed as moderate.
	Water Pollution	Domestic wastewater & storm water		B-		OS: Wastewater may be generated from the staff housing, toilets, canteen etc. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: Wastewater may be generated from the site cleaning activities, temporary toilets at construction sites, etc. Stormwater runoff passing through the construction sites may contain muddy water, construction materials, etc. Therefore, the significance of impact can be assessed as moderate.
	Solid Waste	Managements of waste disposal		B-		OS: Used coolant oil, oil-contaminated metal scraps, rags and soil, and expired stand-by batteries would be generated from the maintenance and replacement of transformers. Non-hazardous solid waste such as paper, food waste, etc. may be generated from staff housing. Solid waste will be received by the Township development committee. Especially in the new substation area, Hlegu Township Development Committee will manage the solid waste and the dumping site is Kyun Kone Gwae in Let Pan Village Tract, which is beside Sar Ta Lin Village Tracts, the new substation site. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: Low amounts of hazardous waste (such as used car batteries, broken glass, engine oil, etc.) and non-hazardous waste (such as debris, concrete, paper, food waste, etc. and electric wires, empty packages of material, etc.) would be generated from construction and construction camps/demolition activities. Solid waste will be received by the Township development committee and will be managed appropriately at their responsibility. Therefore, the significance of impact can be assessed as moderate.
	Soil Contamination	Spillage/leakage of hazardous materials/waste and fuel		B-		OS: Soil contamination in and around the Project area may occur due to the direct discharging of wastewater (domestic) onto the soil, and spillage/leakage of oil and fuel from on-site storage. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: Oil spillage may arise from transferring oil to machines, equipment or vehicles or from equipment, machinery and vehicles during maintenance work. Therefore, the significance of impact can be assessed as moderate.
	Noise and Vibrations	Noise level		B-		OS: Noise from the operation of transformers will be in the form of buzzing and humming, which will be felt only up to 15 to 50 m from the substation area. Noise from overhead transmission lines will be from the corona phenomenon or hissing noises near ROW only. Therefore, the significance of impact can be assessed as moderate.
		Noise and Vibration level	B-		B-	CS/CLS: The major sources of noise and vibration will be construction equipment and vehicle movement, but this will be short term only. Moreover, the construction site is far enough from the residential areas (about 100 m or more)

Category	Assessment Item	Items	Evaluation			Sources of the Impacts and reason for the Evaluation
			CS	OS	CLS	
						to reduce the noise and vibrations. Therefore, the significance of impact can be assessed as moderate.
	Ground Subsidence	Withdrawal of groundwater/ use of heavy machines	D	D	D	CS/OS/CLS: In the substation area, no great amounts of groundwater will be withdrawn during the construction and operation stages. Moreover, heavy machines will not be used for long time. Therefore, the significance of impact can be assessed as negligible.
	Offensive Odors	Odor emission		B-		OS: Offensive odors may be generated in small amounts from the sanitary areas of staff housing (e.g. toilets, showers, etc.) and septic tanks. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: Small volumes of offensive odors may come from temporary septic tanks, solid waste and food waste from construction workers, but the amount will be limited because there is no large construction work. Therefore, the significance of impact can be assessed as moderate.
	Sediment	Wastewater discharge	D	D	D	CS/OS/CLS: Wastewater drainage including heavy metals or high-level organic substances will not be discharged into the water body. Therefore, the significance of impact can be assessed as negligible.
Natural Environment	Protected areas Flora and Fauna, Ecosystem	Site cleaning and other construction activities	B-	B-	B-	CS/CLS /OS: The transmission line will not pass through any wildlife park. There were no records at the project site according to the results of interviews with flora and fauna experts. It was also confirmed that the project site does not belong to the Critical Habitat Definition of IFC Guidance Note 6, Biodiversity Conservation and Sustainable Management of Living Natural Resources. As for wild elephants, according to the natural environmental experts in Myanmar, there are the Yangon Mandalay expressway and Bago River and others between the place in which wild elephants were observed and the project site. According to BANCA, the impact on migratory bird due to bird crush is anticipated but limited since the Moeyungyi Wetland wildlife is 7-8km away from the project site, and there are structures in human settlement around the transmission line, so the birds is unlikely to fly at the height of the transmission line. However, mitigation measure such as increasing the visibility of transmission lines using markers and/or bird diverters if any impacts are identified through monitoring during operation.is necessary since the detailed flyway has not been confirmed. Any disruption of wildlife behavior will be temporary during construction, and animals, including birds, will be able to move around or over construction sites. Still, there is always the risk that avifauna vulnerable or endangered species may be affected due to a reduction in habitat size, or disturbances in their daily movements, and will be at risk from poaching (by construction workers). Therefore, the significance of impact can be assessed as moderate, but it is necessary to consider having mitigation measures for birds.
	Hydrological conditions		D	D	D	CS/OS/CLS: The proposed Project will not include activities that may cause hydrological conditions changes. Therefore, the significance of impact can be assessed as negligible.
Social Environment	Involuntary Resettlement and Land Acquisition	Land acquisition and resettlement	B-	B-	B-	CS/OS/CLS: Permanent land of approximately 32.37 ha (80 acres) has to be acquired for construction of the substation. The total area of tower bases along the transmission line has to be acquired for installation of transmission lines to follow the appropriate rules. Therefore, the significance of impact can be assessed as moderate.
		Local Economy		A+		OS: The Project will implement the development of a 500kV backbone system to solve the issue of an insufficient

Category	Assessment Item	Items	Evaluation			Sources of the Impacts and reason for the Evaluation
			CS	OS	CLS	
	Local Economy and Livelihood					power supply network system in Yangon City. It will help in regional infrastructure and economic development in Yangon City. Therefore, the significance of impact can be assessed as major.
			B-		B-	CS/CLS: The Project will temporarily disrupt sales at local shops and vendors, etc. during the construction of towers for transmission lines. The construction period will be limited and can be reduced to minimize the disturbance on the local economy. Therefore, the significance of impact can be assessed as moderate.
		Livelihood		B-		OS: Changes in livelihoods will occur for the PAPs whose lands are permanently acquired. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: During the construction phase, job opportunities will be created as most of the general construction labor work force will derived from the local people. At the same time, land acquisition will have a negative impact on the livelihoods of the Project Affected People. Therefore, the significance of impact can be assessed as moderate.
	Existing social infrastructure and services	Accessibility		D		OS: No further impact is expected during the operation phase because the transmission line is overhead and underground. Therefore, the significance of impact can be assessed as negligible.
			B-		B-	CS/CLS: The project will not relocate houses based on the current plan. Accessibility of social infrastructure/services will be affected due to the increase of construction vehicles. Therefore, the significance of impact can be assessed as moderate.
	Social Institutions	Traffic congestion		D		OS: There will be no further impact on social institutions, including government institutions within the region, because the electricity will be in the national grid. Therefore, the significance of impact can be assessed as negligible.
			B-		B-	CS/CLS: Due to the traffic congestion impact on social infrastructure and services, the community near the Project area will be affected. Therefore, the significance of impact can be assessed as moderate.
	Landscape and Greening	Effects on landscape and greening	D	D	D	CS/CLS/OS: The transmission line will mostly cross agricultural land and rural roads in rural areas, and go along roads in urban areas. Therefore, the significance of impact can be assessed as negligible.
	Indigenous and Ethnic People	Effects on indigenous and ethnic people	D	D	D	CS/CLS/OS: No indigenous or minority people are around the Project site. Therefore, the significance of impact can be assessed as negligible.
	Land use and local resources	Effects on land use and local resources	D	D	D	CS/CLS /OS: The project will not use local resources and there will not be any impacts on land use or local resources. Therefore, the significance of impact can be assessed as negligible.
	Conflict of interests within the region	Causes of conflict of interests	D	D	D	CS/CLS /OS: There may not be conflicts of interests within the region because the electricity will be in the national grid. Therefore, the significance of impact can be assessed as negligible.
	Cultural Heritage	Effects on cultural heritage	D	D	D	CS/CLS/OS: The impacts on cultural heritage sites such as the Taukkyan war ceremony and Kanbawzathadi palace are negligible, as these places are approximately 6km and 5km from the Project site. Therefore, the significance of impact can be assessed as negligible.
	Gender Discrimination	Effects on gender	D	D	D	CS/CLS/OS: The Project will not create any impacts concerning gender discrimination because the electricity will be in the national grid and distributed fairly. Therefore, the significance of impact can be assessed as negligible.
	Children's Right	Effects on children's right	D	D	D	CS/CLS/OS: The Project will not create any impacts concerning children's rights and there are no schools in the

Category	Assessment Item	Items	Evaluation			Sources of the Impacts and reason for the Evaluation
			CS	OS	CLS	
						ROW for the transmission line. Therefore, the significance of impact can be assessed as negligible.
	Risks of Infectious Diseases such as AIDS/HIV	Operation		D		OS: Because there will be no large changes in traffic volume due to the increased inflow to the site from different regions, impacts concerning infectious diseases are not anticipated. Therefore, the significance of impact can be assessed as negligible.
		Construction and closure	B-		B-	CS/CLS: No large-scale construction/demolition work is planned. The spread of infectious diseases is estimated to some extent due to the influx of contract workers from outside of the community. Therefore, the significance of impact can be assessed as moderate.
	Working conditions (including occupational safety)	Noise exposure, Heat exposure		B-		OS: Engineers, electricians and overhead line workers may be exposed to electrical hazards. The project proponent has great experience in avoiding such negative situations at other project sites. Therefore, the significance of impact can be assessed as moderate.
			B-		B-	CS/CLS: There is a possibility of air pollution, noise pollution, heat exposure, exposure to hazardous materials, etc. In order to prevent the occurrence of accidents and incidents in normal work conditions, working conditions during the construction and closing stages shall be managed by the contractor. Therefore, the significance of impact can be assessed as moderate.
Other	Accidents	Fire and traffic accidents	B-	B-	B-	CS/OS/CLS: The risk of fire accidents and traffic accidents is anticipated for all stages. However, the proposed project will not contain large-scale work using firearms or explosives. In addition, people working with high voltages and in high places might encounter accidents but the project proponent has avoided such accidents in other similar projects in Myanmar through normal working conditions. Therefore, the risk of accidents could be considered low and the significance of impact can be assessed as moderate.
	Transboundary and global environmental	Climate change and other transboundary pollution	D	D	D	CS/OS/CLS: CO_2 emissions from construction vehicles and transboundary pollution are not significant because the transmission line work is limited, and substations are of a limited area and use limited amounts of machinery. No activities that will affect global warming or transboundary pollution are expected. Therefore, the significance of impact can be assessed as negligible.

Note: Rating - In general, both positive impact (+) and negative impact (-) are expected due to the anticipated project activities. Thus, the following rating criteria are adopted with respect to the extent of impacts:
A (+/-): Significant positive/negative impact is expected,
B (+/-): Positive/negative impact is expected to some extent,
C: Extent of impact is unknown (further examination is needed and the impact could be clarified as the study progresses),
D: Negligible or no impact is expected.
Source: JICA Study Team

4.1.7. Mitigation Measures and Costs for Implementing Mitigation Measures

An Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) were developed based on the results of impact assessments for Environmental, Social, and Health Impacts and Emergency Risks, as described below.

(1) Mitigation Measures to be Considered for Construction and Closure Stages

Environmental mitigation measures to be considered for the construction/closure stages for different aspects, including pollution, natural environment, social environment, health and safety, and emergency risks, are summarized in the following Table 4.1-36. Most of the environmental mitigation measures will be implemented by the contractor for construction/demolition work under the management of the project proponent.

Table 4.1-36 Environmental Mitigation Measures to be Considered for the Construction/Closure Stages

Category	Item	Mitigation Measures	Implementer
Pollution	Air pollution	• Water spraying of the entire construction site will be carried out during the construction and demolition activities to suppress and control dust emissions. • Dust nets of adequate height shall be erected around the entire construction site perimeter • The excavated earth material should be kept at the designated place and should be covered to prevent wind erosion. • In the case of higher wind forces, construction work relating to dust generation will not be allowed. • Netting will be attached along fences to minimize the spread of dust to neighboring areas. • Construction materials which emit dust will be covered.	Contractor
	Water pollution	• Cover piles of building materials like cement, sand and other powders, regularly inspect for spillages, and locate them where they will not be washed into waterways or drainage areas. • Generators are sited on concrete foundations and with bund wall to prevent any spillage or leakage. • Sewage from septic tanks will be disposed of by requesting collection by Township Development Committee. • Site drainage system (temporarily opened soil gutters) will be in effect to ensure no water ponding, overflowing or blocking.	Contractor
	Solid Waste	• Prepare a plan, which includes the control of receipt, storage and final disposal of such substances. • Waste should be collected daily. • Non-hazardous waste should not be mixed with any category of hazardous waste at any time. • All waste shall be collected by the city/township development committee and processed at the appropriate disposal site by the committee. Therefore, communicate with the committee for smooth solid waste disposal.	Contractor
	Soil contamination	• Construction materials (hazardous or non-hazardous types) are stored in adequate places managed by City Development Committee to avoid contamination during occurrences of rain or floods. • Maintenance of heavy equipment, machinery and vehicles will be conducted by authorized and experienced personnel. • Fuel filling of some machinery, equipment and vehicles will be carried out by an authorized vendor to prevent spill-over and leakage from fuel transfers and on-site storage. • In any cases of occurrence, the contaminated soil will be collected, placed in appropriate containers and disposed of through TDC.	Contractor
	Noise and vibration	• Prior notification to the local community on the schedule for construction activities. • Restricted operation hours of heavy construction machines (such as excavators fitted with construction/demolition/breaking equipment) and avoid idling. • Paying attention when dropping materials from a height. • Construction work will not be conducted at night. • Regular inspections, maintenance and servicing of machines and equipment will be conducted.	Contractor
	Offensive Odor	• Proper management of sewage and domestic waste from temporary construction camp. • Monitor waste storage conditions and odor conditions around septic tanks of temporary construction camp.	Contractor
Natural Environment	Flora, Fauna, Ecosystem, Biodiversity,	• Ensure minimal land clearing and removal of vegetation by working closely with the Forest Department/MONREC to ensure that there is no rampant clearing or felling of forests	Contractor

Category	Item	Mitigation Measures	Implementer
	Protected area	in and around work sites. • Replant the number of lost plants in another area in this region. • Flora that are indigenous and/or specific species in the project area must be maintained, if there are any. • Conservation awareness/familiarization by construction workers to be carried out by the project proponent. • Poaching activities by construction workers shall not be allowed (no illegal hunting).	
Social	Involuntary Resettlement and Land Acquisition	• Appropriate compensation and social assistance will be provided in accordance with The Land Acquisition, Resettlement and Rehabilitation Act (2019), The Farmland Law and Rules (2012), and Land and Crop Compensation Regulations by MOEE. • The project will provide compensation and income restoration support measures in accordance with JICA Guidelines, and an Abbreviated Resettlement Action Plan (ARAP) will be prepared in accordance with the Guidelines for affected PAPs and PAHs.	Contractor
	Local Economy and Livelihood	• For persons affected by the acquisition of agricultural land, the proper amount of compensation should be provided to not only the landowner but also the laborers working in those areas. • Temporary crop compensation in accordance with The Land Acquisition, Resettlement and Rehabilitation Act (2019), The Farmland Law and Rules (2012), and Land and Crop Compensation Regulations by MOEE, should be provided to the affected business owner during the construction phase. • The mobilization and construction work for the project should be carried out carefully, so that standing crops are not damaged unnecessarily. Also, job opportunities in the construction work can be provided to the workers who suffer temporary disruptions in sales. • The project work may be delayed to allow the farmers to harvest their crop. The work should not be continued through ripened crop fields.	Contractor
	Existing Social Infrastructure and Social Services	• Easy access to social infrastructure will be considered in the ARAP for PAHs. • Arranging careful logistics management with an understanding of the bearing capacity of roads and bridge to be utilized. • Dispatching road maintenance crew to areas where access roads are damaged by construction activities in consultation with relevant authorities. • Delivering prior notification to local authority and public for temporary road closures. • Providing road signs, and safety barriers. • Avoiding rush hours when more traffic is expected, such as school start and end times, for transportation of construction materials and heavy machinery.	Contractor
	Social Institutions	• Arranging careful logistics management with an understanding of the bearing capacity of roads and bridge to be utilized. • Dispatching road maintenance crew to areas where access roads are damaged by construction activities in consultation with relevant authorities. • Delivering prior notification to local authority and public for temporary road closures. • Avoiding rush hours when more traffic is expected, such as school start and end times, for transportation of construction materials and heavy machinery.	Contractor
	Risks of Infectious Diseases such as AIDS/HIV	• Ensure discharges of wastewater from the project site do not affect/disturb the local community. • Educate employees to prevent infectious diseases from spreading, including training for workers.	Contractor

Category	Item	Mitigation Measures	Implementer
		• Educate employees on correct ways to integrate into the community and on understanding local culture and traditions.	
	Working conditions (including occupational safety)	• Visitors to the site are provided with PPE and escorted around the construction site. • PPE requirement signboards. • Nettings and toe boards are provided at scaffolding workplaces to prevent falling material hazards. • Warning signage for various hazards are visibly posted to warn workers at the workplace.	Contractor
Others	Accidents	• Storage of fuel to be managed appropriately (e.g. diesel and petrol for generators, and heavy machinery equipment such as excavators), with worker education to avoid any traffic accidents. • Electrical fires to be managed appropriately (e.g. avoid usage of faulty equipment, un-safe electrical connections, broken electrical cords, etc.) • Check gas cylinders, valves and connections for usage of acetylene torches and incompatible work nearby, and provide portable fire extinguishers, etc.	Contractor

Source: JICA Study Team

(2) Mitigation Measures to be Considered for Operation Stage

Environmental mitigation measures to be considered for the operation stage for different aspects, including pollution, natural environment, social environment, health and safety, and emergency risks, are summarized in the following Table 4.1-37. Most of the environmental mitigation measures will be implemented by the project proponent.

Table 4.1-37 Environmental Mitigation Measures to be Considered for Operation Stage

Category	Item	Environmental Mitigation Measures	Implementer
Pollution	Water Pollution	• Sewage generated from staff housing will be disposed of by requesting collection by Township Development Committee. • Ensure no leakages from oil pits to drain line. • Drainage system of substation will be checked to ensure no water ponding, overflowing or blocking occurs.	Project proponent
	Solid Waste	• Substation should be regularly checked so as not to generate hazardous waste. • Waste oil/hydrocarbons shall be stored in drums that are leak-proof • All storage areas shall be cleaned thoroughly and regularly and especially in the event of any spillage, contamination, leaks or the like. • Keep dustbins for waste which may include damaged electrical equipment or be used by surrounding people. • All waste, including hazardous waste such as waste oil, batteries, etc., shall be collected by the city/township development committee and processed at the appropriate disposal site by the committee. Therefore, communicate with the with the Township development committee for smooth solid waste disposal.	Project proponent
	Soil contamination	• Fuel filling of some machinery, equipment and vehicles will be carried out by an authorized vendor to prevent spill-over and leakage from fuel transfers and on-site storage. • DPTSC should monitor oil leakage from aging or used electric transformers, oil-circuit breakers and batteries. • If considerable oil leakage is identified, DPTSC should reconsider proper prevention measures such as installing oil pits.	Project proponent

Category	Item	Environmental Mitigation Measures	Implementer
	Noise and vibrations	• Avoid installations of transformers around sound-reflecting surfaces in narrow places or hallways. • Avoid mounting transformers on floors with low masses and uneven surfaces. • Use flexible conduits and bus connections. • Regular maintenance of transformers to avoid unnecessary noise production. • Use corona rings, smooth rounded shape high voltage electrodes and high-quality insulation.	Project proponent
	Offensive Odors	• Proper management of sewage and domestic waste from staff housing. • Monitor waste storage conditions and odor conditions around septic tanks of staff housing.	Project proponent
Natural Environment	Flora, Fauna, Ecosystem, Biodiversity, Protected areas	• Replant the number of lost plants in another area in this region. • Monitor bird strikes at the transmission line and towers and take necessary measures such as increasing the visibility of transmission lines, and using markers and/or bird diverters if any impacts are identified. • Allow the vegetation along the alignment to grow back to at least 2 meters in height, which will provide cover for most wildlife that needs to move through the right-of-way. • Collaborate with Wildlife and biodiversity Conservation Programs such as environmental awareness activities in the target area with the forestry department of each area.	Project proponent
Social Impacts	Involuntary Resettlement and Land Acquisition	• Appropriate compensation and social assistance will be provided in accordance with The Land Acquisition, Resettlement and Rehabilitation Act (2019), The Farmland Law and Rules (2012), and Land and Crop Compensation Regulations by MOEE. • The Abbreviated Resettlement Action Plan (ARAP) will be prepared for affected PAPs and PAHs.	Project proponent
	Local Economy and Livelihood	• For persons affected by the acquisition of agricultural land, the proper amount of compensation should be provided to not only the landowner but also the laborers working in those areas. • Temporary crop compensation in accordance with The Land Acquisition, Resettlement and Rehabilitation Act (2019), The Farmland Law and Rules (2012), and Land and Crop Compensation Regulations by MOEE, should be provided to the affected business owner during the construction phase. • The mobilization and construction work for the project should be carried out carefully, so that standing crops are not damaged unnecessarily. • The project work may be delayed to allow farmers to harvest their crop. • The work should not be continued through ripened crop fields.	Project proponent
	Working conditions (including occupational safety)	• Certified and competent electrical workers should conduct all electrical work, the checking and usage of safe and approved electrical equipment should be implemented, and the usage of un-safe and faulty electrical devices should be avoided. • Identify the potential exposure levels in the workplace, and train the workers in occupational safety. • Make sure that transmission lines are deactivated and grounded prior to working on them. • Provide appropriate and adequate PPE for workers.	Project proponent
Other	Accidents	• Regular training and exercises for site staff regarding firefighting and other emergency responses. • Minimize the storage of paper products, cleaning fluids and other combustible materials. • Trim or cut the trees regularly near the area of ROW and monitor ROW vegetation according to fire risk.	Project proponent

Source: JICA Study Team

4.1.8. Monitoring Plan

The environmental monitoring plan, including monitoring items, location, frequency and related organization in construction/closure stages and operation stage, is shown in the following Table 4.1-38. Monitoring for the construction/closure stages will be implemented by the contractors and monitoring for the operation stage will be implemented by the project proponent. An environmental monitoring form (EMoF) in line with this monitoring plan is attached to this report.

Table 4.1-38 Environmental Monitoring Plan

Env. Indicators	Location	Means of Monitoring	Measurement Method	Frequency	Repo-rting*	Responsibility	
						Supervision	Supervision
Construction/Closure Stage							
Air Quality	One point at the new 500 kV substation	CO2, PM2.5, PM10, NO2, SO2, Ozone, Wind Speed, Wind Direction	On-site measurement	Annually	Annually	MOEE/ DPTSC	Contractor
	In and around substation area and along all transmission lines	Water spraying, dust nets, covering construction materials and excavated earth	Visual inspection and record keeping	Monthly	Bi-annually	MOEE/ DPTSC	Contractor
Water Quality	One point near new 500kV substation	Temperature, pH, Electrical Conductivity,	On-site measurement	Once in dry season and once in rainy season	Annually	MOEE/ DPTSC	Contractor
		BOD5, COD Cr, Oil and grease, Total coliform bacteria, Total Nitrogen, Total phosphorus, Suspended Solids, Total Chromium, Cadmium, Arsenic, Zinc, Lead, Mercury, Copper, Iron, Manganese	Laboratory analysis				
	In and all around substation and along all transmission lines	Septic tanks, temporary drainage system, bund wall or spill kit	Visual inspection and record keeping	Monthly	Bi-annually	MOEE/ DPTSC	Contractor
Solid Waste	All construction sites	Waste manage plan, record of waste collection and disposal (photos, vouchers, etc.)	Visual inspection and record keeping	Monthly	Every 6 months	MOEE/ DPTSC	Contractors
Soil Contamination	All construction sites	Waste storage conditions, fuel filling method, spill kit considering soil contamination (photos, drawing, etc.)	Visual inspection and record keeping	Monthly	Every 6 months	MOEE/ DPTSC	Contractors
Noise and Vibrations	One point at the new	Noise Level LAeq (dB)	On-site measurement	Annually	Annually	MOEE/ DPTSC	Contractor

Env. Indicators	Location	Means of Monitoring	Measurement Method	Frequency	Repo-rting*	Responsibility	
						Supervision	Supervision
	500kV substation	Vibration Level Lv10 (dB)					
	In and all around substation and along all transmission lines	Records of notice letters, work schedule and night work, inspection and maintenance of machines	Visual inspection and record keeping	Monthly	Bi-annually	MOEE/ DPTSC	Contractor
Offensive Odors	All construction sites	Waste storage conditions, odor conditions around septic tanks	Visual inspection and record keeping	Monthly	Every 6 months	MOEE/ DPTSC	Contractors
Flora, Fauna, Ecosystem, Biodiversity,	All construction sites	Incident and accident record, and record of measures as necessary	Visual inspection and record keeping	Monthly	Bi-annually	MOEE/ DPTSC	Contractor
Risks of Infectious Diseases such as AIDS/HIV	All construction sites	Records of status of community safety and health including infectious diseases	Record keeping	Monthly	Every 6 months	MOEE/ DPTSC	Contractors
Working conditions (including occupational safety)	All construction sites	Records of PPE wearing, safety sign boards, hazard warning posts, toolbox meetings, training, etc.	Visual inspection and record keeping	Monthly	Every 6 months	MOEE/ DPTSC	Contractors
Accidents	All construction sites	Records of fire, and traffic accidents at the site	Record keeping	Quarterly	Every 6 months	MOEE/ DPTSC	Contractors
Operation Stage							
Water Quality	In and all around substation	Records of Septic tanks and drainage usage	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Solid Waste	In and all around substation	Waste manage plan, record of waste collection and disposal (photos, vouchers, etc.)	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Soil Contamination	In and all around substation	Waste storage conditions, oil filling method, oil pits (photos, drawing, etc.)	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Noise	Inside substation	Records of inspection and maintenance of machines	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Offensive Odors	Staff housing	Waste storage conditions, odor conditions around septic tanks	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent

Env. Indicators	Location	Means of Monitoring	Measurement Method	Frequency	Repo-rting*	Responsibility	
						Supervision	Supervision
Flora, Fauna, Ecosystem, Biodiversity	ROW of transmission line including tower	Incident and accident records, such as bird strikes	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Working conditions (including occupational safety)	In and all around substation, and ROW of transmission line	Incident and accident record, Records of wearing PPE provided	Visual inspection and record keeping	Monthly	Bi-annually	MOEE	Project Proponent
Accidents	In and all around substation, and ROW of transmission line	Records of fire, and traffic accidents at the site	Record keeping	Quarterly	Bi-annually	MOEE	Project Proponent

Note*: The reporting frequency described this table indicates the reporting frequency from the project proponent to MONREC-ECD. As a general rule, the results of environmental and social consideration shall be reported from MOEE/DPTSC to JICA once a quarter.
Source: JICA Study Team

In terms of the budget for environmental monitoring before/during construction and the closure and operation phases, the main monitoring costs are those for field measurements, such as air quality, water quality and noise. Annual costs for field measurements at the construction stage by the contractor, and at the operation stage by the Project Proponent are estimated as shown in Table 4.1-39.

Table 4.1-39 Estimated Annual Costs for Monitoring

Stage	Monitoring Items	Implementing Organizations	Expected Cost	Remarks
Pre-construction	- Conducting DMS survey (including crops)	Project Proponent	USD 45,000	To calculate the land compensation costs
500 kV and 230 kV transmission lines				
Construction	- Implementation of mitigation measures	Project Proponent	USD 14,000/yr	Only the costs for field work
Operation	-Training and capacity development - EMF and safety clearance monitoring	Project Proponent	USD 6000/yr	
Substations				
Construction	- Onsite monitoring of air, water and noise levels - Implementation of mitigation measures	Project Proponent	USD 15,000/yr (AQ, WQ, NV) USD 6,000/yr	
Operation	-Training and capacity development - EMF and safety clearance monitoring	Project Proponent	USD 6000/yr	

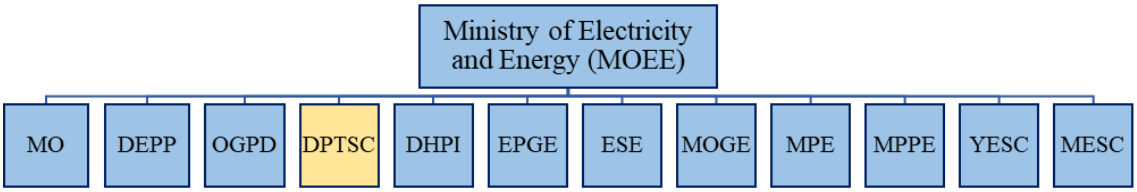
Note: 1) Budget is estimated at April 2020 from various existing information.
2) If the cost for monitoring at the operation and closure stages exceeds the budget, the extra expense will be secured by the Project Proponent
Source: JICA Study Team

4.1.9. Institutional Arrangements

(1) Project Proponent

The project proponent for National Power Transmission Network Development (Phase-III) is the

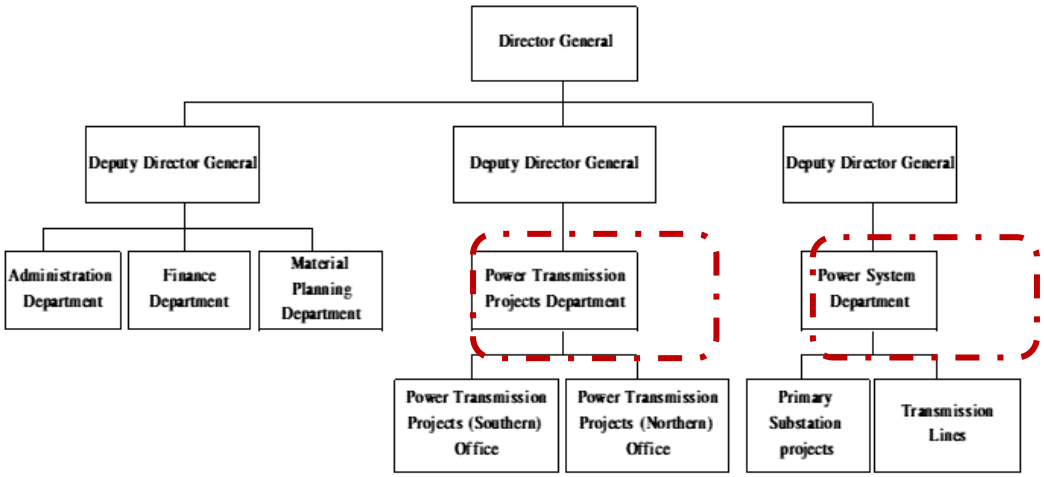
Department of Power Transmission and System Control (DPTSC), under the Ministry of Electricity and Energy (MOEE), which is mainly responsible for the planning and implementation of power transmission network and power system projects. DPTSC has five main departments: the administration department, finance department, material planning department, power transmission projects department and power system department. Among these, the power transmission projects department is mainly responsible for environmental and social considerations during the pre-construction and construction stages, while the power system department will be responsible for all the substantive work at the project site during the operation stages. The organizational structures of MOEE and DPTSC are shown in Figure 4.1-13 and Figure 4.1-14, respectively.



MO = Ministry Office
DEPP = Department of Electric Power and Planning
OGPD = Oil and Gas Planning Department
DPTSC = Department of Power Transmission and System Control
DHPI = Department of Hydropower Implementation
EPGE = Electric Power Generation Enterprise
ESE = Electric Supply Enterprise
MOGE = Myanmar Oil and Gas Enterprise
MPE = Myanmar Petrochemical Enterprise
MPPE = Myanmar Petroleum Product Enterprise
YESC = Yangon Electricity Supply Corporation
MESC = Mandalay Electricity Supply Corporation

Source: MOEE

Figure 4.1-13 Organizational Structure of the Ministry of Electricity and Energy (MOEE)



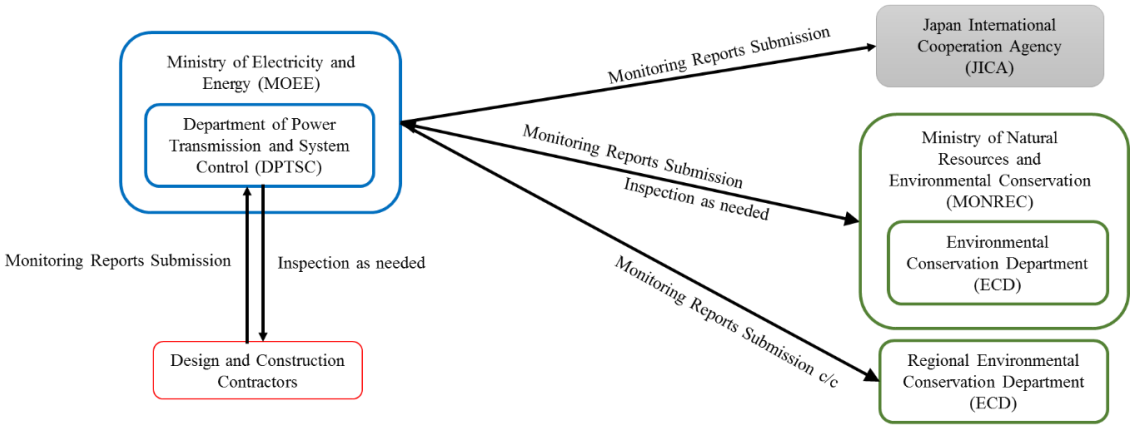
Source: MOEE

Figure 4.1-14 Organizational Structure of the Department of Power Transmission and System Control (DPTSC)

(2) Institutional Arrangements Before/During Construction

The key parties who are responsible for the implementation of the Environment Management Plan (EMP) at the pre-construction and construction stages are proposed, as shown in Figure 4.1-15. DPTSC, as a project proponent, is wholly responsible for the implementation and supervision of the

project, including the environmental aspect. The project proponent will implement environmental monitoring and submit the monitoring report to MONREC. The project proponent will submit the monitoring report to JICA as well. Environmental, Social and Health management will be the responsibility of the HSE team from the Design and Construction Contractors during the construction stages.

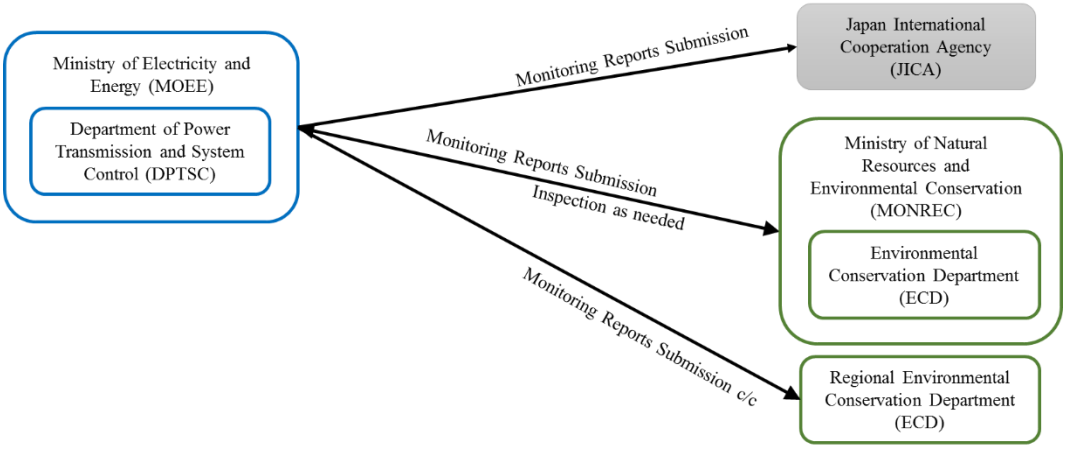


Source: JICA study team

Figure 4.1-15 Proposed Institutional Arrangements for Environmental Management of the Project at Pre-construction and Construction Stages

(3) Institutional Arrangements during Operation

The institutional arrangements at the operation stage are shown in Figure 4.1-16. For the operation stage, DPTSC will take care of all the substantive work at the site.



Source: JICA study team

Figure 4.1-16 Proposed Institutional Arrangements for Environmental Management of the Project at Operation Stage

4.1.10. Stakeholder Meetings

It is necessary to conduct stakeholder consultations at least once during the IEE study in order to

comply with the EIAP in Myanmar. The first stakeholder meeting was conducted as a preliminary individual discussion from February to March 2020. After that, the project proponent (DPTSC/MOEE) and the JICA Study Team informed the communities and stakeholders of each Township and District. The meetings were held with invitations posted on the township notice boards so that any residents or interested persons could attend.

(1) 1st Stakeholder Meeting

There are ten townships totally/partially overlapping the Project area. Specifications for methodology and approach, such as notifications, venue, date, time, and participants for all the meetings, were decided for the consultation based on recommendations from the General Administration Departments in the Yangon and Bago Regions. Interviews on specific, recent, local conditions were also implemented during the meeting to aid in the design of the Project, as well as the design of the Stakeholder Meeting.

Table 4.1-40 Summary of the 1st Stakeholder Meetings

Meeting	Date and Time	Venue	Attendants	Discussion results for the 2nd Meeting Content
1st Yangon Northern District	Tuesday, 18 February 2020, 9:30 am	General Administration Department, Northern Yangon District	District level: 1 person JICA Study Team: 2 persons	20 March at Hlegu Township of Northern District 13 wards/villages 13 March at Mingalardon Township of Northern District 5 wards/villages
2nd Eastern District	Tuesday, 18 February 2020, 1:30 pm Monday, 3 March 2020, 1:30 pm	General Administration Department, Eastern Yangon District	District level: 1 person JICA Study Team: 2 persons District level: 1 person MOEE: 2 persons JICA Study Team: 2 persons	1 March North Dagon Township (7 wards) South Dagon Township (3 wards) North Okkalapa Township (1 ward) Thaketa Township (1 ward)
3rd Hlegu Township	Thursday, 20 February 2020, 10:30 am	General Administration Department, Hlegu Township	Township level: 1 person MOEE: 2 persons JICA Study Team: 3 persons	20 March 13 wards/villages
4th Mingalardon Township	Thursday, 20 February 2020, 1:30 pm	General Administration Department, Mingalardon Township	Township level: 4 persons MOEE: 2 persons JICA Team: 3 persons	13 March 5 wards/villages
5th Bago District	Wednesday, 4 March 2020, 11:00 am	General Administration Department, Bago District	Township level: 1 person MOEE: 1 person JICA Study Team: 4 persons	18 March Bago District (14 villages) Kawa Township (1 village) Thanapin Township (6 villages)
6th Thanatpin Township	Thursday, 5 March 2020, 11:30 am	General Administration Department, Thanatpin Township	Township level: 2 persons MOEE: 1 person JICA Study Team: 2 persons	
7th Kawa Township	Thursday, 5 March 2020, 1:30 pm	General Administration Department, Kawa Township	Township level: 1 person MOEE: 1 person JICA Study Team: 2 persons	

Meeting	Date and Time	Venue	Attendants	Discussion results for the 2nd Meeting Content
8th East Dagon Township	Friday, 6 March 2020	General Administration Department, East Dagon Township	Township level: 1 person JICA Study Team: 2 persons	16 March 8 wards

Source: JICA study team

(2) 2nd Stakeholder Meeting

a) Methodology for Public Consultation for IEE

The methodology of the Public Consultation Meetings for IEE (2nd Stakeholder Meeting) is described in the following Table.

Table 4.1-41 Summary of Public Consultation Meetings for the draft IEE Report

Timing	Methodology and Special Considerations
Draft IEE stage: planned for March 2020	【Method and No. of Meetings】 1 meeting is planned for one day, which will be organized in order to ensure the participation of the stakeholders in the public sector and the local residents. 【Venue】 Related Township General Administration Department (Mingalardon, Hlegu, Dagon Myothit (East) and Bago, North Okkala, South Dagon, North Dagon, Thaketa). 【Agenda】 Draft IEE on the Department of Power Transmission and System Control (DPTSC). Baseline survey results and impact assessment results Proposed environmental mitigation measures and environmental monitoring plan IEE study schedule 【Expected Participants & Invitation Method】 Local government bodies in and around the related townships. Local residents in the project area. Project Proponent and related government organizations Any interested individuals and parties The invitation/notice for the meeting will be posted in each village for one week in advance. 【Language Used】 The presentation and handout will be in the Myanmar Language. The explanation will also be provided in the Myanmar Language. 【Special Considerations for Socially Vulnerable Groups】 Feedback forms will be provided to the participants so that people who hesitate to speak out in public can share their views and comments in written form. Assistants will be available to fill out the form in case the participant requires assistance in writing/reading. Female assistants will be available for female participants who need any assistance.

Source: JICA study team

The public consultation meeting is held over five sessions to cover all of the project areas of influence, as described in Table 4.1-42.

Table 4.1-42 Detailed Information for Stakeholder Meetings

Time and Date	Mingalardon Township: Friday, 13 March 2020, 10:00 am to 12:00 pm East Dagon Township: Monday, 16 March 2020, 10:00 am to 12:00 pm Bago Region: Wednesday, 18 March 2020, 10:00 am to 12:00 pm Yangon Eastern District: Thursday, 19 March 2020, 4:00 pm to 5:00 pm Hlegu Township: Friday, 20 March 2020, 10:00 am to 12:00 pm
Venue	Mingalardon Township: Administration Office, Thingangyungyi Village, Mingalardon Township, Yangon East Dagon Township: General Administration Department, Dagon Myothit (East) Township, Yangon Bago Region: General Administration Department, Bago District, Bago Yangon Eastern District: General Administration Department, Eastern Yangon District, Yangon Hlegu Township: General Administration Department, Hlegu Township, Yangon
Attendees	Mingalardon Township: 33 persons

	East Dagon Township: 29 persons Bago Region: 54 persons Yangon Eastern District: 17 persons Hlegu Township: 34 persons Total: 167 persons
Agenda	Explanation of the Project Description Explanation of JICA's Policy Explanation of Results of IEE Study Question and Answer session
Language used	In the local language (Myanmar language)
Feedback Sheet	In total, 38 comments during five PCM sessions and disclosure were submitted.

Source: JICA study team

Questions/comments from participants and explanations/responses from DPTSC/JICA study team during the stakeholder meetings are shown in Table 4.1-43.

Table 4.1-43 Questions/Comments and Explanations/Responses from Public Consultation Meetings

No.	Question/Comment	Explanation and Response
Mingalardon Township		
1.	Mr. Zaw Lin (Township Administrator, Administration Department, Mingalardon Township) Comments – Show the exact list of PAPs, present the route for the transmission lines and how the overhead and underground transmission lines will pass through, and check the 2019 Law for land acquisition.	Mr. Nyunt Wai (Executive Engineer, DPTSC) Answer - Presented on ROW; will be less or no impact as this project is long-term and will apply updated techniques to reduce major impacts as much as possible.
2.	Mr. Phone Thet Khaing (Sub-Assistant Engineer, YCDC), Mr. Aunh Htut Linn (Assistant Engineer, YCDC) Question 1 - Will the transmission line from Hlegu to Dagon Township (Dagon Myothit (East)) pass through No. 7 Main Road? Question 2 - There is a water supply system near the project. Will it be affected? Question 3 - Informed of the location of water distribution pipeline. Check the Law for land acquisition (2019). Discussed how many transmission lines there will be. Can YCDC join the transmission lines from Hlegu? Question 4 - Will there be any damage due to transmission tower construction?	Mr. Nyunt Wai (Executive Engineer, DPTSC) Answer 1 - It will not pass through the No. 7 main road but go along the road. Answer 2 - Underground transmission line will pass through Bo-Chan Street to the substation. The team have been doing surveys. Requested YCDC to approve DPTSC's letter. Monopole transmission towers will be used at Thaketa substation. Answer 3 - Presented on Law (2012) on Land Acquisition. DPTSC will discuss the losses and complaints. They will give compensation for crop losses. 30 ft square will be used for 230kV, and 50 ft square will be used for 500kV. They will use 120 ft temporarily for the construction yard to store the construction materials. Answer 4 - Compensation will be paid for any losses, according to the Department of Agriculture, Land Management and Statistics. They will use updated techniques to reduce losses.
3.	Mr. Thet Khaing Oo (Hundred Household Head, Pyan Lei Nay Yar Cha Htar Ye Ward) Question - Which area will be included in this project? Will the transmission line be underground or overhead?	Mr. Nyunt Wai (Executive Engineer, DPTSC) Answer - Monopole transmission towers or super slim (towers) towers will be used to upgrade the 230 kV Hlawga-Thaketa transmission line but underground transmission lines will be used instead of monopole towers along the Bo-chan Road near the Hlawga Substation because of the presence of a crowded residential area near the current transmission line.
4.	Mrs. Tin New Ni (YCDC) Question - Can the transmission lines and towers be combined? When will the project be implemented? Comments - Any suggestion for Pyin Ma Pin Line? If the current gas pipe route will not be	Mr. Nyunt Wai (Executive Engineer, DPTSC) Answer - YESC is trying to combine transmission lines as much as they can. In Mandalay, there are combined transmission towers (4 in 1). The proposed transmission line will be from Dagon Township (East) to Zay Kabar (Bo-Chan).The noise is

No.	Question/Comment	Explanation and Response
	used, new routes would be. If new underground transmission lines are constructed under the Bo-chan Road, there might be underground gas pipelines under the road. The transmission towers from Pyin-Ma Pin are currently generating noise.	generated from Pyin Ma Bin as the transmission lines are suffering overloaded capacity. The proposed project will include a 2 circuit system for better current capacity to solve the overload problem at Pyin Ma Bin. It may take over 5 years to implement this project.
Dagom Myothit (East) Township		
1.	Mr. Zaw Min Htike (GAD) Comment 1 - Although almost all the land is owned by township development committee, there is still farmland worked by farmers. So it would be necessary to negotiate with both TDC and the local people. One issue in this township is that even though YCDC owns the land for implementing projects, some land is still not utilized. Therefore, the original farmers cultivate their lands again. The legal owner is YCDC and the original farmers are currently working it. Therefore, discussions should be undertaken with all of them. ROW of Transmission line (200 ft.) from Sar Ta Lin Village to Dagon Myothit (East) should be clear in design. Comment 2 - There are also other projects (especially industrial zone development plan) related to this township so DPTSC needs to consider a long term plan over about 30 years. YCDC has those long-term plans and this should be discussed with them. Comment 3 - It is better to plan the design after field study because some data from Google Earth cannot provide exact information.	Mr. Nyunt Wai (Assistant Director, DPTSC, MOEE) The suggestions are very useful for the project. There are many projects in MOEE which are facing many difficulties due to land issues. Therefore, we will carefully consider all your suggestions for the project. Yes, we will follow your suggestions.
2.	Mr. Nay La (Water Distribution Department, Township Development Committee) Comment 1 - There are also gas lines and water distribution lines. Therefore, it is necessary to negotiate with the respective authorities or departments. Most of the data can be obtained from the Township Development Committee.	Mr. Nyunt Wai (DPTSC, MOEE) Answer 1 - We also face many difficulties whereby the data are not relevant to the ground conditions. But we will always meet and discuss with related departments. For design, we proposed to use Slim Towers with double circuits, which can increase the cost, but they only need a small land area or size and reduce the amount of land acquisition issues. But it is difficult to use Slim Towers in Mingalardon Township. Therefore, we will put 6 circuits in an underground tunnel. After passing through the tunnel, we will use Mono towers. Therefore, I also wish to suggest that YCDC invite and discuss matters with MOEE when implementing the new industrial zones. Then we will discuss including enough space for transmission lines in the future. We do not get data for gas pipelines. We also carried out detailed survey designs along Bo Chan Road. Comment 1 - Due to problems in land acquisition, the projects have to be delayed. Comment 2 - Existing transmission lines of Hlawga-Thaketa need to be upgraded. Slim towers are planned to be used with bored pile although it might be expensive. Comment 3 - If government is planning to develop an industrial zone in this Dagon Myothit (East) Area, the electricity will be essential for everyone. So, please do cooperate with us.
3.	Mr. Linn Htet Ko (District GAD) I wish to include land owner list and related government list in the presentation. It should include project initial time and finishing time. How should GAD and related departments like YCDC/YESC provide support for this project? There cannot be land issues in Yangon Area.	Mr. NAKANO Hiroshi (JICA Study Team) Answer 1 - As it is only the feasibility stage, the project schedule has not been fixed. The only information we can give for now is that target timing of the loan agreement is in August. Design stage may take about 1 year. So, we still do not have a project schedule.

No.	Question/Comment	Explanation and Response
	Since the project is a National level project, there should be discussions at the Central level. Sometimes, following JICA guidelines exactly in our country may create difficulties. Therefore, international standards and guidelines should be relevant to our country's conditions. Question 1 - Is there any project schedule which includes start and end date of the project? Question 2 - How can GAD and other related departments be involved in the project? Comment 1 - It would be better to include departments and land owners related to project in power point presentation so that it is easier to understand each party's responsibilities. Comment 2 - The project includes cutting trees and replantation. Therefore, the project owner should discuss this with Forestry Department. There can be disagreements in usage of agricultural lands in Kawa and Thanatpin Townships. For slide 46, Ministry of Forestry has regulations on which kind of trees can be cut and where to replant them. Therefore, before starting the project, please make sure to negotiate with the Ministry of Forestry.	Answer 2 - Our team could not decide how GAD can be involved. DPTSC will discuss this with related departments.
4.	Mr. Than Hlaing (No. 1 Ward Administrator) Comment 1 - There were two fatal incidents due to electric shock in my ward: one was at a dumping site and the other occurred while undertaking electricity repairs. To avoid such situations, please provide us with more information in advance so that we can give precautions to the public.	Mr. Nyunt Wai (DPTSC, MOEE) Answer (DPTSC) Trees like bamboo, for which height cannot be controlled, will need to be cut. However, those which can be controlled will be remain the same. So, I believe if everyone follows the respective laws and rules, the number of accidents will be reduced.
5.	Mr. Aung Ko Ko (EE, YESC) If the transmission line will pass through No. 7 Road, I wish the line to be installed in the area located within the project operated by Zayyar Premier Company. If No. 7 Road is expanded by a future project, the transmission line will need to be removed again.	Mr. Nyunt Wai (Assistant Director, DPTSC, MOEE) Currently, water pipelines exist along No. 7 Road. We will discuss with YCDC on the transmission line area. We will place the towers after negotiations with them.
Bago District		
1.	Mr. Kyi Swe (Administrator, Oe Bo Village Tract) Question - If the transmission line passes through a village track, will DPTSC give compensation?	Mr. Soe Naing Win (Assistant Director, DPTSC) Answer - When DPTSC does surveys, there is a surveyor to be followed. During construction of the tower, there will be access road, so DPTSC will give compensation for damaged crops until the construction ends. The compensation's value may be decided via Department of Agriculture, Land Management and Statistics rules through step-by-step negotiations. Dr. Phyo Thu Aung (MKI) Answer - According to MOEE Law, there is no compensation for land acquisition in any village tract development project.
2.	Mr. Kyaw San Aung (Deputy Township Administrator, Ka Wa Township) Question - Will DPTSC give compensation for Land Acquisition surrounding the towers? Communications operator gave compensation for land acquisition annually. Comments (Deputy Administrator, Ka Wa Township) - DPTSC should consider making PCM for severely affected people because it is unable to construct any buildings and unable to plant any crops.	Mr. Soe Naing Win (Assistant Director, DPTSC) Answer - There will not be compensation for land used for substation, but DPTSC will give crop compensation of three times' the current market price in every season because there are many towers in Myanmar. So, the government can't give compensation for every piece of land used. Dr. Phyo Thu Aung (MKI) Answer - This is just the process of implementing IEE report. After loan is agreed, there will be detailed design, the list of actual affected persons will be released and Public Consultation Meeting will be held.

No.	Question/Comment	Explanation and Response
3.	Mr. Kyaw Thet (Department of Public Health) Comments - Noise and Vibrations at Hlegu-Dar Pein should be measured every three months and should be inspected monthly. Water quality should also be tested twice in every rainy season.	Dr. Phyo Thu Aung (MKI) Answer - There are no standard rules or regulations for monitoring frequency but DPTSC will follow these comments.
4.	Mr. Tin Win Htut (Officer, Department of Fisheries) Question - There are many fish ponds under towers, so will they be affected due to electricity?	Mr. Soe Naing Win (Assistant Director, DPTSC) Answer (DPTSC, MOEE) - There are transmission lines above fish ponds in Ayeyarwady Region and no issues have occurred up to now. There may not be an effect on these but after negotiation with the village tract, DPTSC will avoid these areas if possible. Mr. NAKANO Hiroshi (JICA Study Team) Answer – Sufficient insulators will be fixed at towers, so there will be no electricity danger for fish ponds. If an uneducated person touches a tower, it might result in electrocution. DPTSC will follow the MOEE's Laws and JICA's international laws to lessen or eliminate the impacts. According to MOEE's rules, towers must be built a sufficient distance from houses. Moreover, there are households under the Hlawga-Thaketa 230kV transmission line. So, the technicians from both MOEE and JICA will improve that line by applying updated techniques.
5.	Mrs. Pa Pa Win (Assistant Director, Planning Department, Thanatpin Township) Question - Will there be any danger if people work under transmission lines?	Mr. Soe Naing Win (Assistant Director, DPTSC) Answer - There will be no danger after the tower construction has been completed. 75 feet square is required for 230kV transmission for ROW. Lightning conductors will be fixed on the top of towers for safety.
6.	Mr. Nay Min (Deputy Staff Officer, Department of Forestry) Comments - Sub-group composition should include the members from relevant departments. According to his experience, compensation processes were very complicated and it was hard to deal with Project-Affected Persons (PAPs).	Dr. Phyo Thu Aung (MKI) Answer - This is just the stage to implement the IEE report. After the loan is approved, which could take 1 year, the detailed designs will be published. Then, DPTSC will cooperate with other departments to implement this project, and affected people will be recorded and compensated. The cut-off date will be specified and surveys will be undertaken.
7.	Mr. Maung Soe (Kan Ni Village Tract Administrator, Kawa Township) Comments - The transmission line in Kawa Township is broken. So please implement the projects in a safe way to create less damage. The relevant organizations should discuss the Land Acquisition with local people in detail.	Mr. Soe Naing Win (Assistant Director, DPTSC) Answer - If the transmission line is broken, there is no current in it so no electric hazard is expected. Therefore, we don't need to be afraid of that condition. Dr. Phyo Thu Aung (MKI) Answer - MKI submitted IEE (Draft), and JICA gave comments, including on the routes for bird migration. MKI has been considering JICA's comments to put in IEE (Draft).
Eastern Yangon District		
1.	Mr. Soe Lin Htike (Thaketa Township Administrator) Comment 1 - There are transmission lines in No. (9) Ward of Thaketa. So, it would be better to get detailed information on how the project affects that area. Comment 2 - Even after the agreement between Myanmar Government and JICA, there might be difficulties when it comes to ground surveys and negotiations with local people. Question 1 - Are transmission line towers new? Where would they be placed? Question 2 - How many third parties are involved in this project?	Dr. Phyo Thu Aung (Myanmar Koei LTD) Answer 1 - The old transmission line will be upgraded with a new line. Therefore, the location and length of the line is the same. We will upgrade the current tower area. In other areas which are far from the main road, the project will construct approach lanes. Mr. Thura Aung (General Manager, Resource and Environment Myanmar Co., Ltd.) The leading organization for IEE Study is Myanmar Koei International Co., Ltd. and we (REM) take the responsibility for social considerations and RAP framework. When we discussed this with DPTSC, they did not want to share the project information with local people as it is at the feasibility stage and they worried that rumors would spread and the project would not work out as planned. However,

No.	Question/Comment	Explanation and Response
		they agreed to have a stakeholder meeting at this feasibility stage.
2.	Mr. Tint Zaw (North Okkalapa Township Administrator) Question 1 - Has DPTSC informed parliament members about the project? Question 2 - What are these feedback forms for?	Dr. Phyo Thu Aung (Myanmar Koei LTD) Answer 1 - DPTSC invited one parliament member in Hlegu Township. Answer 2 - These feedback forms are for Township Administrator, Ward Administrator and Local people who are interested in the project.
3.	Mr. Ye Aung (Dagon Myo Thit (South) Township Administrator) Comment 1 - There will not be many issues in Eastern Yangon District since it is an old transmission line area. Mr. Kyaw Moe (Dagon Myo Thit (North)) Comment 1 - If the project is carried out after signing MOU, there will be many problems to be solved at ground level. The project should discuss matters with communities first. Moreover, impact of transmission line is high on farmers especially during rainy season.	Dr. Phyo Thu Aung (Environmental Expert, Myanmar Koei International Co., Ltd.) The project is just at the study phase for loan agreement. The government has budget limitations. During meeting with MOEE in Naypyitaw, they said that they do not wish to survey villages/wards because some areas are a sensitive area for survey. Moreover, the design is not confirmed yet.
4.	All Township Administrators We can give suggestions after giving information to the community. We wish the project members to meet related government departments and the public as well. We will support the project 100 percent as electricity is essential for the sake of our country and people.	Mr. Thura Aung (General Manager, Resource and Environment Myanmar Co., Ltd.) The project is at the initial stage and the design may be changed. If IEE study is not sufficient for this project, the developer will carry out EIA study according to ECD comments.
Hlegu Township		
1.	Mr. Win Aung (Deputy Township Administrator, General Administration Department (Hlegu)) Question - Ask Land Acquisition about the area which will be passed through for 230kV and 500kV. How many towers will be in Hlegu Township and how big will the area used be? Comments 1 - Should consider the area which will be used in Hlegu Township. Comments 2 - The project should consider people who cannot live under ROW of 500 kV Transmission line. Compensation for substation area as well as for transmission line should be considered. Number of towers, distance between each tower and their locations should be considered. We found that other transmission lines are sagging in some areas.	Dr. Phyo Thu Aung (Environmental Expert, Myanmar Koei International Co., Ltd.) Answer – DPTSC needs site survey to know about the numbers of towers in Hlegu Township. After the MOU, detailed designs will be published. JICA will provide support financially, but this is the draft stage. There are households under 230kV Hlawga-Thaketa but an improvement of this line will be included in this project. Moreover, JICA will call tender for techniques as the adviser. So, many technicians will be included. JICA will also inspect the construction using International Guidelines. It is certain that the proposed project will be better than the previous projects.
2.	Mr. Aung Aung (Village Administrator, Sar Ta Lin Village Tract) Comment - Since this is the loan acquisition phase, we cannot give suggestions for our village. When the project starts, our village will cooperate with the project by negotiating with land owners and community. Mr. Bo Bo Myint Aung, U Mya Aung (Township Development Committee) Comment - The vertical right of way can be changed when villages are developed and ground level is changed due to the development.	-
3.	Mr. Min Zaw (Township Engineer, Electricity Supply Cooperation) Comment 1 - Since ground clearance changes as time passes, the project should consider carefully the height of the towers with some percentage added onto the current ground level. Comment 2 - Hlegu has limitations in electricity. The township will be developed in the near future with many development projects. The village	Dr. Phyo Thu Aung (Environmental Expert, Myanmar Koei International Co., Ltd.) Answer 1 - Yes, the Ministry will install the towers at a height of at least 30 ft. But in some places, the ground clearance of the tower will decrease due to the upgrading of the road. Answer 2 - According to PCMs in other townships, there are suggestions for the cooperation of related government departments, township administrators,

No.	Question/Comment	Explanation and Response
	administrators cannot discuss the project today because they did not see the detailed design or transmission line routes, but when the project starts, Hlegu Township will cooperate to ensure the success of the project.	ward/village heads and so on. Moreover, stakeholders also suggested that meeting with current development project owners and proposed development project owners was also necessary. Mr. Hla Ko Oo (Assistant Engineer, DPTSC) Answer - According to MOEE law, there is no compensation for land acquisition in any village tract development project.
4.	Mr. Bo Bo Myint Aung, Mr. Mya Aung (YCDC) Comment - There is a 66kV transmission line from Hlawga but the villagers can't accept this, so the route might be changed. If DPTSC shows the affected area in detail, the leaders from the village tracts can discuss this with each other.	Dr. Phyo Thu Aung (Environmental Expert, Myanmar Koei International Co., Ltd.) Answer - Some proposed areas are under private companies and DPTSC expects to get MOU with the current government. Once the detailed designs are out, it will be possible to conduct a site survey.
5.	Mr. Win Aung (Deputy Township Administrator, General Administration Department (Hlegu)) Comments - If DPTSC shows the detailed design, the administrators from village tracts can discuss this in more detail. In Htan-Ta-Bin, once the towers were constructed the contractors could not pay compensation and they still haven't been able to negotiate this. The value of the land will increase.	Dr. Phyo Thu Aung (Environmental Expert, Myanmar Koei International Co., Ltd.) Answer - DPTSC will negotiate with public construction enterprises and ROW is rarely allowed.
6.	Mr. Win Aung (Deputy Township administrator, General Administration Department) Comments - Plantation will be needed in exact areas.	

Source: JICA study team

(3) Public Disclosure for Draft IEE Report

The Executive Summary of the draft IEE report in the Myanmar language was disclosed for review and comments, as shown in Table 4.1-44. The final IEE will be available for public viewing on the website of MOEE.

Table 4.1-44 Public Disclosure for the IEE

Stage	Methodology and Special Considerations
Draft IEE stage: planned for March 2020	【Announcement Method】 Public disclosure will be announced 5 days before the public consultation meeting and 7 days after the public consultation meeting. (In total, about 10 days.) Disclosure period, and comment submission method will be described in the disclosure places. The draft IEE report will be available on the MOEE official website. 【Disclosure Places】 Related Township General Administration Department (Mingalardon, Hlegu, Dagon Myothit (East) and Bago, North Okkala, South Dagon, North Dagon, Thaketa). Village Tract Offices/Ward Offices in the Project area. 【Disclosure Period】 About 10 working days (to exclude National Holidays, Saturdays and Sundays) 【Comment Submission Method】 Comments can be submitted with the comment form provided at the disclosure places or by e-mail, either in the Myanmar Language or the English language.

Source: JICA study team

An executive summary of the IEE report translated into the Myanmar language was prepared and disclosed together with a feedback form for each invitee during the stakeholder meetings. The disclosure duration was 7 weekdays starting from the date of holding the stakeholder meetings. The disclosure duration for each township is shown in Table 4.1-45.

Table 4.1-45 Disclosure Duration for draft IEE report Executive Summary

Target Area	Disclosure Duration
Mingalardon Township	13-23 March 2020
East Dagon Township	16-24 March 2020
Bago Region	18-26 March 2020
Yangon Eastern District	19-30 March 2020
Hlegu Township	20-31 March 2020

Source: JICA study team

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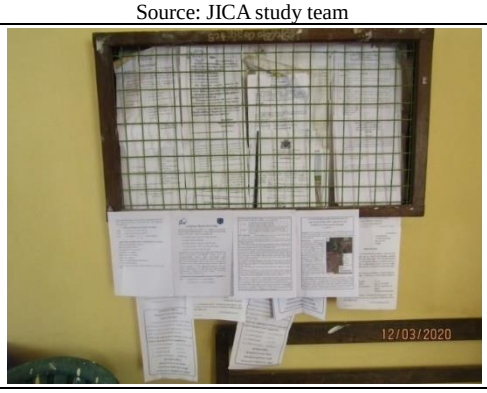
<tr><td> 
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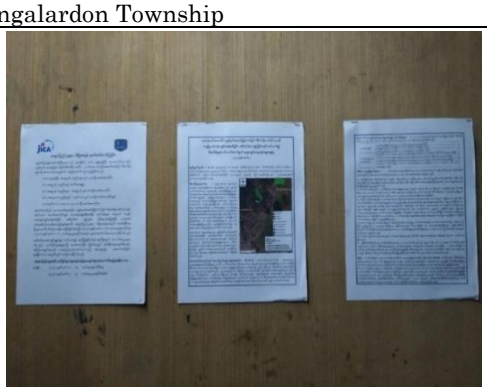
Public Disclosure at General Administration Department, Dagon Myothit (East) Township</td><td> 
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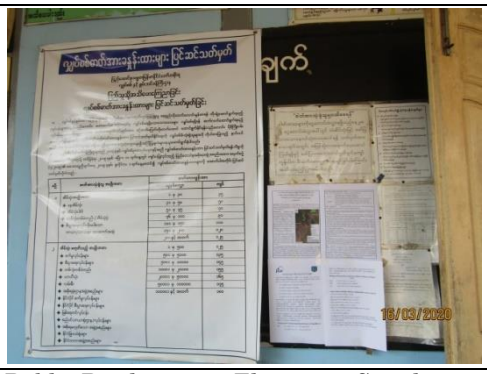
Public Disclosure at General Administration Department, Bago District	Public Disclosure at General Administration Department, Bago Township
	
Public Disclosure at Township Development Committee, Bago Township	Public Disclosure at Forest Department, Bago District
	
Public Disclosure at Department of Agricultural Land Management and Statistics, Bago Township	Public Disclosure at Electricity Supply Corporation, Bago District
	
Public Disclosure at General Administration Department, Thanatpin Township	Public Disclosure at Department of Public Health, Thanatpin Township

	
Public Disclosure at Township Development Committee, Thanatpin Township	Public Disclosure at General Administration Department, Kawa Township
	
Public Disclosure at Township Development Committee, Kawa Township	Public Disclosure at Department of Agricultural Land Management and Statistics, Kawa Township
	
Public Disclosure at Electricity Supply Corporation, Kawa Township	Public Disclosure at General Administration Department, Hlegu Township
	
Public Disclosure at Electricity Supply Cooperation, Hlegu Township	Public Disclosure at National League for Democracy Party Office, Hlegu Township

Source: JICA study team

Figure 4.1-17 Photos of Public Disclosure of the draft IEE Report Executive Summary

Several comments in the PCM sessions and 26 written comments in feedback forms during the PD were received. Comments are shown from Table 4.1-46. There were no special written comments from Yangon Eastern District.

Table 4.1-46 Feedback from Mingalardon Township at Stakeholder Meeting and Public Disclosure

No.	Township	Comments/Suggestions
1	Thingangyungyi Village, Mingalardon	The consultations and meetings with the local people should be carried out four to five times rather than just one time.
2	Pyanlalnayyarchahatryay Ward, Mingalardon	There should be proper, detailed explanations concerning the houses within the rehabilitation ward, and those located within the project area, and concerning measures for the compensation.
3	Mingalardon	There should be effective compensation schemes to lessen the potential impacts on the communities within and around the project area.
4	Shwe Nanthar Ywama Village, Mingalardon	If the project will be good for the country, it is fully encouraged. It would be better if the project does not have negative impacts on the communities as well.
5	Thingangyungyi Village, Mingalardon	There should be no impact on the houses during project implementation.
6	Thingangyungyi Village, Mingalardon	There should be no impact on the houses, and public health should be considered.

Source: JICA study team

Table 4.1-47 Feedback from East Dagon Township at Stakeholder Meeting and Public Disclosure

No.	Name	Township	Comments/Suggestions
1	U Kyaw Win Naing	125 Ward, Dagon Myothit (East)	The consultations and meetings with the local people should be carried out four to five times rather than just one time.

Source: JICA study team

Table 4.1-48 Feedback from Bago Region at Stakeholder Meeting and Public Disclosure

No.	Township	Comments/Suggestions
1	General Administration Department, Bago	There should be more effective measures to make the respective farmers aware of and understand the compensation for their lands and gardens due to the project. There can be problems in signing MoUs on loans without taking these measures. The land compensation should be reconsidered by the Ministry concerned. According to 2012 Farmland Law, the farmers holding the Land Use Certificate (Form 7) are supposed to be the owners of their agricultural land.
2	Township Development Committee, Bago	It is known that cultivation can be carried out under the 500KV transmission towers. However, cultivation should not be done alone in this area since there can be dangers of electrical hazards. The area of the transmission line (41' x 31') is not a large one when it comes to the villages. After the project is implemented, there should be transparent negotiations and discussions.
3	Forest Department, Bago	There should be transparency in conducting field surveys for compensation with the local people before the actual implementation of the project so as to avoid unnecessary disputes.
4	Bago	The current 230 kV transmission lines do not have clear-cut ground clearance in some places, and there are some cables falling off just above the ground. In order to avoid such incidents, there should be strict line span distances between the transmission towers.
5	Myanmar Maternal and	Sometimes, especially in winter, transformers in the city can malfunction and make noises that can cause local people and the monks living around there to become nervous and worried. In some

No.	Township	Comments/Suggestions
	Child Welfare Association, Bago	cases, the electricity can even go off. Thus, it would be best to avoid such cases happening after this project. We are very grateful to you for upgrading the transmission lines.
6	Myanmar Women's Affair Federation, Bago	There can be problems concerning land. Since this project is intended to aid the development of the country, it would be better if the government also takes responsibility in solving such problems. There should be awareness raising activities and training by the organizations concerned so that the local people will be more engaged, interested and willing to support the project. In doing this, the non-governmental organizations should also contribute.
7	Kanni Village, Bago	There should be effective measures concerning the environmental impacts of the project and the compensation for the affected communities. The system for the electrical transmission line should be safe enough to avoid possible risks for the local people. Since this project can bring advantages to our country, there is no objection to it.
8	Shwe Tan Village, Bago	The compensation should be provided not only for the affected crops in the land near the transmission towers but also for the affected land and crops along the transmission line.
9	Aut See Tee (East) Village, Bago	The project will be successful if there is strong collaboration among the government, the ministries concerned, the public and JICA.
10	Department, of Agricultural Land Management and Statistics, Thanatpin	The project area should be away from the residences of the local communities as well as extensive village areas. Concerning the compensation for crops, although the seasonal crops can be re-cultivated, the long-term crops cannot be cultivated again. Thus, for those long-term crops, compensation for the costs of cultivating them and for a further two- or three-year period should be provided.
11	Livestock Breeding and Veterinary Department, Thanatpin	Since there are measures to replant trees, there should also be measures for the pond providing drinking water for animals located near the power station. In the awareness raising workshops, information and knowledge on the routes of wild birds should be included.
12	Thanatpin	There should be consultations with the local communities living around the project area. It would be more feasible if there are measures on compensation or the annual rents for the land for the transmission towers. There should be awareness raising activities for the communities around the project area on the measures taken for the potential risks of electrical hazards.
13	Department of Agriculture, Thanatpin	There should be open discussions about the project implementation with the farmers working the land.
14	Department of Fisheries, Thanatpin	The Department of Fisheries would like to suggest that the transmission lines should not be placed in fishing ponds since it can cause electrical hazards. Thus, there should be consideration of this fact.
15	Forest Department, Thanatpin	The Initial Environmental Evaluation for the project (phase-3) should be carried out after conducting the field survey and awareness-raising activities with the departments concerned and village tracts, with training provided for the local communities.
16	Department of Public Health, Thanatpin	There should be regular monitoring on noise pollution once a month. The drains should be cleaned before and after the rainy season. There should be measures for the safety and security of the local population.
17	General Administration Department, Kawa	The 500-KV transmission line will pass through the Na Be Village Tract, Kawa Township. Thus, the construction of the transmission towers and the installation of the transmission line will be carried out across these areas. We were informed that compensation will be provided only for the affected crops at 3 times that of the current price, but not for the land. The telecom operators pay annual rents

No.	Township	Comments/Suggestions
		for the land where their transmission towers are placed. If the compensation or the annual rents for the land for constructing the transmission towers are not provided, there could be complaints since it is not in accordance with the government's Land Acquisition Policy.
18	Department, of Agricultural Land Management and Statistics, Kawa	It is said that compensation of three times' the current price will be paid for the crops cultivated on the land where the transmission line passes through. It would be better if there is specification of widths for both sides in installing the transmission line. For conducting the initial evaluation, prior information should be given, with all the departments concerned included. The compensation for land and crops should be reported to the Township Farm Land Management Committee in order to be more reliable and effective.
19	Nabebin Village, Kawa	During construction of the towers, there should be measures to create the minimum impacts on the local farmers, the natural environment and the local people. There should also be proper compensation schemes. There should be transparent and open negotiations with the local farmers with more consideration of their interests.

Source: JICA study team

Table 4.1-49 Feedback from Hlegu Township at Stakeholder Meeting and Public Disclosure

No.	Area	Comments/Suggestions
1.	Sar Ta Lin Village Tract, Hlegu	This project should be implemented because it will support the energy sector of the country. Safe operations in the environmental and social sectors and mitigation of negative health impacts should be systematically and sufficiently carried out.
2.	Sar Ta Lin Village Tract, Hlegu	We fully agree with the construction of the 500kV transmission line in Hlegu Township. It is crucial for development of the township. It can support the energy sector of the country, too. The project should be carefully implemented by minimizing negative environmental impacts.
3.	Sar Ta Lin Village Tract, Hlegu	No disagreement with the project because it will not impact biodiversity-sensitive areas or Yangon's Cultural Heritage Infrastructure. The project contractor should follow related mitigation measures within project area.
4.	Inn Taing Village Tract, Hlegu	The project is fully encouraged because it is very important for implementing the country's projects and development of the country's economy.
5.	Inn Taing Village Tract, Hlegu	We fully welcome the project since it can develop the Villages/Wards, factories and living standards in Hlegu Township. But the project can have some negative impacts on the environment and people. Therefore, technicians and professionals should work together to reduce negative impacts.
6.	Inn Taing Village Tract, Hlegu	We are in full agreement regarding the project because it will support the electricity needs of the county. The project should understand people's worries about the dangers and should explain the protection systems for transmission lines. Law Pi Ta Transmission Line has fallen to the ground due to ground filling. Therefore, traffic and local people face electricity dangers during the rainy season. Maintenance for such issues should be included in the project.
7.	Alan Gapo Village Tract, Hlegu	The project will develop some villages in Hlegu Township. Compensation for affected farmers should be given by negotiating with related persons. Technicians and professionals should work together to reduce negative impacts on the environment. I am ready to help ensure the success of the project.
8.	Alan Gapo Village Tract, Hlegu	The project will improve the economy of Hlegu Township and living standards of the people. Compensation for affected owners of farms and gardens should be given by negotiating with township representatives, village representatives and related government persons. It is very important because 75% of the main livelihood of

No.	Area	Comments/Suggestions
		people in rural areas comes from farming. Technicians and professionals should work together to mitigate negative impacts on the environment. I am ready to help ensure the success of the project.
9.	Alan Gapo Village Tract, Hlegu	The project will improve the economy of Hlegu Township and living standards of the people. Impacted owners of farms and gardens should be given compensation negotiating with Township representatives, village representatives and related government persons. It is very important because 75% of the main livelihood of people in rural areas comes from farming. Technicians and professionals should work together to mitigate negative impacts on the environment. I am ready to help ensure the success of the project.
10	Shan Te Gyi Village Tract, Hlegu	Yangon has limitations in electricity and thus the 500kV transmission line should be installed. The project can produce a few negative impacts on the environment, but it can provide many positive impacts.
11.	Shan Te Gyi Village Tract, Hlegu	The 500kV transmission line project should be implemented at the earliest opportunity to reinforce the power supply in the township, minimizing negative impacts and using modern technologies.
12.	Shan Te Gyi Village Tract, Hlegu	Even though the 500kV transmission line project may impact the environment, it should be implemented because the people in ward, village and township can get a sufficient electricity supply.

Source: JICA study team

4.1.11. Summary of the Study Schedule following EIAP

The Ministry of Natural Resources and Environmental Conservation (MONREC) announced the stipulation of the EIA procedures, which define the detailed legal process for the preparation of the Environmental Management Plan, Initial Environmental Examination (IEE) Report and Environmental Impact Assessment (EIA) Report in Dec 2015. Basically, the IEE Procedure covers the below content, such as the screening of projects (Project Proposal application), qualifications for conducting IEE studies (submission of the 3rd party consultant selection), preparation of IEE report, environmental management plan (EMP), public involvement, submission and approval of IEE report by MONREC (according to the EIAP, the Ministry shall deliver the final decision within sixty working days of receipt of an IEE Report), and monitoring process after approval of the EIA/IEE/EMP report. The Project Proposal was submitted by DPTSC/MOEE in January 2020. However, ECD/MONREC normally does not have the processing capacity to comply with the EIAP description. Additionally, there was the COVID-19 pandemic and work restrictions at ECD/MONREC. DPTSC eventually received the screening results from MONREC-ECD at the end of December 2020.

1) Project Proposal Application — Submitted: January 2, 2020
Re-submitted: September 21, 2020
Received the screening result: December 30, 2020

2) Submission of 3rd Party Consultant selection

3) IEE report preparation

3) Public Consultation Meeting

5) Draft Final IEE Report submission

6) IEE Report Approval

The letter from MONREC-ECD (original Burmese and English translated version) is attached to this report. The screening result was to prepare two IEE Reports for this Project. MONREC-ECD

requested DPTSC to do the following:

a) Submit the Initial Environmental Examination (IEE) report covering all activities, including the construction of a new 500-kV substation (25 ha) in Hlegu and the construction of a new 68.9 km of 500 kV TL from Bago Region (Hpayargyi) to Hlegu.

b) Submit the Initial Environmental Examination (IEE) report covering all activities, including the improvement of Dagon Myothit (East) Substation (230kV) and Hlawga Substation (230kV), the construction of a new 19.5 km of 230kV TL from Hlegu Substation to Dagon Myothit (East) Substation, the construction of a new 17.4 km of 230kV Overhead TL and 4.6 km of 230 kV Underground TL from Hlegu to Hlawga, and improvement of the 22.3 km of existing overhead TL from Hlawga Substation to Thaketa Substation.

c) Get approval for the Third Party (or) Organization from MONREC, in accordance with Article 32 of the Environmental Impact Assessment Procedures, who will conduct the Initial Environmental Examination (IEE).

d) Submit and get the approval for IEE Reports from MONREC, in accordance with Articles 34, 35, 36, 37, and 38 of EIA Procedures, after getting the approval for the Third Party (or) Organization.

For the preparation of the Project Proposal in line with EIAP, the JICA Study Team and DPTSC discussed this from the first fieldwork for the Project (August 2019), and DPTSC submitted the Project Proposal on January 2, 2020, but ECD/MONREC eventually screened it as two IEE projects. The JICA Study team and JICA discussed the screening results from MONREC-ECD, and decided that it will be necessary to proceed with DPTSC support via a loan consultant in consideration of the necessary steps and this Preparatory Survey period. First, DPTSC needs to submit the IEE implementer, corresponding to c) above (submit the 3rd Party Consultant selection form from MOEE/DPTSC to MONREC-ECD). After that, it will be necessary to carry out the required baseline surveys and public consultation meetings in accordance with the EIA Procedures (2015) and General EIA Guidelines (draft in 2017) in Myanmar.

4.2. Land Acquisition and Resettlement

4.2.1. Necessity of Land Acquisition and Resettlement

The Project requires permanent and temporary land acquisition, as described in the following table. The details of the land to be acquired and the amount of resettlement will therefore be studied.

The final decision on the route for the transmission line and the location of towers will be made by DPTSC in the Detailed Design Phase. The route to be studied is the one agreed between the JICA Study Team and DPTSC in the F/S Phase.

Table 4.2-1 Permanent and Temporary Impacts due to the Project

Project Component	Permanent Impacts	Temporary Impacts (during construction work)
Construction of New Substation	● Acquisition of the land (stoppage of existing land use)	● None (possibility of need for temporary access road construction)
Construction of New Transmission Line	● Occupation of the land at the 4 legs of a transmission tower ● Land use regulations (height limit) within the ROW	● Work area at the foot of the transmission towers ● Access road to reach the tower site ● Areas for storage, repairs and other purposes
Construction of Transmission Line Using Existing ROW	● Occupation of the land at the 4 legs of a new transmission tower may be necessary ● Additional land use regulations (height limit) within the ROW may be necessary because of the increase in voltage	● Land for similar purposes above may be necessary
Construction of underground transmission line	(No land acquisition)	● Temporary use of storage, and repair yard ● Temporary occupation of the work area

Source: JICA Study Team

4.2.2. Legal Framework for Land Acquisition and Resettlement

(1) Legal Framework of Republic of the Union of Myanmar

1) Land Acquisition and Resettlement

a. Legal Framework and the Essence of the Laws

The Land Acquisition Law 1894 was terminated when the new Land Acquisition, Resettlement and Rehabilitation Law (hereinafter, 'Land Acquisition Law 2019') (drafted by the Amyotha Hluttaw (House of Nationalities - a 224-seat upper house)) was enacted in August 2019. In the meeting with DPTSC on October 9, 2019, it was agreed that this Project will be implemented based on the Land Acquisition Law 2019.

The Land Acquisition Law 2019, in fact, states in Articles 2 (g), 45, and 67, that acquisition of Farm Land will still apply the Farm Land Law 2012. Most of the substations and the foundations for the transmission towers is currently used as rice paddies and it is assumed that the land is registered as Agricultural Land. For Agricultural Land, the Farm Land Law and Farm Land Rules (2012) will still be applied for the process of land acquisition and the price of land and crops.

The fourth, Vacant, Fallow and Virgin Land Law (VFV Law), defines the process and regulations when there is a proposal to use land classified as Vacant Land, Fallow Land, or Virgin Land. Since the

Project is located in the Yangon Metropolitan area, it is assumed that the Project site is classified as VFV land. Once the site to be acquired is agreed between respective parties, land class and the law to be applied will be confirmed.

b. Related Organizations

Communication and coordination with various authorities related to land acquisition and resettlement are the responsibility of the General Administration Department, both at Township and Region level. Land acquisition issues, including the measurement and finalization of the PAPs list, involve the Township Land Management Committee. DPTSC plays the role of initiator at every step in the implementation, but none of the steps shown in the table can be completed without coordinating with other authorities. DPTSC is also responsible for securing the budget necessary for compensation and assistance. RAP implementing authorities at each step of implementation are shown in Table 4.2-33.

Within DPTSC, staff from Project Manager-1 Office located in Yangon and Project Manager (Civil) Office located in Nay Pyi Taw, both under the supervision of the Power Transmission Projects (South) Office, will join the Township level Compensation Committee to determine the compensation amounts and eligible PAPs.

2) **Land Use Regulations within the ROW**a. Legal Framework

The essence of the land use regulations described in item c. below is published on the website of DPTSC.

b. Related Organizations

Communication and coordination with people to be affected are the responsibility of the General Administration Department at the Township level. DPTSC plays the role of project owner, and explains the project to affected people, and secures the budget necessary for compensation and assistance.

c. Essence of the Regulations

Land use regulations will be applied to the land under the transmission line, as shown in the following table and figures, depending on the voltage. Within the ROW, low-height crops such as rice can be cultivated. Rubber trees, however, need to be cleared where the new ROW passes through the plantations.

Table 4.2-2 Width of ROW

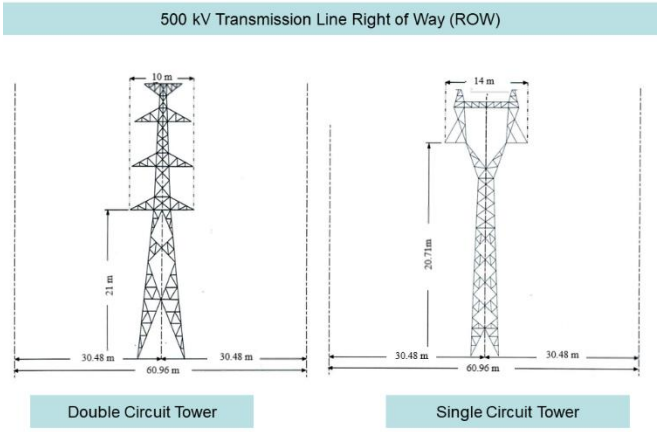
kV	One side	Both sides
230	22.86m	45.72m
500	30.48m	60.96m

Source: DPTSC Website https://www.moee.gov.mm/mm/ignite/page/598 (Visited 2019.11.3)

In addition to setting the ROW, the minimum clearance distance between the overhead transmission line and ground/trees/buildings is determined.

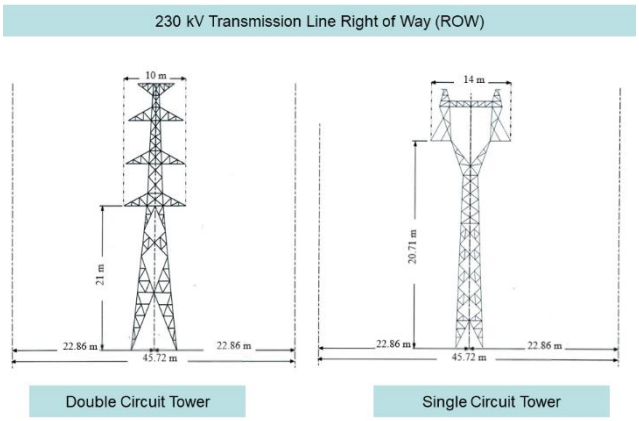
Minimum clearances between overhead transmission lines and ground, trees and buildings are shown in the following figures. Existing land use is expected to be continued in the ROW as long as the minimum clearance distance is secured.

Details on the land use restrictions in the planned ROW are being confirmed with DPTSC as of April 2020.



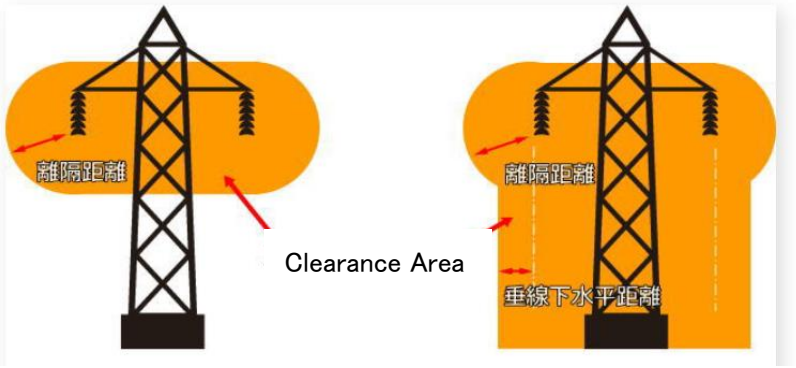
Source: DPTSC website https://www.moee.gov.mm/mm/ignite/page/598 (Visited 2019.11.3)

Figure 4.2-1 500 kV Transmission Tower and Width of ROW



Source: DPTSC website https://www.moee.gov.mm/mm/ignite/page/598 (Visited 2019.11.3)

Figure 4.2-2 230 kV Transmission Tower and Width of ROW



Source：https://www.myhomedata.net/real_estate/important/electric-line.html

Figure 4.2-3 Illustrations of the Transmission Line and Clearance Distance

Table 4.2-3 Minimum Height of Overhead Power Line from the Ground

Content	500 kV
Ground (Mountain or forest areas)	11.0 m
Ground (Paddy field)	14.0 m
River crossing (Above highest water level)	20.0 m
Road	15.0 m
Railway	16.0 m
Trees (Rubber plants etc.)	7.0 m
Distribution line (including poles)	8.0 m
Transmission line (including towers) –	
66 kV transmission line	9.0 m
132 kV transmission line	9.0 m
230 kV transmission line	9.0 m
Other	7.0 m

Source: National Power Transmission Network Development Project (Phase II)

No	Content	230 kV
1	The height of overhead power line where vehicles cannot go through.	6.7 m (22ft)
2	The height of overhead cable line parallel with any road, passage or village street.	7.32 m (24ft)
3	The height of overhead cable line passing over any road, passage or village street.	7.01 m (23ft)
4	Passing over a railway track.	7.62 m (25ft)

a) The maximum distance must be (36.58 m) to pass over railway track.

b) Must pass over the railway track perpendicularly.

c) Medium voltage overhead power line passing should be horizontal and should not be within railway area.

d) Electricity poles or towers should be constructed far from railway, and at least 1.5 times' its height.

Source: DPTSC website https://www.moee.gov.mm/mm/ignite/page/598 (Visited 2019.10.9)

Table 4.2-4 Minimum Clearances between Overhead Transmission Lines and Buildings

Sr.	Description	230kV
1.	Horizontal Distance	15.24 m (50 ft)
2.	Vertical Distance	4.88 m (16 ft)

Source: DPTSC website https://www.moee.gov.mm/mm/ignite/page/598 (Visited 2019.10.9)

(2) JICA Guidelines

The Environmental Screening conducted prior to the Study categorized the Project as Category B because the Project does not belong to a sector, have characteristics, or include sensitive areas that are likely to have significant adverse impacts on the environment and society.

On February 2, 2020, the improvement of the existing Lhawga-Thaketa Transmission Line was newly added to the project scope. The JICA Study Team explained the definition of Categories to DPTSC, and it was well understood by DPTSC that minimization of resettlement is critical to implement not only the improvement project, but the Project as a whole.

(3) Gap Analysis

The gap analysis and measures to fill the gaps between the Myanmar Land Acquisition Law 2019 and JICA Guidelines are described in the next table.

Table 4.2-5 Gap Analysis and Measures to Fill the Gaps between the Myanmar Land Acquisition Law 2019 and JICA Guidelines

No.	JICA Guidelines	Myanmar Land Acquisition Law 2019 (Informal translation by the JICA Study Team)	Gaps Between Laws in Myanmar and JICA Guidelines	Measures to Fill Gaps
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA Guidelines: JICA GL)	48. While carrying out programmes, the Resettlement and Restoration Implementation Body shall: (a) Make necessary arrangements to avoid adverse impact on livelihood activities, life, and environment of host communities, and land owners due to resettlement.	There is no significant difference. The law talks about minimizing the negative impacts. JICA Guidelines require minimization of the resettlement and loss of livelihoods.	The Project examined alternatives to avoid or minimize resettlement and loss of livelihoods.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	No description on minimization. 3. (p) Compensation means money paid to the land owner compensated for the land acquired and buildings on the acquired land, and other immovable objects and crops on the acquired land.	There is no significant difference. No description to encourage minimization of the impact.	The Project examined alternatives to minimize negative impacts of resettlement and loss of livelihoods.
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Following considerations for damages will be provided to all affected, not limited to the resettlers. 3. (o) Cost of land acquisition includes the following costs: (1) Compensation and Damages; (3) Costs related to administration and management; (p) Compensation means money paid to the land owner compensated for the land acquired and buildings on the acquired land, and other immovable objects and crops on the acquired land; (q) Damages means the money (or other support measures) provided to affected persons to compensate for the following	There is no difference.	People who must be resettled involuntarily and people whose means of livelihood will be assisted to improve or restore livelihood at least to pre-project level via cash assistance and job training that will be decided by township level Compensation Committee based on the needs determined during the stakeholder meetings in the implementation phase.

No.	JICA Guidelines	Myanmar Land Acquisition Law 2019 (Informal translation by the JICA Study Team)	Gaps Between Laws in Myanmar and JICA Guidelines	Measures to Fill Gaps
		damage/disturbance due to land acquisition: (1) Living Costs and Meal Costs for land owner before resettlement; (2) Loss of income due to termination/disruption of livelihood activities and jobs; (r) Relocation Expenses includes the expenses incurred due to relocation or removal from the acquired land, as well as support provided for settling at the relocation site.		
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	11. (c) Negotiation on the amounts for Resettlement and Restoration of Livelihoods to be paid by the department and organizations proposing to acquire land, based on expert opinion and the requests of the affected persons, and IN ACCORDANCE WITH FULL REPLACEMENT COST of the affected land and/or assets;	There is no difference.	-
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	33. (d) When field survey is finished, data recorded shall be made public; (e) The confirmed list of loss entitled to be compensated for with Compensation and Damages and the amount of money to be provided, deadline for the request for the payment, the person and the place the compensation request can be submitted, shall be made public: 34. Land Acquisition Implementation Body: (1) Shall take the land in possession after carrying out activities under section 32 and 33; 46. (a) Once the process of taking land in possession and transferring land has begun, resettlement and restoration process for the head of the landowner household shall be implemented.	There is no clear indication about timing of compensation payments in the Myanmar legal framework.	DPTSC will disburse the compensation and assistance before the physical resettlement or taking of the land.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	8. Department and organization under section 7 shall submit the proposal to acquire land for Public Purpose for any matter, to the Central Committee in accordance with the rules. 9. The proposal for land acquisition for Public Purpose shall attach the following necessary documents: (e) Environmental impact assessment report and socio-economic impact assessment report; (f) RESETTLEMENT AND RESTORATION	There is no difference. No matter the scale of the involuntary resettlement, resettlement plan must be prepared.	The Project, at F/S stage, prepared the Resettlement Action Plan. In the implementation phase, the plan will be revised for each component of the project, such as the substation and the transmission lines, based on the results of the Detailed Measurement Survey, population census survey, and socio-economic survey that will be implemented by

No.	JICA Guidelines	Myanmar Land Acquisition Law 2019 (Informal translation by the JICA Study Team)	Gaps Between Laws in Myanmar and JICA Guidelines	Measures to Fill Gaps
		REHABILITATION PLAN/S to be implemented for land owners of the land to be acquired.		DPTSC for each component.
7.	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. (JICA GL)	18. (a) Moreover, copies of Notification of Intention to Acquire Land shall be placed on public noticeboards in the following places where the land is situated, for information of the general public, and if necessary, the Notification shall also be published in the local language: 21. Land Acquisition Implementation Body shall carry out the following duties after informing affected persons at least 7 days in advance about the process related to field survey of the land to be acquired and seeking public opinion about the purpose and condition of land acquisition; (c) seek and accept written objections from affected persons and the public concerning the Purpose and situation of the land acquisition, and may hold hearings or call for the submission of supporting documents and if necessary undertake field surveys to investigate and resolve objections.	Provision of information and seeking public opinion are clearly stated. Organizing consultation meeting with PAPs during the preparation of resettlement action plan is not included in the Myanmar legal framework.	DPTSC, together with other authorities related to land acquisition, will hold consultation meetings with the affected people and their communities before the commencement of the Detailed Measurement Survey, and after the draft resettlement action plan is prepared. Above meetings are additional to the gatherings and individual negotiations that are to be implemented during the land acquisition procedure in the standard Myanmar public works projects.
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	18. (a) The Notification of Intention to Acquire Land shall be placed on public noticeboards in the following places where the land is situated, for information of the general public, and if necessary, the Notification shall also be published in the local language:	There is no difference.	The consultations will use Myanmar language in oral and written communications with assistance via visual images.
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	Affected people will be surveyed by the Project Proponent, and by the Land Acquisition Implementation Body, three times in total, in the RAP planning phase. (LA Law 9(f), 11(a), 21(d)) 6. The Central Committee shall take the following duties: (a) Adopting policies related to land acquisition, resettlement and rehabilitation and developing guidelines in accordance with those policies and monitoring the implementation.	Participation of affected people through surveys in the planning phase is secured. Participation of affected people in implementation and monitoring of resettlement action plan is not required by the LA Law.	By implementing the internal and external monitoring during the implementation phase of the project, affected people will participate as interviewees. In the planning and implementation phase, representatives of affected people will be members of the township-level compensation committee.
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	41. If any affected person is not satisfied with the following matters, they shall make a request to the Land Acquisition Implementation Body by providing the reason why they	The procedure for grievances in the Myanmar context is direct settlement at court, which may	In the planning and implementation phase, DPTSC will establish a site-based grievance redress team as well as a Grievance Focal

No.	JICA Guidelines	Myanmar Land Acquisition Law 2019 (Informal translation by the JICA Study Team)	Gaps Between Laws in Myanmar and JICA Guidelines	Measures to Fill Gaps
		would like to seek a court ruling: (a) Regarding the size of the land for which Compensation and Damages are to be provided; (b) Regarding the amount of Compensation and Damages being provided; (c) Regarding the matter of which affected persons should be compensated or who has the right to receive such Compensation and Damages; (d) Regarding the matter of who should be included in the allocation of Compensation and Damages or whether such allocation is too little or too much.	not easy or accessible to PAPs.	Person in village and township level to receive grievances in oral and written forms. The grievance can be accepted either directly from the affected person or indirectly from other person such as village head.
11.	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 cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advantage of such benefits. (WB OP4.12 Annex A Para. 6)	32. After the Ministry responsible issues the Notification to Acquire Land for Public Purpose and informs the public, the following shall be carried out by Land Acquisition Implementation Committee as necessary; (a) Informing the public AGAIN at the location where the land is situated, about the Notification to Acquire Land, if necessary. Notification in local language shall also be attached; (b) Doing field survey and recording the land to be acquired if necessary and calculating and issuing Compensation and Damages in accordance with the provisions under Chapter 8 of this law.	There is no specific description for identifying affected people as early as possible in the national law.	The locations and the site/ROW boundaries for the substation and the transmission lines are not yet decided by DPTSC/MOEE, or approved by the local authorities as of November 2020. Once the locations and the site/ROW boundaries are decided and approved, DPTSC will implement the Detailed Measurement Survey as early as possible, and declare the cut-off-date, to identify and record affected people and assets.
12.	Eligibility of benefits includes the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para. 15)	3. (c) Land Owner means a person and his/her household who owns the land with strong evidence and who are entitled to demand compensation, damages and other entitlements bestowed by this law for being affected by land acquisition. The term also includes the following affected persons: (1) a person who is recorded in the land records in accordance with existing law as being the owner or person who has the right to possess or use land or a building or a part thereof; (2) a person who has been issued an owner grant or lease grant in respect of that land according to existing law; (3) a person who has been declared or enrolled as the Land Owner under any order of Court or authority; (4) a person who is accepted by local groups and recognized by relevant Region or State government as the owner	No difference.	DPTSC will identify all the persons related to the acquired land who are affected by the land acquisition by the survey in the implementation phase.

No.	JICA Guidelines	Myanmar Land Acquisition Law 2019 (Informal translation by the JICA Study Team)	Gaps Between Laws in Myanmar and JICA Guidelines	Measures to Fill Gaps
		according to customary practices of ethnic nationalities, though there are no legal documents; (5) a person who genuinely **lives on or uses for economic purposes**, such as cultivation, the acquired land **for at least twelve consecutive years before acquiring the land** though there are no legal documents **and invests in the land for livelihood activities**; (l) Affected persons mean land owners and persons related to the acquired land who are affected by the land acquisition.		
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para. 11)	38. Land Acquisition Implementation Committee shall provide the replacement land or other form of compensation equivalent to the compensation money with the approval from Union Government after coming to an agreement with the landowner.	There is no regulation requiring the giving of preference to land-based resettlement strategies.	DPTSC will confirm the choice of the affected households. If the affected households choose replacement land equivalent to the compensation money, DPTSC will coordinate with the Department of Agricultural Land Management and. Statistics, which is a member of the township-level compensation committee.
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para. 6)	3. (r) Relocation Expenses include the expenses incurred due to relocation or removal from the acquired land, as well as support provided for settling at the relocation site; 39. For the land being acquired, the Land Acquisition Implementation Body: (d) Shall provide the following Compensation and Damages if there are perennial crops, seasonal crops, or livelihoods on the acquired land: (1) 3 times the market price based on the standing trees cultivated on the acquired land (2) 3 times the market price based on the yield amount per acre of seasonal crops (3) Estimated loss in income due to the loss of livelihood and job opportunities.	There is no specific description about support between displacement and recovery of original standard of living.	DPTSC will find out whether the amount of compensation and relocation assistance will be sufficient in terms of the support between displacement and recovery of original standard of living for each affected household. If it is found that the amount of compensation and relocation assistance will not be sufficient, the affected households will be treated as Vulnerable and will be given additional support for the transition period.
15.	Particular attention must be paid to the needs of vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para. 8)	50. Resettlement and Restoration Implementation Body shall pay special attention to prevent potential harmful effects due to resettlement and restoration activities on vulnerable people, including women, children, ethnic minorities and those entitled to own land by customary practices.	There is no difference.	-

Source: JICA Study Team

(4) The land acquisition and resettlement policy for the Project

The land acquisition and resettlement policy for the Project is summarized as follows.

I. The Government of Myanmar will use the Project Resettlement Policy (the Project Policy) for the Project specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practices, including JICA's policy. The Project Policy aims to fill in any gaps which local laws and regulations cannot provide for in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the Myanmar legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable, mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.

II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore their former economic and social conditions.

IV. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

: Standard of living adversely affected;

: Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land), commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;

: Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or

: Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets (IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. When a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

IX. The resettlement plans will be designed in accordance with Myanmar Land Acquisition Law 2019 and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of replacement cost.

XII. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based

strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading the livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore the livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, and the elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVll. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided at resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for the supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility: The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, the cut-off-date for titleholders will be the date of commencement of the Detailed Measurement Survey or the last date of the Detailed Measurement Survey. This date will be disclosed to each affected village by the relevant local governments and the villages will disclose this to their populations. The establishment of the eligibility cut-off-date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Replacement Cost: All compensation for land and non-land assets owned by households/shop owners who meet the cut-off date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction, as follows:

a. Productive Land (agricultural, aquaculture, garden and forest) based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes and taxes or in the absence of such sales, based on productive value.

b. Residential land based on actual current market prices that reflect recent land sales, and in the absence of

such recent land sales, based on prices of recent sales in comparable locations with comparable attributes, fees and taxes.

c. Existing local government regulations for compensation calculations for buildings, crops and trees will be used wherever available.

d. Houses and other related structures based on actual current market prices of affected materials.

e. Annual crops equivalent to three times the current market value of the annual yield of crops, or lost harvest timing of crops for temporal impacts, at the time of compensation.

f. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation, plus three times the current market value of the annual yield, or lost harvest timing for temporal impact.

g. For standing trees, including timber trees cultivated on the acquired land, cash compensation at three times the market price that should be in line with local government regulations, if available, for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree. (Act 2019 33 (a) 4)

Source: JICA Study Team

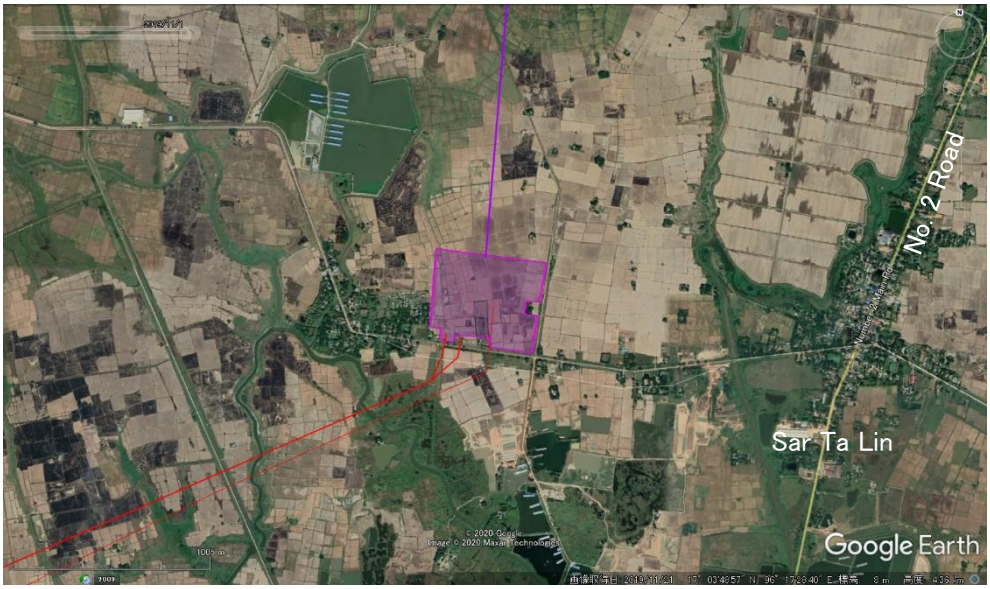
4.2.3. Location and Scale of Land Acquisition and Resettlement

(1) New Construction of the 500 kV Sar Ta Lin Substation

Based on a request by DPTSC, 24.3 ha (60 acres) will be selected for the site for the new 500 kV substation. The existing land use of the site is irrigated rice paddy with 2 harvests per year. Houses surrounded by various trees are scattered in the matrix of the rice paddy. No temporary lease of land is planned for the substation.

Purple: Substation site
Source: JICA Study Team

Figure 4.2-4 500kV Sar Ta Lin Substation Site Close-up



Source: JICA Study Team

Figure 4.2-5 500kV Sar Ta Lin Substation Site and Surrounding Area

(2) New Construction and Improvement of Transmission Lines

1) Transmission Lines

The Project contains 4 transmission line routes, as shown inTable 4.2-6 . The Hlawga - Thaketa Line is improvement (voltage increase) work within already existing ROW. The other three lines are new constructions.

Table 4.2-6 New Constructions and Improvement of Transmission Lines

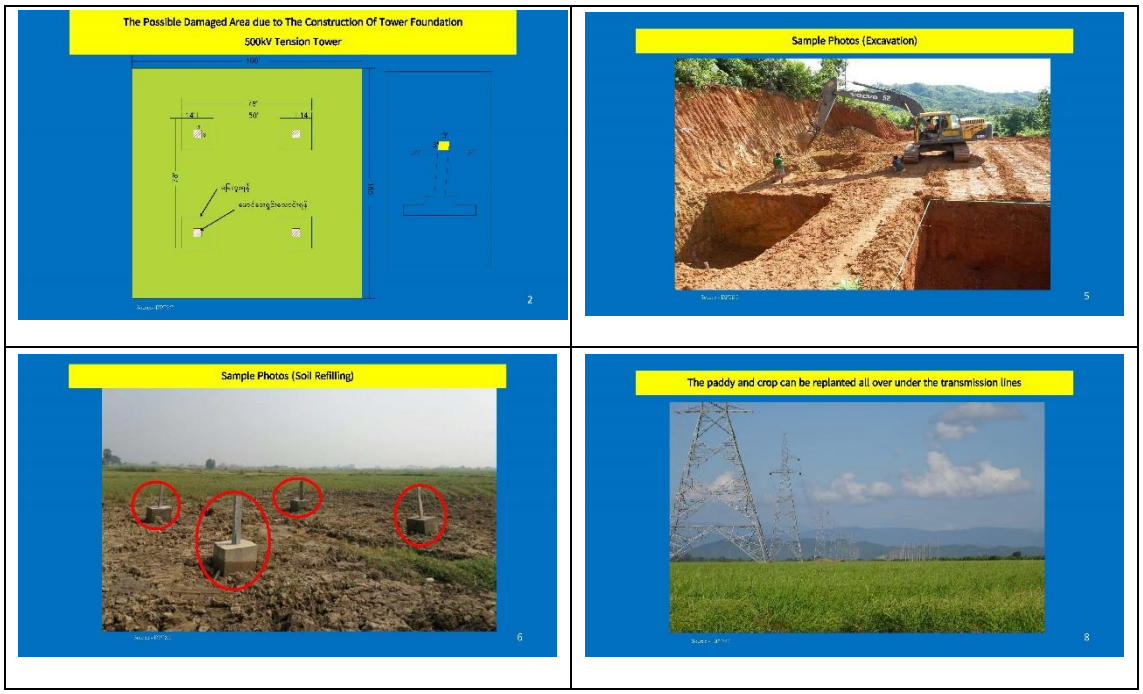
No.	Voltage	Start	End	Overhead		Under-ground	Total
				New	Improvement		
1	500 kV	Pharyargyii	Sar Ta Lin	70.0 km	-	-	70.0 km
2	230 kV	Sar Ta Lin	East Dagon	18.0 km	-	-	18.0 km
3	230 kV	Sar Ta Lin	Hlawga	16.9 km	-	4.6 km 6.0 km	27.5 km
4	230 kV	Hlawga	Thaketa	-	18.0 km	5.7 km	23.7 km
Total				104.9 km	18.0 km	16.3 km	139.2 km

Source: JICA Study Team

Permanent impacts from the above transmission line work include the occupation of land for 4 foundation blocks per tower, and land use (height) limitations of the land within the ROW.

During the construction of the towers on farmland, relatively large excavations will be necessary, as shown in the figure below. After finishing the base concrete work, however, 4 separated base blocks will remain on the ground surface, and DPTSC has explained that the land owner can continue farming even under the towers after the completion of the work. With such conditions, DPTSC does not acquire ownership rights or farming rights for the land under the towers. DPTSC pays cash for a land lease during the construction work that is equivalent to the size of the loss of harvest caused by the land

lease.



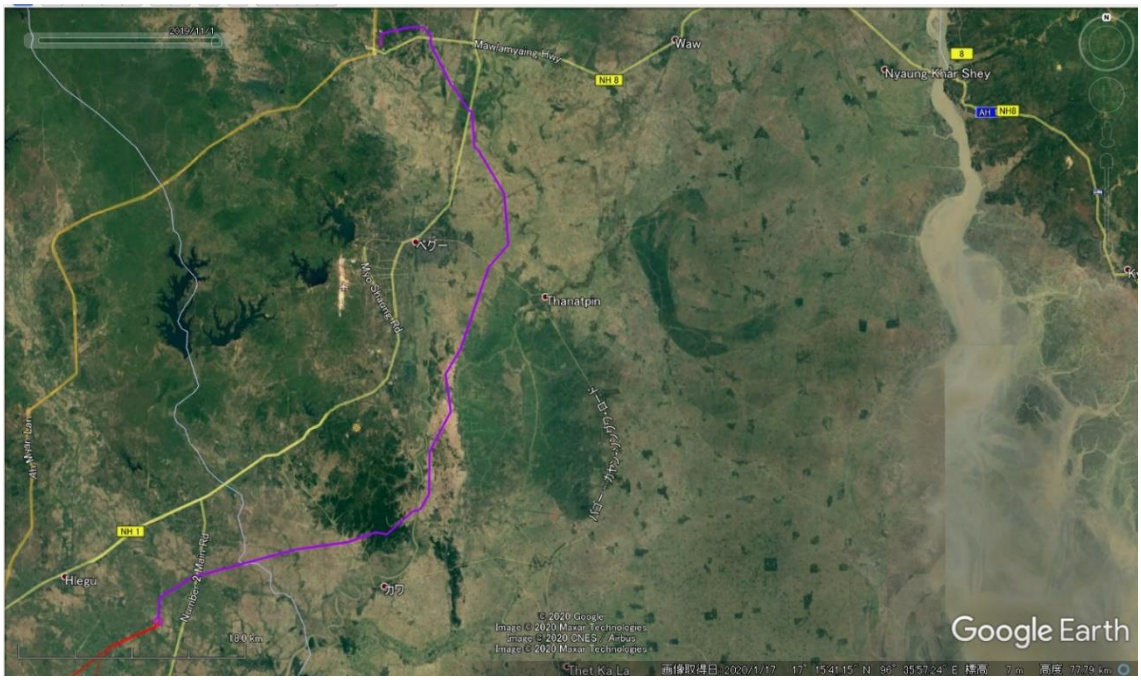
Source: DPTSC

Figure 4.2-6 Land Occupation by DPTSC under the Transmission Towers

Temporary land lease during the construction will be necessary for the access road between the towers (within ROW, width about 4m (14ft)), for the work areas around the tower foundations, and for the yard for stocks and machinery.

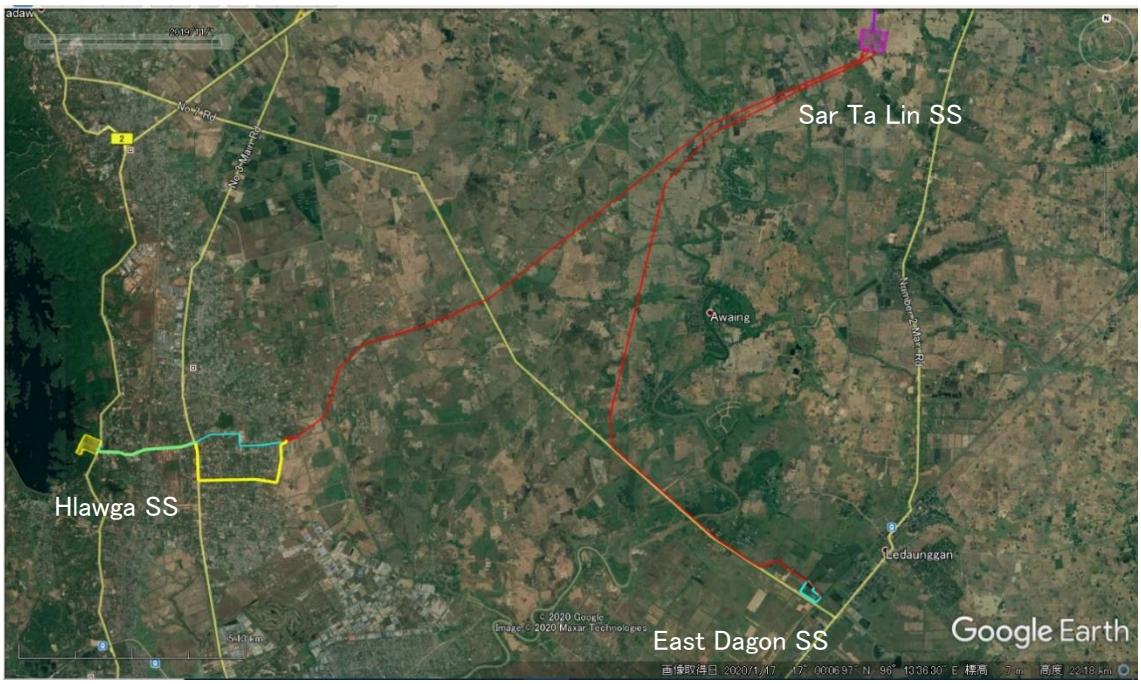
Underground transmission lines are planned for areas where the lines need to cross existing urban areas. Since the underground lines are planned to be under existing roads, no permanent acquisition of private land is necessary. Permanent facilities such as maintenance manholes will be set within the road ROW. Temporary land lease will be necessary with overhead transmission lines for storage.

The ROW where transmission line improvement work is planned is defined by a road and ditches on both side, and it is basically open land in between. Houses and shops are situated along the crossing road where the road crosses the ROW. The improvement work will consist of the removal of existing lines and towers, the construction of new, higher towers, and the stringing of the transmission lines. All this work, including temporary storage and work areas with tall cranes, will use the space within the ROW. Access to the ROW from the adjacent road may require the temporary lease of privately owned vacant land.



Source: JICA Study Team

Figure 4.2-7 Route of the 500kV Transmission Line (Purple: Pharyargyii SS to Sar Ta Lin SS)



Source: JICA Study Team

Figure 4.2-8 New 230kV Overhead Transmission Lines (Red)

Source: JICA Study Team

Figure 4.2-9 Existing 230kV Transmission Line (Orange: Overhead, Blue: New underground)

2) Land Lease for Tower Foundations

The work area surrounding the base of the transmission line towers will be leased during the Construction Phase. The required land area totals 5.6 ha, as shown in the table below.

Table 4.2-7 Estimated Size of Land Acquisition for Transmission Line Construction

No.	Voltage	Start	End	Number of Towers	Side Length	Average Area per Tower	Total
1	500 kV	Pharyargyii	Sar Ta Lin	152	15-20m	243m2	3.7ha
2	230 kV	Sar Ta Lin	East Dagon	45	14-16m	207m2	0.9ha
3	230 kV	Sar Ta Lin	Hlawga	45			1.0ha
4	230 kV	Hlawga	Thaketa	(51)*			-*
Total				242			5.6ha

*: Located within existing ROW
Source: JICA Study Team

3) Temporary Lease of Land for the Access Road during the Construction Phase

To construct the overhead transmission lines, temporary access roads will be constructed within ROW with a width of 4m (14ft). The total area to be leased is estimated as 42.0 ha.

Table 4.2-8 Temporary Leases of Land for the Access Road during the Construction Phase

No.	Voltage	Start	End	Length		Width of Access Road	Necessary Area
				New	Improvement		
1	500 kV	Pharyargyii	Sar Ta Lin	70.0 km	-		28.0 ha

No.	Voltage	Start	End	Length		Width of Access Road	Necessary Area
				New	Improvement		
2	230 kV	Sar Ta Lin	East Dagon	18.0 km	-	4m	7.2 ha
3	230 kV	Sar Ta Lin	Hlawga	16.9 km	-		6.8 ha
4	230 kV	Hlawga	Thaketa	-	18.0 km		-*
Total				104.9 km	18.0 km		42.0 ha

*Located within existing ROW
Source: JICA Study Team

4) Area of New ROW

As shown in Table 4.2-9, land use within the ROW of the overhead transmission line will have a height limit restriction. The width of the ROW is about 61m for the 500kV line and about 46m for 230kV lines. The total area to be newly affected is calculated as about 590ha.

Table 4.2-9 Area of Newly Designated ROW

No.	Voltage	Start	End	Length	Width	Area
1	500 kV	Pharyargyii	Sar Ta Lin	70.0 km	60.96m	426.7ha
2	230 kV	Sar Ta Lin	East Dagon	18.0 km	45.72m	82.3ha
3	230 kV	Sar Ta Lin	Hlawga	16.9 km		77.3ha
4	230 kV	Hlawga	Thaketa	-		-
Total				104.9 km		586.3ha

-: Use already existing ROW
Source: JICA Study Team

(3) Population Census

1) Sar Ta Lin Substation

Direct displacement of residents will not occur due to the new substation constructions because the site boundary is set to avoid any existing structures.

Since the satellite photo shows 81 lots of rice paddies surrounded by footpaths, the maximum number of land owner households to be affected at the site can be estimated as 81.

In the implementation phase of the Project, affected land owners will be identified, and a population census for them will be carried out.

Because the rice paddies within the site receive irrigation water, it can be assumed that the paddies are covered by a regional, strategic farming plan or project. Therefore, it can be assumed that the land owners will be either legal owners or customary owners, and will not include illegal occupation.

Other Project Affected Peoples (PAPs) who will not be relocated by the Project, such as seasonal agricultural wage laborers or temporary agricultural wage laborers, will be identified and a population census for them will be carried out during the implementation phase of the Project.

No temporary lease of land is planned for the construction of the substation.

Table 4.2-10 Population Census of the PAPs from the Construction of the Sar Ta Lin Substation

Type of loss	No of PAUs			No of APs		
	Legal	Illegal	Total	Legal	Illegal	Total
Physical displacement required						
1 HH (Structure owner on Gov. land)	0	0	0	0	0	0
2 HH (Structure on Private land)	0	0	0	0	0	0
3 HH (Tenants)	0	0	0	0	0	0
4 CBEs (Structure owner on Gov. land)	0	0	0	0	0	0
5 CBEs (Structure owner on Private land)	0	0	0	0	0	0
6 CBEs (Tenants)	0	0	0	0	0	0
7 Community-owned structures including physical cultural resources	0	0	0	0	0	0
Sub-total	0	0	0	0	0	0
Physical displacement not required [a]						
8 Land owners	Max 81	0	Max 81	371	-	371
9 Wage earners	b	0	b	b	-	b
Sub-total	Max 81	0	Max 81	371	-	371
Grand Total (1-9)	Max 81	0	Max 81	371	0	371

HH: House-hold, CBEs: Commercial and Business Enterprises
a: The number is an estimation. The 81 lots of rice paddies surrounded by footpaths is estimated as the maximum number of land owner households. Number of affected persons is calculated by assuming an average household size of 4.57 persons per household.
b: Seasonal and temporal laborers to be affected will be identified in the implementation phase of the Project
Source: JICA Study Team

2) Transmission Lines

In total, 5.6 ha for construction of the towers, and 42.0 ha for the access road between the towers will be leased to construct the transmission lines. In addition, new ROW of about 590 ha will be subject to land use restrictions (height limit). DPTSC has a policy of avoiding not only affecting existing structures, but also affecting residential plots in the decision on tower locations. The proposed routes and ROWs were studied by the JICA Study Team and the Team agreed that technically existing structures can be avoided. Therefore, no relocation of residents, businesses, or commercial entities is expected.

The size of the work areas for the tower base is 10 to 20 m square for a 500kV tower, and 14 to 16 m square for a 230kV tower. These areas are far smaller than the average size of one rice paddy in the Study Area. Therefore, it can be assumed that one land owner will be affected by the construction of one tower. The maximum number of land owner households to be affected by the 242 transmission towers was assumed as 242.

In the implementation phase of the Project, affected land owners, seasonal or temporary agricultural wage laborers, and businesses who will be affected by the temporal land lease and/or land use restrictions will be identified, and a population census for them will be carried out.

Table 4.2-11 Population Census of the PAPs from the Construction of the Transmission Lines

Type of loss	No of PAUs			No of APs		
	Legal	Illegal	Total	Legal	Illegal	Total
Physical displacement required						
1 HH (Structure owner on Gov. land)	0	0	0	0	0	0
2 HH (Structure on Private land)	0	0	0	0	0	0
3 HH (Tenants)	0	0	0	0	0	0
4 CBEs (Structure owner on Gov. land)	0	0	0	0	0	0
5 CBEs (Structure owner on Private land)	0	0	0	0	0	0
6 CBEs (Tenants)	0	0	0	0	0	0
7 Community-owned structures including physical cultural resources	0	0	0	0	0	0
Sub-total	0	0	0	0	0	0
Physical displacement not required (land lease during construction for tower base) [a]						
8 Land owners	Max 242	b	Max 242	1,106	b	1,106
9 Wage earners	b	b	b	b	b	b
Sub-total	Max 242	b	Max 242	1,106	b	1,106
Grand Total (1-9)	Max 242	b	Max 242	1,106	b	1,106

HH: House-hold, CBEs: Commercial and Business Enterprises
a: The number is an estimation. The 81 lots of rice paddies surrounded by footpaths is estimated as the maximum number of land owner households. Number of affected persons is calculated by assuming an average household size of 4.57 persons per household.
b: Seasonal or temporary laborers to be affected will be identified in the next phase of the Project
Source: JICA Study Team

(4) Land Survey and Asset Census

1) Sar Ta Lin Substation

According to past and recent satellite photos, 25.0ha of land is currently used for rice paddies, or was used for rice paddies. The land type, therefore, is expected to be registered farm land. Official land type information needs to be obtained from the Hlegu Township Department of Agriculture, Land Management and Statistics during the implementation phase of the Project.

Table 4.2-12 Land Area to be Affected by the Construction of the Sar Ta Lin Substation

No	Location	Land Type	Affected	Total
1	Hlegu Township	Farm Land	25.0 ha	25.0 ha
2		Other land	a	
Total				25.0 ha

a: Need final confirmation by Hlegu Township Department of Agriculture, Land Management and Statistics.
Source: JICA Study Team

Table 4.2-13 Structures to be Affected by the Construction of the Sar Ta Lin Substation

No.	Location	Type of Building	Affected	Total
1	Hlegu Township	Residential Building	0	0
2	Hlegu Township	Shops	0	
3	Hlegu Township	Public Institution	0	

Source: JICA Study Team

Table 4.2-14 Trees and Crops to be Affected by the Construction of the Sar Ta Lin Substation

No.	Location	Type of Plants	Area/Number
Crop			
1	Hlegu Township	Rice (2 times per year)	25.0 ha
Perennials, trees*			
2	Hlegu Township	Palm tree	17
3		Banana	560
4		Acacia tree (border tree)	90

*: Estimated using satellite photos
Source: JICA Study Team

2) Transmission Lines

Land areas in townships affected by the lease of construction areas and access roads, as well as the ROW subject to land use restrictions, are shown in the following tables.

As the route maps show, the majority of the stretches of the lines pass farm land (mainly rice paddies) and some parts pass through wooded areas, including rubber plantations.

Table 4.2-15 Land Area to be Affected by the Construction of the Transmission Lines

500 kV PharyargyiiSar Ta Lin							
District	Township	Length (km)	%	No. of towers	Work area (243m2/tower) (ha)	Access road (W=4m) (ha)	ROW (W= 60.96m)
Bago	Bago	39.0	56%	85	2.1	15.6	237.7
	Thanatpin	14.1	20%	31	0.7	5.6	86.0
	Kawa	3.9	6%	8	0.2	1.6	23.8
Northern Yangon	Hlegu	13.0	19%	28	0.7	5.2	79.2
Total		70.0	100%	152	3.7	28.0	426.7

230 kV Sar Ta Lin East Dagon							
District	Township	Length (km)	%	No. of towers	Work area (207m2/tower) (ha)	Access road (W=4m) (ha)	ROW (W= 45.72 m) (ha)
Northern Yangon	Hlegu	14.4	80%	36	0.7	5.8	65.8
Eastern Yangon	Dagon Myothit (East)	3.6	20%	9	0.2	1.4	16.5
Total		18.0	100%	45	0.9	7.2	82.3

230 kV Sar Ta Lin Hlawga							
District	Township	Length (km)	%	No. of towers	Work area (207m2/tower) (ha)	Access road (W=4m) (ha)	ROW (W= 45.72 m) (ha)
Northern Yangon	Hlegu	14.9	88%	40	0.8	6.0	68.1
	Mingalardon	2.0	12%	5	0.1	0.8	9.1
Total		16.9	100%	45	0.9	6.8	77.3

Source: JICA Study Team

(Existing ROW)

230 kV Hlawga Thaketa (Existing ROW)				
District	Township	Length (km)	%	No. of towers
Northern Yangon	Mingalardon	3.4	19%	10
Eastern Yangon	North Okkalapa	1.5	8%	4
	Dagon Myothit (North)	7.9	44%	22
	Dagon Myothit (South)	4.9	27%	14
	Thaketa	0.3	2%	1
Total		18.0	100%	51

Source: JICA Study Team

Table 4.2-16 Impacts by Township

Length of Transmission Line						
District	Township	500kV	Sar-ED	Sar-Hlawga (overhead)	Hlawga-Thake (east of NH3)	Total
Bago	Bago	39.0				39.0
	Thanatpin	14.1				14.1
	Kawa	3.9				3.9
Northern Yangon	Hlegu	13.0	14.4	14.9		42.3
	Mingalardon			2.0	(3.4)	2.0 (3.4)
Eastern Yangon	Dagon Myothit (East)		3.6			3.6
	North Okkalapa				(1.5)	(1.5)
	Dagon Myothit (North)				(7.9)	(7.9)
	Dagon Myothit (South)				(4.9)	(4.9)
	Thaketa				(0.3)	(0.3)
Total		70.0	18.0	16.9	(18.0)	104.9 (18.0)

(): Within the existing ROW

Number of Transmission Line Towers (Pylon)						
District	Township	500kV	Sar-ED	Sar-Hlawga (overhead)	Hlawga-Thake (east of NH3)	Total
Bago	Bago	85				85
	Thanatpin	31				31
	Kawa	8				8
Northern Yangon	Hlegu	28	36	40		104
	Mingalardon			5	(10)	5 (10)
Eastern Yangon	Dagon Myothit (East)		9			9
	North Okkalapa				(4)	(4)
	Dagon Myothit (North)				(22)	(22)
	Dagon Myothit (South)				(14)	(14)
	Thaketa				(1)	(1)
Total		152	45	45	(51)	242 (51)

(): Within the existing ROW
Source: JICA Study Team

Table 4.2-17 Land Lease Area by Township (ha)

		500kV		Sar-ED		Sar-Hlawga (overhead)		Hlawga-Thake (east of NH3)		Total
District	Township	Work area	Access road	Work area	Access road	Work area	Access road	Work area	Access road	
Bago	Bago	2.1	15.6*							17.7
	Thanatpin	0.7	5.6							6.4

	Kawa	0.2	1.6							1.8
Northern Yangon	Hlegu	0.7	5.2	0.7	5.8	0.8	6.0			19.2
	Mingalardon					0.1	0.8	-	-	0.9
Eastern Yangon	Dagon Myothit (East)			0.2	1.4					1.6
	North Okkalapa							-	-	-
	Dagon Myothit (North)							-	-	-
	Dagon Myothit (South)							-	-	-
	Thaketa							-	-	-
Total		3.7	28.0	0.9	7.2	0.9	6.8			47.5

*: 2.26ha of woodland is included
Source: JICA Study Team

Table 4.2-18 New ROW Area by Township

District	Township	500kV	Sar-ED	Sar-Hlawga (overhead)	Hlawga-Thake (east of NH3)	Total
Bago	Bago	237.7				237.7
	Thanatpin	86.0				86.0
	Kawa	23.8				23.8
Northern Yangon	Hlegu	79.2	65.8	68.1		213.2
	Mingalardon			9.1	-	9.1
Eastern Yangon	Dagon Myothit (East)		16.5			16.5
	North Okkalapa				-	-
	Dagon Myothit (North)				-	-
	Dagon Myothit (South)				-	-
	Thaketa				-	-
Total		426.7	82.3	77.3	-	586.3

Source: JICA Study Team

The 500 kV Transmission Line passes through rubber plantations at 2 locations, one north of Phayargi Substation, and the other north of Tongyi Rail Station. The total length over the plantation is 5.65 km. The trees within the 60.96 m ROW will be permanently cleared. The land ownership will remain with the original owner, and the owner will be able to use the land for the cultivation of low-height crops.

The area of wooded ROW is calculated as 34.44 ha (= 5.65km x 60.96m). The field survey in May 2020 found that the density of rubber trees varies widely between 560/ha, 720/ha, and 930/ha. Taking the simple average of 737 trees/ha, the number of trees to be cleared within the new ROW was calculated as 25,383 (= 34.44ha x 737 trees/ha).

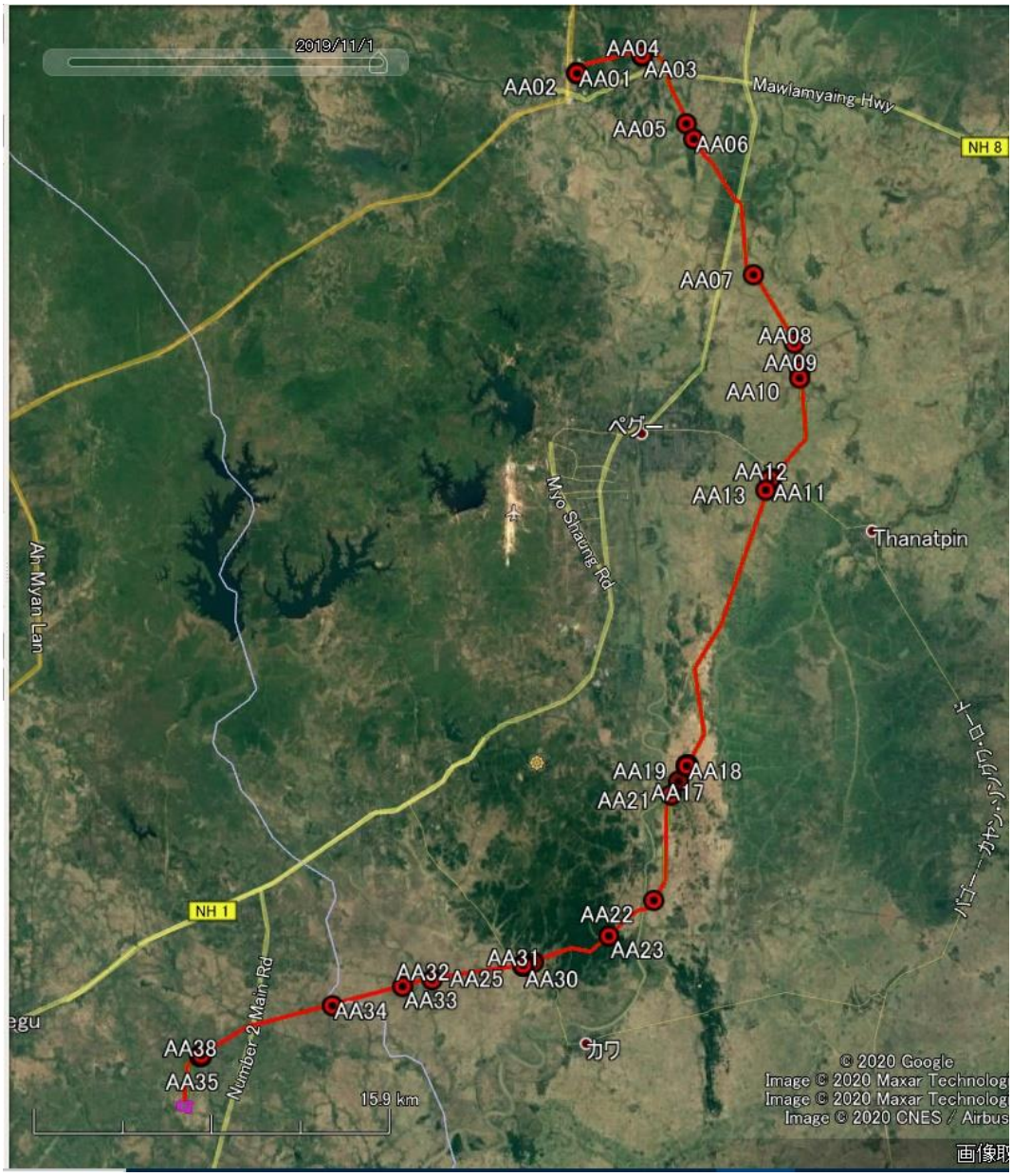
A detailed field survey of assets, jointly conducted by all respective parties, will be necessary to articulate the number of trees, along with their types and annual yields, during the implementation phase of the Project.

The results of structure count within ROWs based on satellite photos are shown in the table below. DPTSC and the JICA Study Team agreed on the policy for these structures, as follows: for the 500kV line, the towers and the route of the line will be adjusted in the next phase of the Project so that no structures will be on the ROW; for 230kV lines, construction work will be implemented keeping the existing structures as they are. With this policy, impact on private assets within the ROW is avoided.

Table 4.2-19 Structure Count within ROWs based on Satellite Photos and Handling Policy

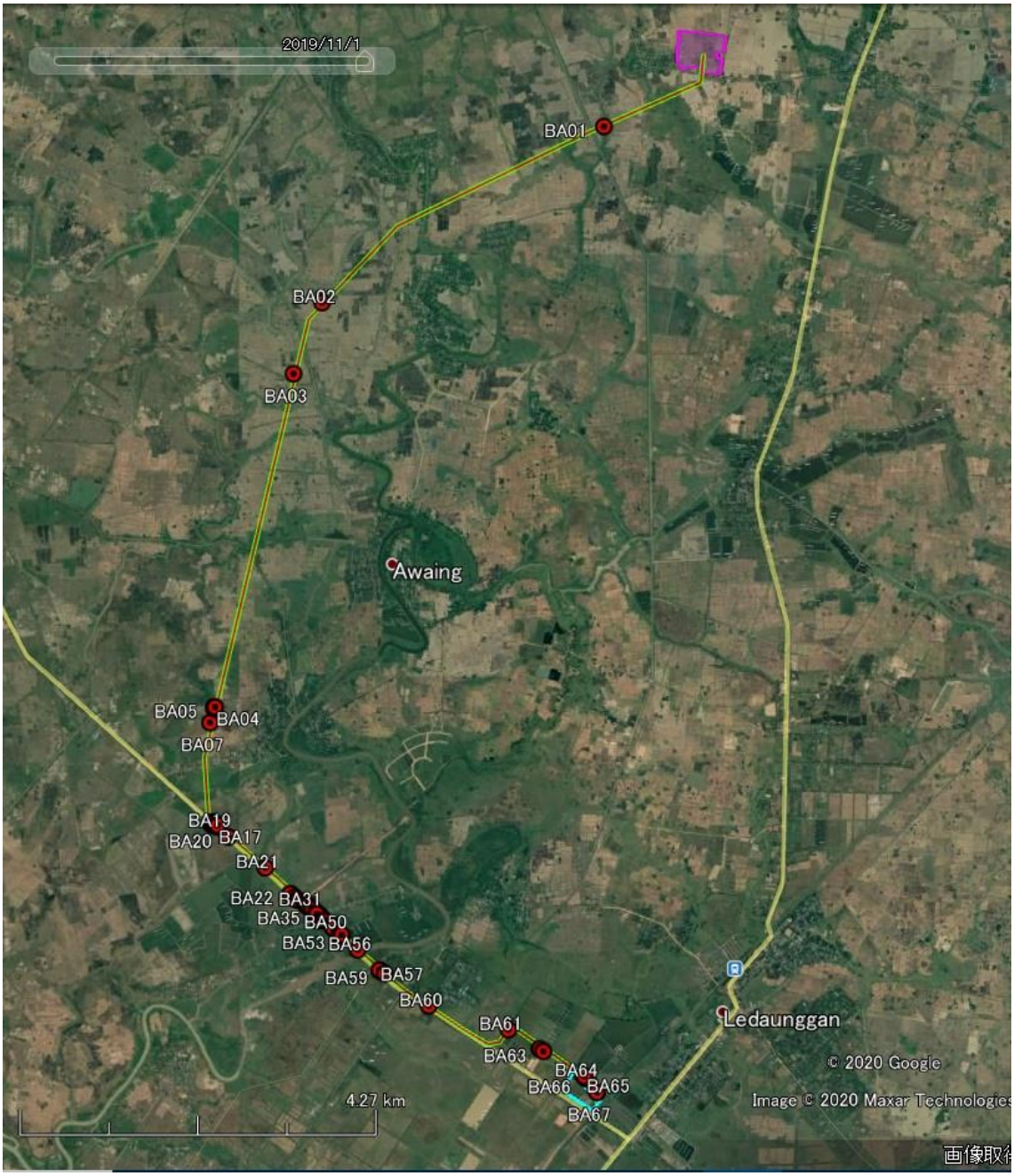
No.	Voltage	Start	End	Overhead		Number of Structures	DPTSC and the JICA Study Team Policy
				New	Existing		
1	500 kV	Phayargi	Sar Ta Lin	70.0 km	-	38	Location of the towers and route will be adjusted so that no structures will be on the ROW
2	230 kV	Sar Ta Lin	East Dagon	18.0 km	-	67 On No.7 Road: 60 Other: 7	Location of the towers will be adjusted so that existing structures will not be affected during the construction, and will remain as-is after the construction
3	230 kV	Sar Ta Lin	Hlawga	16.9 km	-	6	Location of the towers will be adjusted so that existing structures will not be affected during the construction, and will remain as-is after the construction
4	230 kV	Hlawga	Thaketa	-	18.0 km	433	With the demolition of existing towers and lines, and with the construction of new towers and lines, construction methods and locations will be selected so that existing structures will not be affected during the construction, and will remain as-is after the construction

Source: JICA Study Team



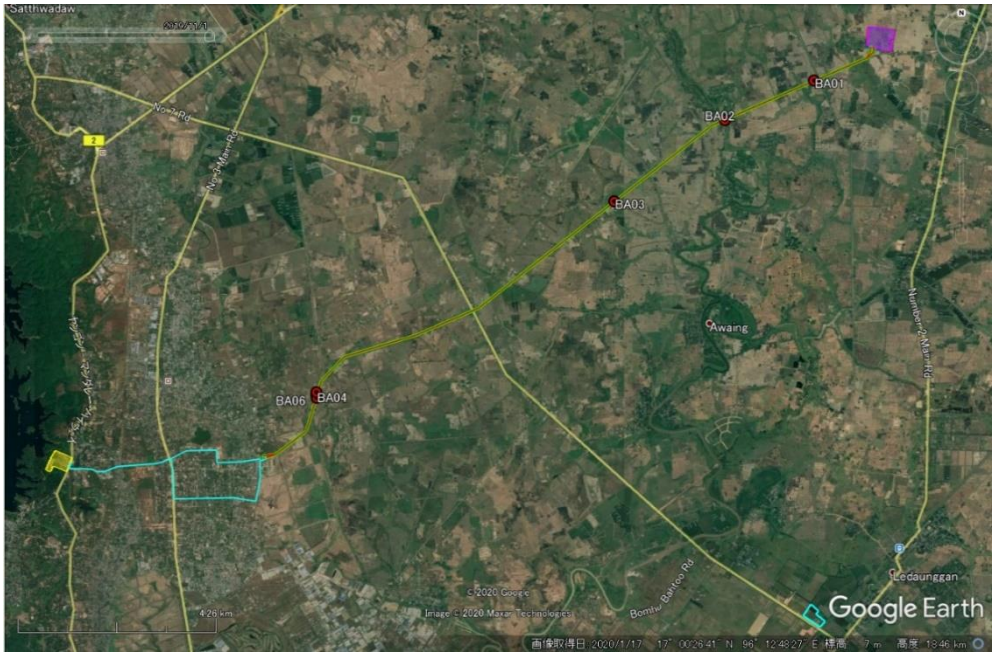
Source: JICA Study Team

Figure 4.2-10 Existing Structures (AA01-AA38) and 500kV Transmission Line Route



Source: JICA Study Team

Figure 4.2-11 Existing Structures (BA01-BA67) and 230kV Transmission Line Route (Sar Ta Lin-East Dagon)



Source: JICA Study Team

Figure 4.2-12 Existing Structures (BA01-BA06) and 230kV Transmission Line Route (Sar Ta Lin-Hlawga)

Source: JICA Study Team

Figure 4.2-13 Existing Towers (HT), ROW (Green), and Structures (Red circles) along the 230kV Transmission Line (Hlawga-Thaketa)

(5) Livelihood and Living Conditions Survey

Literature survey results on the livelihood and living conditions in the area to be affected are

summarized as follows. Identification of the Project Affected Persons and a survey on their livelihood and living conditions will be done in the implementation phase of the Project.

The townships to be affected by the Project are listed in Table 4.2-20.

Table 4.2-20 Planned Facilities and Townships to be Affected

Region	Township	Sar Ta Lin Substation	500kV TL	230kV TL
Bago	Bago		X	
	Thanatpin		X	
	Kawa		X	
Yangon	Hlegu	X	X	X
	Mingalardon			X
	North Okkalapa			X
	North Dagon			X
	South Dagon			X
	East Dagon			X
	Thaketa			X

Source: JICA Study Team

Land use in the affected townships is shown in Table 4.2-21. Kawa and Hlegu townships mainly consist of agricultural land. The southern townships, North Okkalapa, North Dagon, South Dagon, East Dagon, and Thaketa, consist of urban land such as civil land.

Table 4.2-21 Land Use in Affected Townships

Sr. No	Bago Region			
	Township	Bago	Thanatpin	Kawa
	Total Land Area (km2)	2,905.1	997.2	1,677.5
1	Agricultural Land (%)	28.62	**65.13**	**48.21**
	1) Paddy Field	14.59	63.67	47.23
	2) Farmland	0	0	0.00
	3) Cultivated Land	0.82	0.00	0.00
	4) Garden Field	13.20	1.46	0.98
	5) Hill-side Cultivated Land	0.01	0	0.01
2	Abandoned Land (%)	0	0	0.10
	1) Paddy Field	0	0	0.10
	2) Farmland	0	0	0.00
	3) Cultivated Land	0	0	0.00
	4) Garden Field	0	0	0.00
	5) Hill-side Cultivated Land	0	0	0
3	Grazing ground (%)	0.72	2.60	0.13
4	Industrial Area (%)	0.25	0.01	0.02
5	Civil land and other types of land (%)	1.71	0.18	0.05
6	Village Land (%)	1.23	3.10	3.00
7	Other (%)	5.41	28.98	**46.98**
8	Reserved forest/Natural Forest Area (%)	**55.14**	5.53	0.00
9	Wild Forest (%)	0	0	0
10	Wild Land (%)	0.13	0.01	1.51
11	Non-cultivated Land (%)	8.19	0.82	0.00
Total (%)		101.40	100	100

Source: Township Profiles, General Administration Department, 2019

Sr. No	Yangon Region							
	Township	Hlegu	Mingalardon	North Okkalapa	North Dagon	South Dagon	East Dagon	Thaketa
	Total Land Area (km2)	1,494.2	108.0	26.7	26.3	79.1	91.0	12.8
1	Agricultural Land (%)	**40.88**	16.06	0	0.77	27.31	8.14	0
	1) Paddy Field	22.46	10.64	0.00	0.77	27.31	8.14	0.00
	2) Farmland	0	0	0	0	0	0	0
	3) Cultivated Land	0	0	0	0	0	0	0
	4) Garden Field	18.36	5.42	0	0	0	0	0
	5) Hill-side Cultivated Land	0.06	0.00	0	0	0	0	0
2	Abandoned Land (%)	3.43	0.20	0	0	0	5	0
	1) Paddy Field	2.82	0.00	0	0	0	0	0
	2) Farmland	0	0	0	0	0	0	0
	3) Cultivated Land	0	0	0	0	0	0	0
	4) Garden Field	0.60	0.20	0	0	0	0	0
	5) Hill-side Cultivated Land	0.01	0	0	0	0	0	0
3	Grazing ground (%)	0.59	0	0	0	0	0	0
4	Industrial Area (%)	0.07	0.20	30.49	0.39	1.21	0.58	5.07
5	Civil land and other types of land (%)	0.31	14.93	**68.90**	**98.84**	**59.00**	**65.05**	**90.76**
6	Village Land (%)	1.16	12.86	0	0	0	2.14	0
7	Other (%)	28.65	**28.21**	0.61	0	0	19.47	4.18
8	Reserved forest/Natural Forest Area (%)	24.28	26.89	0	0	0	0	0
9	Wild Forest (%)	0	0	0	0	0	0	0
10	Wild Land (%)	0.62	0.65	0	0	0	0	0
11	Non-cultivated Land (%)	0	0	0	0	12.49	0	0
Total		100	100	100	100	100	100	100

Source: Township Profiles, General Administration Department, 2019

Population and household numbers are shown in Table 4.2-22. Average household size is about 5 persons. Population density is low in Bago, Thanatpin, Kawa, and Hlegu townships, and quite high in Thaketa and North Okkalapa townships.

Table 4.2-22 Number of Houses, Households and Population

Township	Houses	Households	Total Population	Average population per one house	Average Household Size	Population Density (per km2)
	a	b	c	d=c/a	e=c/b	f
Bago	105,280	115,440	439,622	4.18	3.81	151
Thanatpin	29,178	30,185	165,738	5.68	5.49	166
Kawa	46,242	47,967	217,604	4.71	4.54	130
Hlegu	48,633	51,563	239,458	4.92	4.64	160
Mingalardon	47,699	57,380	263,798	5.53	4.60	2,443
North Okkalapa	46,303	65,669	289,928	6.26	4.41	**10,847**
North Dagon	33,581	39,953	198,743	5.92	4.97	7,560
South Dagon	56,949	59,725	325,886	5.72	5.46	4,120
East Dagon	35,814	39,284	172,277	4.81	4.39	1,892

Thaketa	32,589	45,806	215,696	6.62	4.71	**16,893**
Total	482,268	552,972	2,528,750	**5.24**	**4.57**	

Source: Township Profiles, General Administration Department, 2019

The percentage of each of the 13 ethnic groups in Myanmar is shown in Table 4.2-23. The Bamar group makes up the vast majority in all the townships. In Thaketa and South Dagon, foreign populations, who do not belong to these groups, make up around 10 percent.

Table 4.2-23 Ethnic Composition

Township		Kachin	Kayar	Kayin	Chin	Mon	Bamar	Rakhine	Shan	Pa O	Palaung	Danu	Taungyo	Kayan	Total
Bago	Population	115	104	16,329	463	5,517	390,116	793	822	1,574	5,568	2,837	2,165	2,205	428,608
	%	0.03	0.03	3.66	0.11	1.26	**88.73**	0.18	0.19	0.36	1.29	0.64	0.49	0.5	97.47
Thanatpin	Population	5	–	13	–	30	159,412	2	4	1	–	–	–	–	159,467
	%	0.003	–	0.008	–	0.018	**96.183**	0.0012	0.0024	0	–	–	–	–	96.22
Kawa	Population	1	–	4,524	–	22	208,592	19	6	–	–	–	–	–	213,164
	%	0	–	2	–	0	**95.8**	0	**0**	–	–	–	–	–	97.80
Hlegu	Population	36	2	12,231	600	239	222,421	388	125	–	–	–	–	–	236,042
	%	0.01	–	5.1	0.25	0.1	**92.88**	0.16	0.05	–	–	–	–	–	98.55
Mingalardon	Population	519	221	3,839	2,352	1,642	247,899	3,126	504	–	–	–	–	–	260,102
	%	0.19	0.08	1.45	0.89	0.62	**94**	1.18	0.19	–	–	–	–	–	98.60
North Okkalapa	Population	267	52	3,650	218	1,118	271,770	2,791	327	–	–	–	–	–	280,193
	%	0.09	0.02	1.26	0.07	0.38	**93.73**	0.96	0.11	–	–	–	–	–	96.62
North Dagon	Population	366	75	4,489	3,146	894	183,236	2,931	784	–	–	–	–	–	195,920
	%	0.184	0.377	2.261	1.585	0.495	**92.317**	1.476	0.394	–	–	–	–	–	99.09
South Dagon	Population	824	35	3,474	709	765	287,146	4,600	208	–	–	–	–	–	297,761
	%	0.25	0.01	1.07	0.22	0.24	**88.11**	1.41	0.06	–	–	–	–	–	**91.37**
East Dagon	Population	107	18	2,004	1,236	370	162,140	2,588	310	–	–	–	–	–	169,040
	%	0.06	0.01	1.16	0.72	0.21	**94.12**	1.66	0.18	–	–	–	–	–	98.12
Thaketa	Population	792	706	1,807	840	1,886	174,889	5,436	861	–	–	–	–	–	187,217
	%	0.37	0.33	0.84	0.39	0.87	**81.08**	2.52	0.4	–	–	–	–	–	**86.80**

Source: Township Profiles, General Administration Department, 2019

The sizes of workforces in various industries are shown in Table 4.2-24. In Hlegu township, the workforce in both Livestock and Manual Labor made up over 30%. In Thanatpin township, 43.5% of the workers are in the Fishery business. In South Dagon, 85.3% of the workforce is in Industries. In Mingalardon and North Dagon, more than 30% of the workforce is Government Staff.

Table 4.2-24 Size of Workforce and Fields of Work

Township	Government Staff	Services	Agriculture	Livestock	Buying/ Selling	Industries	Fishery	Manual Labor	Other	Total
Bago	7,803	18,517	37,632	2,670	20,830	36,478	0	21,029	120,774	265,733
	2.9%	7.0%	14.2%	1.0%	7.8%	13.7%	0.0%	7.9%	**45.4%**	100.0%
Thanatpin	3,512	15	27,681	5,437	3,665	211	36,903	7,399	0	84,823
	4.1%	0.0%	**32.6%**	6.4%	4.3%	0.2%	**43.5%**	8.7%	0.0%	100.0%
Kawa	5,494	3	43,060	41,085	5,971	556	0	10,571	48,493	155,233
	3.5%	0.0%	**27.7%**	**26.5%**	3.8%	0.4%	0.0%	6.8%	**31.2%**	100.0%
Hlegu	4,260	3,598	26,404	46,210	486	1,732	170	48,132	17,859	148,851
	2.9%	2.4%	17.7%	**31.0%**	0.3%	1.2%	0.1%	**32.3%**	12.0%	100.0%
Mingalardon	40,732	6,100	2,841	153	25,000	7,300	15	22,000	25,000	129,141
	31.5%	4.7%	2.2%	0.1%	19.4%	5.7%	0.0%	17.0%	19.4%	100.0%
North Okkalapa	5,087	123,102	0	0	5,850	18,821	0	89,783	2,035	244,678
	2.1%	**50.3%**	0.0%	0.0%	2.4%	7.7%	0.0%	**36.7%**	0.8%	100.0%
North Dagon	39,195	26,130	3,920	9,146	19,598	16,985	0	9,146	6,533	130,653
	30.0%	20.0%	3.0%	7.0%	15.0%	13.0%	0.0%	7.0%	5.0%	100.0%
South Dagon	2,940	0	70	460	12,029	182,605	10	9,279	6,792	214,185
	1.4%	0.0%	0.0%	0.2%	5.6%	**85.3%**	0.0%	4.3%	3.2%	100.0%
East Dagon	21,955	16,830	5,381	5,994	30,328	26,040	0	22,372	0	128,900
	17.0%	13.1%	4.2%	4.7%	**23.5%**	**20.2%**	0.0%	17.4%	0.0%	100.0%
Taketa	12,250	39,455	0	0	30,503	7,145	0	50,495	23,358	163,206
	7.5%	**24.2%**	0.0%	0.0%	18.7%	4.4%	0.0%	**30.9%**	14.3%	100.0%

Township	Government Staff	Services	Agriculture	Livestock	Buying/ Selling	Industries	Fishery	Manual Labor	Other	Total
Total	143,228	233,750	146,989	111,155	154,260	280,888	37,098	290,206	250,844	1,534,750
	9.3%	15.2%	9.6%	7.2%	10.1%	18.3%	2.4%	18.9%	16.3%	100.0%

Source: Township Profiles, General Administration Department, 2019

The number and ratio of unemployed workforces are shown in Table 4.2-25 The reason for the high unemployment rate (19.54%) in Mingalardon is not clear. North Dagon (8.01%) and Hlegu (5.11%) townships also showed relatively high unemployment ratios.

Table 4.2-25 Size of Workforce and Unemployment Ratio

Region	Township	Number of Persons			Rate of Unemployment (%)
		Able To Work	Employed	Unemployed	
Bago	Bago	276,844	265,733	11,111	4.01
	Thanatpin	88,100	84,823	3,277	3.72
	Kawa	161,488	155,233	6,255	3.87
Yangon	Hlegu	156,874	148,851	8,023	5.11
	Mingalardon	129,141	103,909	25,232	**19.54**
	North Okkalapa	254,344	244,678	9,665	3.80
	North Dagon	142,034	130,653	11,381	**8.01**
	South Dagon	224,739	214,185	10,554	4.70
	East Dagon	134,080	128,900	5,180	3.86
	Thaketa	170,907	163,206	7,701	4.51
Total		1,738,551	1,640,171	98,379	5.66

Source: Township Profiles, General Administration Department, 2019

The Myanmar Government enacted the “Minimum Wage Law” in 2013, in which a “Worker” means a person who earns a living via a wage obtained by carrying out permanent or temporary work using his physical or intellectual abilities through the conclusion of an employment agreement with an employer to work in any commercial, production and service, or agricultural and livestock breeding business.

On 2nd January 2018, the National Committee for Setting the Minimum Wage (“National Committee”) issued Notification No. 1/2018 proposing a new minimum wage for all employees who work in Myanmar of 600MMK/hour (4,800MMK/day with eight working hours). This proposed minimum wage does not apply to small businesses with less than ten (10) employees and family businesses, or to Civil service personnel.

If a person works 5 days a week for 52 weeks per year, the minimum wage per year can be calculated as 1,248,000 MMK per year.

Annual individual income in recent years is shown in Table 4.2-26. Looking at the Fiscal Year 2017 (Calendar 2017-2018) data, annual individual income was highest in Sough Dagon (about 6.7 million MMK), and lowest in North Dagon (about 0.8 million MMK). The simple average was about 2 million MMK per year. The number in Hlegu township, where the substation is planned, was low at about 1 million MMK per year per person.

Table 4.2-26 Annual individual Income (MMK)

Region	Township	2016-2017	2017-2018	2018-2019
Bago	Bago	2,224,431	2,532,554	-
	Thanatpin	1,229,164	1,305,676	1,424,772
	Kawa	1,162,456	*1,209,806*	-
Yangon	Hlegu	966,166	*1,099,779*	-
	Mingalardon	1,800,000	3,100,889	3,100,889
	North Okkalapa	1,926,889	2,260,724	2,051,121
	North Dagon	913,511	***802,831***	-
	South Dagon	5,514,419	**6,667,680**	-
	East Dagon	1,013,153	*1,154,651*	-
	Thaketa	1,047,842	*1,189,441*	-
	Average	1,779,803	2,132,403	

Italic: Potentially lower than minimum wage income.

Source: Township Profiles, General Administration Department, 2019

Major infectious disease occurrences and deaths in Fiscal 2018 are shown in Table 4.2-27. In Hlegu township, the number of Dysentery (waterborne) patients was the largest, followed by Diarrhea (mainly waterborne) and Tuberculosis (airborne). Tuberculosis caused 56 deaths in the Study Area.

Table 4.2-27 Major Infectious Disease Occurrences and Deaths (2018-2019)

Township	Type of Disease									
	Malaria		Diarrhea		Tuberculosis (TB)		Dysentery		Hepatitis B	
	Occ.	Deaths	Occ.	Deaths	Occ.	Deaths	Occ.	Deaths	Occ.	Deaths
Bago	14	-	1,255	-	315	-	58	-	-	-
Thanatpin	-	-	1,001	1	241	-	197	-	10	1
Kawa	-	-	1,779	-	292	15	241	-		-
Hlegu	5	-	683	-	520	10	884	-	11	-
Mingalardon	-	-	907	-	-	-	393	-	-	-
North Okkalapa	4	1	46	1	768	13	6	-	-	-
North Dagon	1	-	6	-	228	-	-	-	-	-
South Dagon	-	-	130	-	729	18	23	-	5	-
East Dagon	-	-	232	-	-	-	54	-	-	-
Thaketa	-	-		-		-		-	-	-
Total	24	1	6,039	2	3,093	56	1,856	0	26	1

Source: Township Profiles, General Administration Department, 2019

Living conditions of households by Region are shown in Table 4.2-28. The Bago Region has a strong rural character, such as the ownership of houses and its sources of energy and water. In the Yangon Region, however, houses are still built with wood floors and corrugated sheet roofs. Drinking water is taken from Bottled/purifier water (34.4%), Tube well and borehole (25.5%), or Pool/pond/lake (18.8%).

Table 4.2-28 Living Conditions of Households (2014)

Region	Bago	Yangon
Ownership of housing unit (Tenure)		
Owner	**91.9%**	**64.5%**
Renter	2.7%	**24.5%**

Region	Bago			Yangon		
Provided free (individually)	2.0%			**3.4%**		
Government quarters	2.7%			**4.9%**		
Private company quarters	0.4%			**1.3%**		
Other	0.3%			**1.4%**		
Material for housing						
	Wall	Floor	Roof	Wall	Floor	Roof
Dhani/Theke/In leaf	3.6%	–	39.3%	**9.2%**	–	**17.8%**
Bamboo	**62.5%**	25.8%	0.4%	**31.8%**	**15.6%**	**0.2%**
Earth	0.1%	1.6%	–	**<0.1%**	**0.5%**	–
Wood	23.5%	**65.2%**	0.1%	**24.0%**	**52.0%**	**0.2%**
Corrugated sheet	0.1%	–	**58.9%**	**1.5%**	–	**76.3%**
Tile/Brick/Concrete	9.4%	6.7%	0.6%	**32.0%**	**30.7%**	**5.2%**
Other	0.8%	0.7%	0.7%	**1.5%**	**1.2%**	**0.3%**
Main source of energy for cooking						
Electricity	9.4%			**47.1%**		
LPG	0.1%			**2.0%**		
Kerosene	0.2%			**0.1%**		
Biogas	0.1%			**0.5%**		
Firewood	**77.9%**			**26.2%**		
Charcoal	9.0%			**21.0%**		
Coal	0.3%			**0.4%**		
Other	3.0%			**2.6%**		
Main source of energy for lighting						
Electricity	**27.7%**			**69.3%**		
Kerosene	8.8%			**5.7%**		
Candles	**28.9%**			**7.2%**		
Batteries	**22.5%**			**11.8%**		
Generator (private)	4.5%			**4.0%**		
Water mill (private)	0.1%			**Less than 0.1%**		
Solar system/energy	6.4%			**1.6%**		
Other	1.1%			**0.4%**		
Main source of drinking water						
Tap water/piped	1.9%			**13.3%**		
Tube well, borehole	**49.7%**			**25.5%**		
Protected well/spring	18.4%			**4.1%**		
Bottled/purifier water	3.6%			**34.4%**		
TOTAL Improved	*73.6%*			**77.3%**		
Unprotected well/spring	3.9%			**1.8%**		
Pool/pond/lake	**14.4%**			**18.8%**		
River/stream/canal	5.3%			**0.7%**		
Waterfall/rainwater	0.8%			**0.3%**		
Other	2.0%			**1.1%**		
TOTAL Unimproved	*26.4%*			***22.7%***		
Main source of water for non-drinking use						
Tap water/piped	2.4%			**24.4%**		
Tube well, borehole	**55.2%**			**51.1%**		
Protected well/spring	**18.2%**			**4.3%**		
Unprotected well/spring	3.9%			**1.9%**		
Pool/pond/lake	**11.4%**			**15.7%**		
River/stream/canal	6.3%			**1.5%**		
Waterfall/rainwater	0.5%			**Less than 0.1%**		
Bottled/purifier water	0.1%			**0.2%**		
Other	2.0%			**0.9%**		
Type of toilet						

Region	Bago	Yangon
Flush	0.8%	**6.3%**
Water seal (Improved pit latrine)	**73.8%**	**84.8%**
Total Improved Sanitation	*74.6%*	**91.1%**
Pit (Traditional pit latrine)	7.9%	**2.6%**
Bucket (Surface latrine)	5.9%	**2.7%**
Other	0.9%	**0.3%**
None	**10.7%**	**3.3%**
Availability of communications amenities		
Radio	38.0%	**25.9%**
Television	**45.3%**	**71.6%**
Landline phone	3.8%	**8.2%**
Mobile phone	**26.2%**	**60.9%**
Computer	1.4%	**11.1%**
Internet at home	3.9%	**19.1%**
% with none of the items	**32.0%**	**17.8%**
% with all of the items	0.2%	**1.7%**
Availability of Transportation equipment		
Car/Truck/Van	1.2%	**7.8%**
Motorcycle/Moped	**34.3%**	**13.6%**
Bicycle	**49.9%**	**46.2%**
4-Wheel tractor	1.9%	**1.2%**
Canoe/Boat	3.8%	**1.2%**
Motor boat	1.2%	**1.0%**
Cart (bullock)	**27.6%**	**4.8%**

Source: The 2014 Myanmar Population and Housing Census: Bago Region, Yangon Region

(6) Vulnerable Groups

1) Sar Ta Lin Substation

No resettlement of residents or businesses is expected due to the construction of the substation.

Persons who will not be relocated but who will be affected by the land acquisition, such as tenant farmers, will be identified after the official Detailed Measurement Survey by DPTSC, in the implementation phase of the Project.

Literature surveys and field observations are in progress to ascertain the general conditions of the poor, minority groups and other groups of concern in the Hlegu Township.

2) Transmission Lines

No resettlement of residents or businesses is expected due to the construction of the substation.

Persons who will not be relocated but who will be affected by the land acquisition and ROW setting, such as tenant farmers, will be identified after the finalization of the route, and after the official Detailed Measurement Survey by DPTSC, in the implementation phase of the Project.

Literature surveys and field observations are in progress to ascertain the general conditions of the poor, minority groups and other groups of concern in the townships where the lines pass through.

3) Literature survey results on Vulnerable Groups in the area to be affected

The definition of Vulnerable Groups includes the following: all households headed by a woman, with disabled persons, with elderly persons (over 60 years old) without the support of younger family, and with an income below the poverty line.

The poverty line in 2017 was 1,590 MMK per adult equivalent per day (Table 4.2-29). Multiplied by 365, the annual income for one adult household is calculated as 580,350 MMK. Using the Adult Equivalence Scales shown in Table 4.2-30, the annual poverty line for a household with 2 adults and 2 children between 16 and 19 years old is calculated as 2,437,470 MMK, using the equation below.

- 1,590 MMK x (1.00 x 2 + 1.10 x 2) x 365 = 2,437,470 MMK

The ARAP Survey for the Project needs to obtain age information for all the members of the households to be affected to understand their economic status.

Table 4.2-29 Poverty Line and Headcount, 2017

Poverty Line per adult equivalent per day, 2017		1,590 MMK
Poverty headcount %, 2017	Bago Region	17.4 %
	Yangon Region	13.7 %
	Union	24.8 %

Source: Report 03: Poverty Report, Myanmar Living Conditions Survey 2017, June 2019, World Bank

Table 4.2-30 Adult Equivalence Scales

Age group	Required calories	Adjusted for nonfood	Equivalent adult scale
<1 year old	850	1315	0.55
1–3 years old	1,260	1,602	0.67
4–6 years old	1,670	1,889	0.79
7–9 years old	1,800	1,980	0.83
10–12 years old	2,300	2,330	0.97
13–15 years old	2,550	2,505	1.04
16–19 years old	2,750	2,645	1.10
20 and above	2,400	2,400	1.00

Source: Ministry of Health and Sports; and CSO, UNDP, WB staff computations.
Note: A weight of 0.3 is given to non-food, while a 0.7 weight is given to food

Source: Report 03: Poverty Report, Myanmar Living Conditions Survey 2017, June 2019, World Bank

Annual income when working with the minimum wage is calculated as 1,248,000 MMK. Six townships among all those to be affected by the Project showed lower average annual individual incomes compared to the above income levels (Table 4.2-26). The most probable negative impact of the Project on vulnerable groups, therefore, will be worsened poverty conditions caused by a decrease or loss of income. Based on this assumption, mitigation measures for the short term were proposed, including cash compensation of three times the annual agriculture income, and, for the long term, measures including livelihood rehabilitation and assistance such as agricultural technical assistance and opportunities for employment as staff at DPTSC.

When the removal of residential structures is required or livelihoods cannot be sustained with the remaining productive assets because of public projects, the project owner authority in Myanmar, including DPTSC, usually hires one person from the affected household and brings the household into

staff housing as a standard mitigation measure of compensation for the loss of housing and income.

In other words, DPTSC does not have experience of other types of additional assistance for vulnerable groups.

The Framework Resettlement Action Plan for Twente Canal Improvement Project, Myanmar, July 2019, is a recent, good example of assistance for vulnerable groups in the Yangon Metropolitan Area. In this project, the Department of Water Resources and Improvement of River Systems (DWIR) planned to provide cash assistance equivalent to the minimum wage for one month for households that belong to vulnerable groups. In addition to this, a further one month's worth of minimum wage is planned to be provided to the households if the household head is a woman, or if the household income is below the poverty line. The framework also planned to provide assistance in finding relocation houses and livelihood rehabilitation assistance such as vocational training for the vulnerable groups.

In this Project, it is also desirable to provide cash compensation equivalent to 30 days of minimum wage as a mitigation measure for the possible worsening of poverty conditions in vulnerable groups.

Final mitigation measures will be decided based on the results of the livelihood and living conditions survey, and of the stakeholder meetings that will be held during the implementation phase of the Project.

4.2.4. Compensation and Assistance Measures

The JICA Study Team presented the entitlement matrix for Phase I/II of the Project to DPTSC on March 5, 2020. DPTSC agreed on the contents with a few minor changes (Table 4.2-31).

The market price survey method and results, as well as the calculation of compensation prices based on the survey results, are explained in 4.2.8 (2).

In Myanmar, the final decision on compensation and assistance (selection of entitled persons, content and size of the compensation, etc.) will be decided by the land acquisition implementation committee, of which the Project Owner is a member.

Table 4.2-31 Entitlement Matrix for the Project

No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues/Guidelines	Organization Responsible
1.	Fixed Assets				
1.1	Loss of residential land	Person who obtained land use certificate and person who does not have land use certificate but has current land ownership certified by the Settlement and Land Record Department (SLRD) concerned	Cash compensation at replacement price following the JICA Guidelines, calculated based on the current market price of the residential area of that area	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC
1.2	Loss of arable land from permanent land occupation	Person who obtained land use certificate, person who does not have land use certificate but was recorded during population census survey and person who does not have	Cash compensation at replacement price following the JICA Guidelines, calculated based on the current	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG

No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues/Guidelines	Organization Responsible
		land use certificate but has current land ownership certified by the SLRD concerned	market price of the farmland of that area		Implementation: DPTSC
1.3	Temporal loss of land during construction phase	Owner of the land (person who obtained land use certificate and person who does not have land use certificate but has current land ownership certified by the SLRD concerned)	Cash compensation for the loss of income generated from the land during temporary land acquisition (see 2.1)	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC
1.4	Loss of structure within SS site	Those who own the structure	Cash payments for structure (or structure repair for partial loss) at full replacement cost (for materials, labor and contract fee, transportation at current market price), WITHOUT deduction for depreciation or salvageable materials, WITH ownership registration fee, ownership transfer tax, and any other governmental process cost if required.	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC
1.5	Loss of structure within TL ROW	Those who own the structure	Cash payments for structure (or structure repair for partial loss) at full replacement cost (for materials, labor and contract fee, transportation at current market price), WITHOUT deduction for depreciation or salvageable materials, WITH ownership registration fee, ownership transfer tax, and any other governmental process cost if required.	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC
1.6	Permanent loss of standing crops/tress within SS site	To be assisted as part of loss of income sources (2.1, 2.2)	(Refer to 2.1, 2.2)	(Refer to 2.1, 2.2)	(Refer to 2.1, 2.2)
1.7	Permanent Loss of standing crops/trees within TL ROW	To be assisted as part of loss of income sources (2.1, 2.2)	(Refer to 2.1, 2.2)	(Refer to 2.1, 2.2)	(Refer to 2.1, 2.2)
2	Loss of Income Source				
2.1	Loss of income from standing crops/trees within SS	Those who own and cultivate crops and trees	Crops: Three times the current market price of the yield, multiplied by the number of lost harvest timing	Compensation amount is calculated based on yield amount recorded in Township Farmland Management Body at DMS.	Decision: Township Farmland Management Committee, Township/YRG

No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues/Guidelines	Organization Responsible
	site and TL ROW		Trees: Market price of the same size tree, and three times the current market price of the yield, multiplied by the number of lost harvest timing	To the extent possible, affected households will be allowed to harvest their annual and perennial crops prior to construction.	Implementation : DPTSC
2.2	Loss of income from termination of farm labor contract	Those who provide labor on farmland in exchange for cash, food, and accommodation	*Cash compensation equivalent to the labor fee, food and accommodation expenses for the remaining contract term, or for the transition period, whichever is longer. *Assistance by the employer and/or Department of Agriculture in finding alternative employment opportunity in the same production period or the next production period. *Livelihood rehabilitation and assistance (4.1).	To the extent possible, affected households will be allowed to finish the contract term prior to commencement of the construction.	Decision: Township Farmland Management Committee, Township/YRG Implementation : DPTSC, employer
2.3	Loss of income from termination of business activities (permanent or temporal)	*Those who own businesses that need to be closed because of the Project. (e.g. street vendors whose regular operations are located within the transmission line ROW) *Those who work at businesses that need to be closed because of the Project.	*Coordination and negotiation will be done to avoid temporal closure or permanent termination of the businesses by providing alternate locations for the business. *If temporal closure is found to be unavoidable, the business income and wage income during the temporal closure will be compensated for. *If permanent termination is found to be unavoidable, the business income and wage income will be compensated for. Entitled persons will be asked to raise requests for the assistance, such as the number of months to be covered by income compensation, during the consultation in the implementation phase. Relocation assistance will be provided as described in 3.2 when eligible. Livelihood rehabilitation assistance will also be provided as described in 4.1.	Compensation amount is calculated by Township Farmland Management Committee and approved by YRG	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC, employer
3	Relocation				
3.1	Loss of residential structure or land	Relocating households, either legal residents or residents without legal basis	New land and similar infrastructure plus necessary relocation costs (including option of hiring	-	Decision: Township Farmland Management

No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues/Guidelines	Organization Responsible
	resulting from physical relocation		one person per household as DPTSC staff and providing staff housing for the household)		Committee, Township/YRG Implementation: DPTSC
3.2	Loss of productive assets with remaining assets not sufficient to support livelihood (economic relocation)	Affected households, either legal residents or residents without legal basis. Affected businesses.	New land and similar infrastructure plus necessary relocation costs (including option of hiring one person per household as DPTSC staff and providing staff housing for the household)	-	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC
4	Livelihood Rehabilitation and Assistance				
4.1	Loss of productive assets	Those whose livelihoods are to be affected by the Project, including land owners, business owners and employees, and agriculture laborers, either with or without legal rights or contracts	Entitled persons will be asked to raise requests for the assistance during the consultation in the implementation phase. Following assistance was proposed in past cases of public projects in Yangon Region[x] which may also be applicable for the Project: *technical advice on agriculture *vocational training in fields other than farming *job opportunities in construction work at the substation as skilled or unskilled labor For business owners and employees, in addition to above, cash compensation for loss of income, ideally equal to or more than 30 days of minimum wage, will be negotiated during the consultation in the implementation phase.	DPTSC has not provided this type of assistance yet. Assistance will be decided by Township Farmland Management Committee and approved by YRG. Implementation body and preparation of budget for the assistance will be discussed and negotiated among the authorities comprising the Compensation Committee at township level.	Decision: Township Farmland Management Committee, Township/YRG Implementation: service providing authorities, DPTSC
5	Assistance for the Vulnerable				
5.1	Vulnerable Groups	All households affected by substation construction belonging to following groups: headed by woman, with disabled person, elderly person (over 60 years old) without support of younger family, poor household (below poverty line of 2017)	One-time cash assistance (lump-sum) per person, ideally equal to or more than 30 days of minimum wage. Other types of assistance needs, such as job training, will be discussed during the consultation in the implementation phase.	DPTSC has not provided this type of assistance yet. Assistance amount will be calculated by Township Farmland Management Committee and approved by YRG, and may be paid under "crop compensation" or "land compensation." Implementation body and preparation of budget for other types	Decision: Township Farmland Management Committee, Township/YRG Implementation: DPTSC

No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues/Guidelines	Organization Responsible
				of assistance will be discussed and negotiated among the authorities comprising the Compensation Committee at township level.	

Source: JICA Study Team

4.2.5. Implementation Structure

The implementation structure described in the ARAP for Phase I/II of the Project is shown in Table 4.2-32. Although the table mentions the Environmental and Social Staff in the Project Management Unit of MOEE, neither MOEE nor DPTSC have staff specializing in environmental and social issues. Project Managers are the persons in charge of such issues.

RAP implementing authorities at each step of implementation are summarized in Table 4.2-33. Communication and coordination with various authorities are the responsibility of the General Administration Department, both at Township and Region level. Land acquisition issues, including the measurement and finalization of the PAPs list, involves the Township Land Management Committee. DPTSC plays the role of initiator at every step in the implementation, but none of the steps shown in the table can be finished without coordinating with other authorities.

Table 4.2-32 Implementation Structure for Land Acquisition and Resettlement

Institution	Roles and Responsibilities
Pre-Construction Phase	
Compensation Committee at township level	- Set compensation standards/assistance - Members: DPTSC/MOEE*, Regional Government (Yangon and Bago) (land records department, police officers, agriculture and irrigation department, conservation environment and forestry department), YCDC, Officer of GAD
Administration Department in MOEE, Nay Pyi Taw	- Review and approve the ARAP report as Project Owner - Finalize compensation price with affected people and disburse compensation/assistance to project affected peoples
Environmental and Social Staff* in Project Management Unit of MOEE	- Implement ARAP Survey and formulate the report - Monitor compensation procedure based on resettlement action plan
ECD, Nay Pyi Taw	- Review and approve the ARAP report
Construction Phase	
Environmental and Social Staff in Project Management Unit in Project Manager-1 Office (Yangon), MOEE	- Consultation desk for project affected peoples

*: Staff from Project Manager-1 Office located in Yangon and staff from Project Manager (Civil) Office located in Nay Pyi Taw, both under supervision of Power Transmission Projects (South) Office
Source: Resettlement Action Plan for National Power Transmission Network Development Project, January 2014

Table 4.2-33 RAP Implementing Authorities

	DPTSC	GAD	TLMC	Contractor/ CMC	ECD
Role and Authority	Proponent	Local communication and coordination	Land management	Survey and service provision	Review & approval
1. Public Consultation	X	X	X		

Role and Authority	DPTSC Proponent	GAD Local communication and coordination	TLMC Land management	Contractor/ CMC Survey and service provision	ECD Review & approval
2. Implementation of Detailed Measurement Survey 3. Setting and announcing the cut-off date 4. Implementation of Population and Asset Census, Socio-Economic Survey 5. Finalization of PAPs List 6. Explanation and agreement of ROW landowners concerning the land use restrictions	X	X	X	X	
7. Approval of RAP	X				X
8. Payment of compensation and moving/livelihood assistance	X	X			
9. Implementation of livelihood rehabilitation program, if necessary 10. Physical relocation of residents/occupants	X	X		X	
11. Land registration under MOEE	X	X			

NOTE: GAD = General Administration Department
TLMC = Township Land Management Committee
CMC = Construction management consultant
ECD = Environmental Conservation Department
Source: JICA Study Team

4.2.6. Grievance Redress Mechanism

The grievance redress mechanism described in the ARAP for Phase I/II of the Project is shown in Table 4.2-34. A similar mechanism will handle grievances caused by the Project. A grievance focal person in DPTSC will receive the complaints from the PAPs. DPTSC will work with a contractor representative and the authorities concerned at the local and township level in the Redress Team and the Management Committee.

Table 4.2-34 Grievance Redress Mechanism for Land Acquisition and Resettlement

Grievance Focal Person (GFC)	● Grievance focal person, DPTSC, shall be appointed by Project Management Unit to implement the Grievance Redress procedure effectively. The person nominated for the role should have sound and broad experience within the social region and have acted within such a role previously. ● The roles shall function as the primary resources for interfacing on issues relevant to RAP. ● GFC will receive the complaints in verbal or written form from the PAP through the site construction team or village head, or through the PAP himself. The complaint shall be recorded and registered accordingly and the message delivered to the Site Grievance Redress Team promptly.
Site Grievance Redress Team (SGRT)	● Site-based grievance redress team shall be established and headed by DPTSC site manager, contractor representative and authorities concerned at local and township level.

	●	SGRT will review any complaint or concern and find a solution to ease their degree, which will be agreed and accepted by the PAP. SGRT shall address the issue within (14) days. At this stage, as many issues as possible shall be resolved locally.
	●	If the case is not addressed to the satisfaction of the PAP within the given time frame, SGRT shall submit the issue to the Grievance Redress Management Committee for further review.
Grievance Redress Management Committee (GRMC)	●	GRMC is the highest authority for making a final decision within project-specific Grievance Redress System on the issues which SGRT cannot address alone. GRMC is headed by a Senior Official of DPTSC with members of relevant government bodies.
Unsolved Issues	●	If the case is still not resolved by GRMC, PAP can proceed through judicial system, such as appealing to the courts for final resolution, starting from township level jurisdiction.

Source: Resettlement Action Plan for National Power Transmission Network Development Project, January 2014

4.2.7. Implementation Schedule

(1) Implementation Schedule

The steps for implementation of Phase I/II of the Project, with modification of place names for Phase III, is shown in Table 4.2-37. The Detailed Measurement Survey will be started by DPTSC at Step 5, with official declaration of the Cut-Off-Date, and official listing of the PAPs.

Besides the above, conversion of agricultural land to other uses will require a different course to the steps. The process needs to be finished between Step 2 and Step 4 in Table 4.2-36.

The implementation schedule for these activities is shown in Table 4.2-37, together with the Project Implementation Schedule. DPTSC is expected to start the Detailed Measurement Survey (DMS) for the planned sites for the Substation and Transmission Line Towers starting from January 2021. Development of ARAP, approval by MOEE and ECD, and submission to JICA by DPTSC/MOEE are expected to be implemented by the end of September 2021, i.e. the end of Myanmar's fiscal year 2020. Then, the Compensation Committee will be formed, the affected persons will negotiate with the Committee, and the disbursement of compensation will be started well before the commencement of site clearance work, which is planned from July 2023.

Table 4.2-35 Steps for Implementation of Land Acquisition and Resettlement

1.	Detailed design of SS and TL, Decision on and start of the land acquisition process between DPTSC/ MOEE and respective authorities
2.	Application for agricultural land conversion
3.	Setting up of implementation team for ARAP in DPTSC/MOEE (Project Management Office)
4.	Obtaining the approval on conversion for the proposed project land from the land records department at relevant township
5.	DPTSC conducts Detailed Measurement Survey (DMS) for the planned sites for Substations and Transmission Line Towers
6.	Start or end date of the DMS is set as the cut-off-date for each location
7.	Conduct land survey. Identification of PAPs
8.	Conduct stakeholder meetings, implement population and asset census
9.	DPTSC/MOEE draft compensation price for the land consulting with relevant village heads and affected peoples
10.	Development of ARAP, and submission to JICA by DPTSC/MOEE
11.	The project owner makes a request to the general administration department at relevant township to organize a Compensation Committee in order to scrutinize the drafted compensation price Formed of Compensation Committee with following members and tasks

	- Members: DPTSC/MOEE, Regional Government (Yangon and Bago) (land records department, police officers, agriculture and irrigation department, conservation environment and forestry department), YCDC, Officer of GAD - Task: Estimation of and decision on offer amount for Compensation rate
12.	Confirmation survey of PAPs and assets with cut-off-date by the Compensation Committee, if required
13.	The compensation price is finalized at compensation committee
14.	Negotiation with PAPs, obtaining agreement on compensation and assistance with them and arrangement of payment procedures
15.	If affected person is not satisfied with the compensation price, he/she can appeal to the compensation committee to reconsider the price
16.	In the implementation phase, the Compensation Committee or its deputy, or DPTSC/MOEE will disburse the compensation and assistance before the physical resettlement or taking of the land
17.	In the implementation phase, the implementation team for ARAP in DPTSC/MOEE will monitor the progress of resettlement and land acquisition

Source: Modified from Resettlement Action Plan for National Power Transmission Network Development Project, January 2014

Table 4.2-36 Steps for Conversion of Agricultural Land

Step No.	Procedures	Department Concerned	Process	Further Action	Time Taken
1.	*Application with Form -14*	Township Land Records Department (TLRD)	Open the dossier for using farmland for other means on the application	Scrutinizing the requirements as listed in Article 84 of the Rules	Within 30 days starting from the acceptance date of application
2.	*Submitting the application to Township Farmland Management Committee* with comments given by TLRD	Township Farmland Management Committee (TFMC)	Scrutinizing the requirements as listed in Article 86 of the Rules	The application shall be submitted to Region/State Farmland Management Committee through the District Farmland Management Committee with the comments	Within 15 days starting from the acceptance date of the application in TLRD
3.	If the application to use farmland for other means is for Paddy land (Le)	Region/State Farmland Management Committee (R/S - FMC)	Scrutinizing the application	Continued Submission of the application to Central Farmland Management Committee with the comments given by the Region/State Farmland Management Committee	Within 30 days
4.	If the application to use farmland for other means is for land other than Paddy land	Region/State Farmland Management Committee	Scrutinizing the application which has been passed step by step	Continued submission of the application to Region/State Government with comments given by Region/State Farmland Management Committee	Within 30 days
5.	*Issuing Form – 15* Approved Permit shall be issued for Paddy lands (Le) which are to be used by other means	Central Farmland Management Committee (CFMC)	If the application meets with the requirements, approval shall be issued regarding Article 87 (a)	-	-
6.	*Issuing Form – 15 A* Approved Permit shall be issued for land other than Paddy lands which are to be used by other means	Region/State Farmland Management Committee	If the application meets with the requirements, approval shall be issued regarding Article 87 (b)	-	-
	Total time taken for the whole application process until the approval for the use of farmland by other means				*Sub-total 105 days*
7.	*Form – 16* Inspection Report on conditions of implementation for the farmlands granted for other means. The report is to be submitted every 6	Region/State Farmland Management Committee	Field inspections shall be done by DFMC and TFMC for the farmland granted by other means. The inspection reports with photo documents shall be	If the DFMC and TFMC find that the lands granted have not yet started to be utilized by other means or the proposed project has not yet been implemented within 6 months from the date of approval, the case shall be opened as a separate dossier. The report shall then be	

Step No.	Procedures	Department Concerned	Process	Further Action	Time Taken
	months to Central Farmland Management Committee		presented to R/S-FMC	submitted with photo evidence to Region/State Farmland Management Committee	
8.	Presenting the case to Central Farmland Management Committee for necessary actions to be taken	CFMC	Upon receiving the case, CFMC shall analyze and scrutinize the case	After scrutinizing the case, the necessary actions shall be taken as shown in Article 93.	
9.	Confiscate the land	Central Farmland Management Committee (CFMC)	CFMC shall confiscate the land as it is revoked under rule (93) (a) or the land will be revoked by Region/State Government as it is notified under sub rule (b).	-	

Source: Resettlement Action Plan for National Power Transmission Network Development Project, January 2014

(2) RAP Survey TOR in Implementation Phase

The RAP Survey shall be implemented by DPTSC along with the Detailed Measurement Survey so that the survey requirements of the JICA Guidelines are fully satisfied and the survey results are reported to JICA.

Table 4.2-37 Implementation schedule for the Project and the ARAP

	Fiscal year	2020			2021																				2022												2023				
	Calendar month	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
A	Procurement of consultant																																									
B	Consulting service Basic design																																									
C	Tender assistance Preparation of bid documents																																									
D	Construction supervision Site survey																																									
E	Cleaning of ROW/ Construction of access roads																																									
1.	Detailed design of SS and TL, Decision and start of the land acquisition process between DPTSC/ MOEE and respective authorities																																									
2.	Application for agriculture land conversion																																									
3.	Setting up of implementation team for ARAP in DPTSC/MOEE (Project Management Office)																																									
4.	Obtaining the approval of conversion for the proposed project land from the land record department at relevant township																																									
5.	**DPTSC conduct Detailed Measurement Survey (DMS)** for the planned sites for Substation and the Transmission Line Towers																																									
6.	**Start or end date of the DMS is set as the cut-off-date for each location**																																									
7.	Conduct land survey. Identification of PAPs.																																									
8.	Conduct stakeholder meetings, implement population and asset census.																																									
9.	DPTSC/MOEE draft compensation price for the land in consulting with relevant village heads and affected peoples.																																									
10.	**Development of ARAP, approval by MOEE and ECD, and submission to JICA by DPTSC/MOEE**																																									
11.	The project owner makes a request general administration department at relevant township for organizing a Compensation Committee in order to scrutinize the drafted compensation price. **Forming of Compensation Committee**																																									
12.	Confirmation survey of PAPs and assets with cut-off-date by the Compensation Committee, if required.																																									
13.	The compensation price is finalized at compensation committee																																									
14.	Negotiation with PAPs, obtaining agreement of compensation and assistance with them and arrangement of payment procedure																																									
15.	In case affected people is not satisfied the compensation price, he/she can appeal to the compensation committee to reconsider the price.																																									
16.	In the implementation phase, the【Compensation Committee or its deputy】or【DPTSC/MOEE】will **disburse the compensation and assistance** before the physical resettlement or taking of the land.																																									
17.	In the implementation phase, the implementation team for ARAP in DPTSC/MOEE will monitor the progress of resettlement and land acquisition																																									

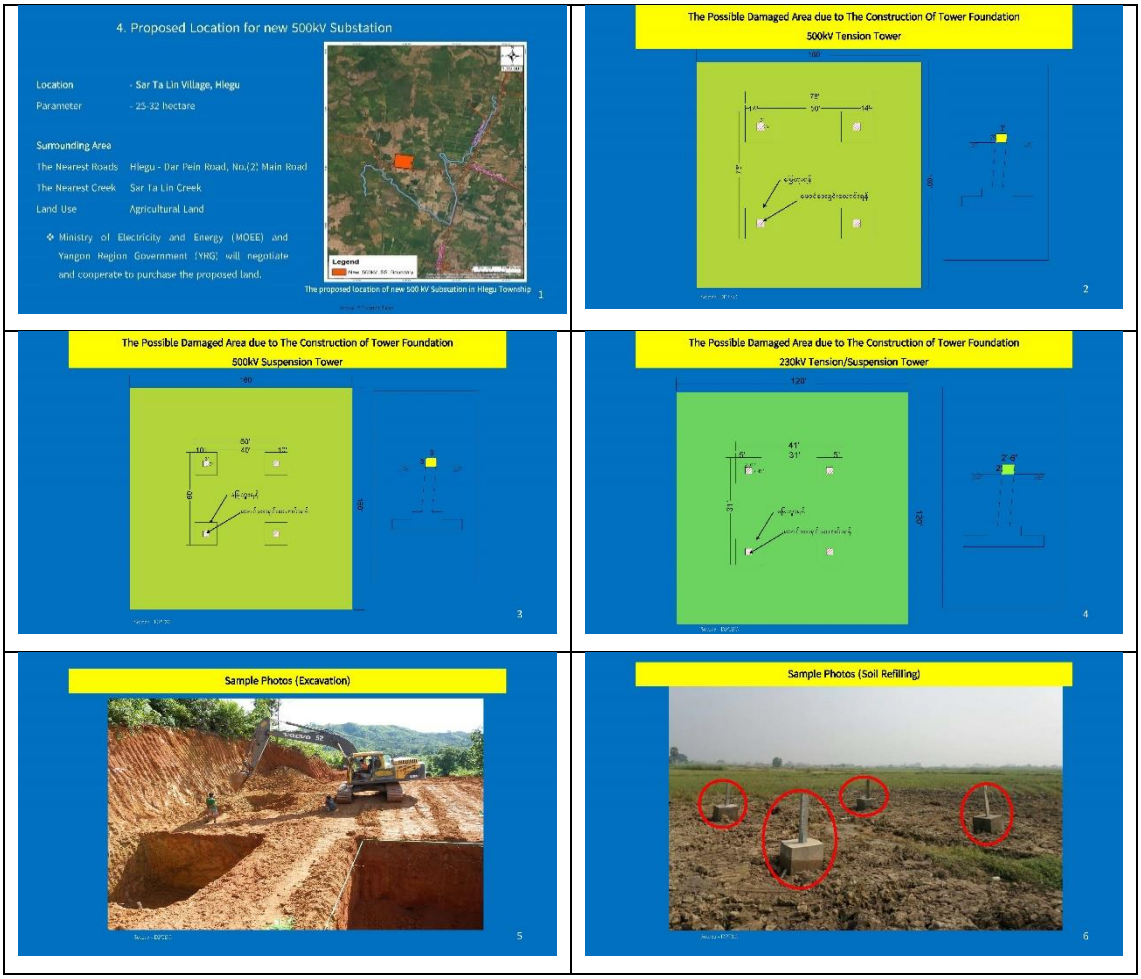
Source: JICA Study Team

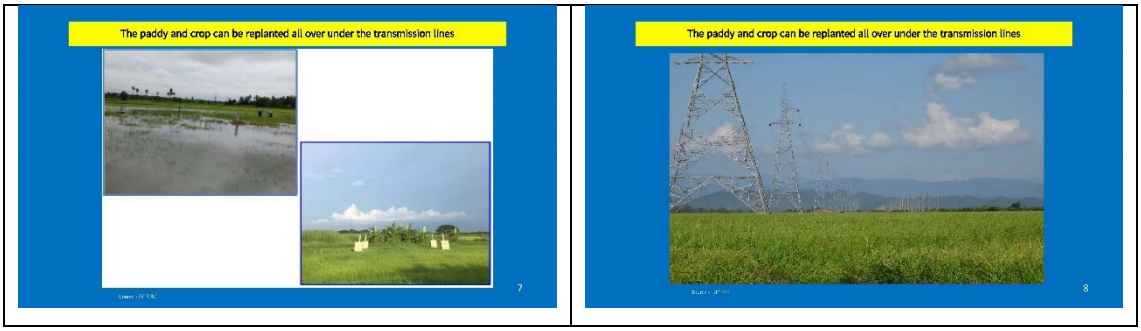
4.2.8. **Public Consultation**

Public consultation on land acquisition and resettlement during the basic design phase of a project is not legally mandated in Myanmar. Therefore, information dissemination for the project and policies regarding land acquisition and resettlement, as well as the recording of local opinions, were implemented through the stakeholder meetings required by the Myanmar EIAP. The design and records of the meetings are explained in 4.1.10.

The first stakeholder meetings were held as preliminary coordination meetings with township and district officials in February and March 2020. The second meetings were held in March 2020 with invitations posted on the township notice boards so that any residents or interested persons could attend.

In the second stakeholder meetings, DPTSC staff, using the slides shown in Figure 4.2-14, explained about the land acquisition for the substation, the size of base blocks for the transmission towers, temporal land leases during the construction phase, and height regulations within the transmission line ROW during the operation phase. The staff then orally explained that: 1) affected land lots will be identified in the following detailed study; 2) DPTSC, together with respective authorities, will hold village-wise stakeholder meetings to explain the Project and ask for cooperation; 3) DPTSC will implement a Detailed Measurement Survey; 4) a township-wise compensation committee will be established; and 5) the type and size of compensation and assistance will be negotiated between the committee and the project affected persons.





Source: Slides were prepared by DPTSC, and were translated by the JICA Study Team

Figure 4.2-14 Meeting Material on Land Acquisition Prepared by DPTSC

In the implementation phase of the Project, the location and site/ROW boundaries of the substation and the transmission lines will be studied in detail. Then, the project affected persons will be identified, and stakeholder meetings will be held to reach agreement on the project implementation, as well as on the compensation and assistance measures. Timings of the stakeholder meetings will be: 1) before commencement of the Detailed Measurement Survey (Line 5 of Table 4.2-37), population census survey, and socio-economic survey; and 2) after the results of those surveys and the draft RAP has been prepared for dissemination and discussion.

4.2.9. Monitoring Structure and Monitoring Forms by Implementation Body

(1) Internal Monitoring

In terms of the monitoring structure, internal monitoring will be implemented by DPTSC. DPTSC will report the results to MOEE, and MOEE will report to JICA.

Monitoring forms provided by the JICA Study Team (Table 4.2-38) were accepted by DPTSC in May 2020. Since the internal monitoring is to be implemented by DPTSC using regular personnel expenses, no specific budget will be necessary.

Table 4.2-38 Monitoring Formats during ARAP Implementation

1. Public Consultation [Monitored by: DPTSC]

No	Date DDMMYY	Location	SS	TL	TL	Number of Attendants	Record of Discussions
			Acquisition	Acquisition	ROW Land use restriction		
1							[Agenda] [Comments and Answers]
2							[Agenda] [Comments and Answers]

2. Progress of Implementation [Monitored by: DPTSC]

Activity	Quantity	Unit	Progress (Number)			Progress (%)		Planned finish date	Implementing Institution and Institution Responsible
			Before this report-ing period	This report-ing period	Total	Before this report-ing period	This report-ing period		
	a		b	c	d=b+c	e=b/a	f=d/a	DDMMYY	
1. Procurement of consultant/NG		M/M							[Implement] DPTSC [Responsible]

Activity	Quantity	Unit	Progress (Number)			Progress (%)		Planned finish date	Implementing Institution and Institution Responsible
			Before this report-ing period	This report-ing period	Total	Before this report-ing period	This report-ing period		
	a		b	c	d=b+c	e=b/a	f=d/a	DDMMYY	
O/ Implementation staff									DPTSC/JICA
2. Implementation of Detailed Measurement Survey		Township							[Implement] DPTSC [Responsible] DPTSC/GAD/ TLMC/ Contractor
3. Setting and announcing the cut-off date		Township							[Implement] DPTSC [Responsible] DPTSC/GAD/ TLMC/ Contractor
4. Implementation of Population and Asset Census, and Socio-Economic Survey									[Implement] DPTSC [Responsible] DPTSC/GAD/ TLMC/ Contractor
5. Township 1:		Household							
6. Township 2:		Household							
7. Approval of RAP			Date of approval: DDMMYY						[Implement] DPTSC [Responsible] DPTSC/ECD
8. Finalization of PAPs List		Township							[Implement] DPTSC [Responsible] GAD/TLMC/ DPTSC
9. Explanation to and agreement of ROW landowners concerning the land use restrictions									[Implement] DPTSC [Responsible] DPTSC/GAD/ TLMC
10. Township 1:		Household							
11. Township 2:		Household							
12. Payment of compensation and moving/livelihood assistance									[Implement] DPTSC [Responsible] DPTSC/GAD
13. Township 1:		Household							
14. Township		Household							

Activity	Quantity	Unit	Progress (Number)			Progress (%)		Planned finish date	Implementing Institution and Institution Responsible
			Before this report-ing period	This report-ing period	Total	Before this report-ing period	This report-ing period		
	a		b	c	d=b+c	e=b/a	f=d/a	DDMMYY	
p 2:									
15. Implementation of livelihood rehabilitation program, if necessary									[Implement] DPTSC [Responsible] DPTSC/GAD/ Contractor
16. Township 1:		Household							
17. Township 2:		Household							
18. Negotiation and agreement of resettlement options									[Implement] DPTSC [Responsible] DPTSC/GAD
19. Preparation of relocation houses									[Implement] DPTSC [Responsible] DPTSC
20. Physical relocation of residents/occupants									[Implement] DPTSC [Responsible] DPTSC/GAD/ Contractor
Township 1:		Household							
Township 2:		Household							
21. Land registration under MOEE									[Implement] DPTSC [Responsible] DPTSC/GAD
Township 1:		ha							
Township 2:		ha							

NOTE: GAD = General Administration Department
TLMC = Township Land Management Committee
ECD = Environmental Conservation Department

3. Record of Grievances [Grievance received by: DPTSC, Monitored by: DPTSC]

Issues	Number received in the reporting period	Number not resolved
1. Refusal for survey		
2. Refusal to sell		
3. Refusal of offered price/assistance		
4. Refusal to relocate		
5. Other (specify)		

4. Other progress and concerns

5. End of Monitoring Activities:

- Any of the following timings that takes the longest period:
  1) Until the end of the Land registration under MOEE;
  2) Until all the grievances are resolved;

3) Until 2 years after the end of the Construction Phase of the Project;
4) If livelihood rehabilitation program is implemented, until submission of the monitoring report after the end of the program.

- After the above, all the grievances will have been received and resolved by the Regional Project Management Offices, DPTSC.

Source: JICA Study Team

(2) External Monitoring

External monitoring should be carried out by an independent monitoring agency to provide an independent view on the achievements of the RAP. The external monitoring will focus on the outcomes and results of compensation and livelihood support, such as the changes in living standards and livelihoods of the PAPs; the effectiveness, impact and sustainability of entitlements; the need for further mitigation measures if any; and to learn strategic lessons for future policy formulation and planning.

The external monitoring can adopt some of the following indicators:

1. Full payment to be made to all affected persons sufficiently before land acquisition.
2. Completion of land acquisition before the construction starts.
3. Public consultation and awareness of compensation policy.
4. The operation of the mechanisms for grievance redress, and the speed of grievance redress will be monitored.
5. The level of satisfaction of PAPs concerning various aspects of the livelihood support program will be monitored and recorded.
6. Throughout the implementation process, the trends of living standards will be observed and surveyed. Any potential problems in the restoration of living standards will be reported, and recommendations for further adjustment of the plan will be made.

The following activities are the standard functions of the external monitors:

1. Verification of internal monitoring reports, by field checking of the following:
   a. payment of compensation, including its levels and timing
   b. livelihood restoration
   c. satisfaction of PAPs concerning the RAP implementation
2. Interview random samples of PAPs to assess their knowledge and concerns regarding the compensation process, their entitlements and rehabilitation measures.
3. Check the type of grievance issues and the functioning of grievance redress mechanisms by reviewing processing of appeals at all levels and interviewing aggrieved PAPs.
4. Survey the standards of living of PAPs to assess whether they have been improved or maintained.
5. Advise Project managers regarding possible improvements in the implementation of the RAP.

The following table is the suggested monitoring framework for the land acquisition, compensation and resettlement.

Table 4.2-39 Outline of External Monitoring for ARAP Implementation

Stage	Major Objectives	Monitoring Item	Frequency	Implementation Organization	Budget (USD)
During relocation	Examination of procedure and effectiveness of resettlement work plan	● Content and process for preparing resettlement work plan	4 times a year	External monitoring experts Individual or firms, or NGOs	10,000

Stage	Major Objectives	Monitoring Item	Frequency	Implementation Organization	Budget (USD)
		● Effectiveness of relocation ● Effectiveness of grievance redress mechanism ● Necessity of further measures			
After relocation	● Examination of procedure and effectiveness of resettlement work plan ● Income and livelihood restoration and other assistance programs (food security, vocational training)	● Content and process for preparing resettlement work plan ● Effectiveness of relocation ● Effectiveness of grievance redress mechanism ● Necessity of further measures	4 times a year	External monitoring experts Individual or firms, or NGOs	10,000

Source: JICA Study Team

5. Outline of Project Plan

5.1. Purposes of and Need for the Project

5.1.1. Purposes

In this project, a 500 KV substation and a 230 kV transmission line will be newly constructed in the eastern part of Yangon City, where power supply facilities are insufficient. The purpose of this project is to supply power from the north and east sides, outside Yangon City and Bago City, to the 500 kV Payagey Substation, which is being constructed near Bago City, and from there to eastern Yangon.

5.1.2. Need

The power demand in Yangon is increasing significantly, and the power supply capacity is lacking. In 2019, an emergency power source to be installed in Yangon city (using domestic gas fields or LNG as fuel) will be recruited to solve the power supply shortage in Yangon city. In addition, extra emergency power will be recruited in 2020. However, these are power supplies with high operation and maintenance costs and high power generation costs, and are provisional contracts for about five years. Therefore, it is not advisable to continue the operation of these emergency power sources for a long time, and it is necessary to supply a sufficient amount of power to Yangon City in the near future by replacing it with a more economical power source.

When the 500 kV transmission facility currently under construction is completed, the economical power of the hydroelectric power plants in northern Myanmar will be transferred to the 500 kV Pharyargyi substation near Bago city in northern Yangon, and the 500 kV Hlaingtayar in western Yangon city. In the future, a new 500 kV transmission line will be installed from China to the 500 kV Pharyargyi Substation, and power will be imported. From the power sources in southeastern Myanmar, the 500 kV Pharyargyi Substation will take power from the new thermal power plants or from Thailand. Because these power supplies are cheaper and more economical than emergency power supplies, it is necessary to replace the emergency power supply with power from these supplies as soon as possible.

However, in the western part of Yangon City, although a sufficient amount of power can be supplied from low-cost power sources via the 500 kV Hlaingtayar Substation under construction, the 230 kV transmission routes from the western part of Yangon City to the eastern part do not have enough circuits, and the existing 230 kV transmission line in eastern Yangon City is old and the current transmission capacity is insufficient. Therefore, it is necessary to quickly replace the power sources and secure the transmission capacity to eastern Yangon city by implementing this project, constructing a new 500 kV substation in the eastern part of Yangon city, constructing 230 kV transmission lines from the new 500 kV substation, and strengthening the existing 230 kV transmission lines.

In addition, gas fields near Yangon are expected to be depleted, and the development of ports for importing fuel will be costly, so the capacity of new thermal power sources installed near Yangon City is limited. For this reason, this alone cannot secure sufficient generated power for the future. Therefore, the facilities of this project will be effective in the future for increasing the transmission capacity from the power sources in the northern and southeastern parts of the outside of Yangon City to the city of Yangon.

In addition, by operating the 500 kV Hlaingtayar substation constructed in the west of Yangon city together with the new 500 kV substation constructed in this project, power can be supplied from the east and west of Yangon in duplicate. Emergency response in the event of a transmission line accident and backup can be performed quickly, and the reliability of power supply to Yangon city can be improved.