Environmental Impact Assessment

March 2018

MYA: Power Network Development Project—Transmission Component

Prepared by AF-Consult Switzerland Ltd. for the Department of Power Transmission and System Control and the Asian Development Bank.

Client **Asian Development Bank**

Project **TA 9179-MYA: Power Network Development Project – PPTA Consultant**

Document Type **Transmission Lines EIA**

Project number **4272**

January 2018

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List of Figures

List of Tables

Supplementary Appendice

ABBREVIATIONS and ACRONYMS

ADB	-	Asian Development Bank
AFC	-	AF-Consult Switzerland (PPTA Consultant)
APMBC	-	Anti-Personnel Mine Ban Convention
APs	-	Affected Persons
ASEAN	-	Association of South East Asian Nations
BOD	-	Biological Oxygen Demand (20^oC)
CEMP	-	Contractor's Environmental Management Plan
CRVA	-	Climate Risk Vulnerability Assessment
PIC	-	Project Implementation Consultant
DEPP	-	Department of Electric Power Planning, MoEE
DMH	-	Department of Meteorology and Hydrology, MOT
DPTSC	-	Department of Power Transmission and System Control, MoEE
DWIR	-	Directorate of Water Resources and Improvement of River Systems
E&M	-	Electrical and Mechanical
EA	-	Executing Agency
ECC	-	Environmental Compliance Certificate
ECD	-	Environmental Conservation Department, MoNREC
EMP	-	Environmental Management Plan
EIA	-	Environmental Impact Assessment
ESO	-	Environmental Safety Officer
FD	-	Forest Department, MoNREC
FHH	-	female headed household
GRM	-	Grievance Redress Mechanism
IA	-	Implementing Agency
IBA	-	Important Bird Area
IEE	-	Initial Environmental Examination
INDC	-	Intended Nationally Determined Contribution
IUCN	-	International Union for Conservation of Nature
KBA	-	Key Biodiversity Area
$MtCO_2e$	-	Million metric tons of carbon dioxide equivalent
M&E	-	Monitoring and Evaluation
MAPDRR	-	Myanmar Action Plan on Disaster Risk Reduction (2011)
MASL	-	meters above mean sea level
MOAI	-	Ministry of Agriculture and Irrigation
MoEE	-	Ministry of Electricity and Energy
MoNREC	-	Ministry of Natural Resources and Environmental Conservation
MOT	-	Ministry of Transport
MRE	-	Mine Risk Education
NAPA	-	Myanmar's National Adaptation Program of Action
NGO	-	Non-Government Organization
NTFPs	-	Non-Timber Forest Products
O&M	-	Operation and Maintenance
PA	-	Protected Area
PCO	-	Public Complaints Officer (at DPTSC)

PIU	-	Project Implementation Unit (at DPTSC)
PMU	-	Project Management Unit
PNDP	-	Power Network Development Project
PPTA	-	Project Preparation Technical Assistance
REA	-	Rapid Environmental Assessment
ROW	-	Right of Way
RP	-	Resettlement and Ethnic Group Development Plan
SIMC	–	Social Impact Monitoring Committee
STD	-	Sexually-transmitted disease
TC	-	Transmission Component, PNDP
TIP	-	Trafficking in persons
TL	-	Transmission Line – or – WHS Tentative List (depending on context)
UNFCCC	-	United Nations Framework Convention on Climate Change
USD	-	United States Dollars
UXO	-	Unexploded Ordnance or Mines
VMCs	-	village mediation committees
WCS	-	World Conservation Society
WHS	-	World Heritage Site
WWF	-	World Wildlife Fund
YCDC	-	Yangon City Development Committee

Executive Summary

1. The Asian Development Bank (ADB) has been requested by the Government of the Republic of the Union of Myanmar to provide financial assistance for the Power Network Development Project (the "Project"). In accordance with ADB's requirements for the provision of financial assistance, ADB is procuring a project preparatory technical assistance (PPTA) to conduct a due diligence of the project and prepare the relevant project documents for the Project as a condition for the further steps in the financial assistance approval process of ADB and the Government. The responsible organization for this component is the Department of Power Transmission and System Control (DPTSC) of the Ministry of Electricity and Energy (MoEE).

2. This document provides an Environmental Impact Assessment (EIA) of the Transmission Component. Three additional related documents, bound separately, accompany this EIA: a Technical Feasibility Report, a Socio-Economic Impact Report, and a Resettlement and Ethnic Group Development Plan. A Supplementary Appendix to this document contains various supporting documents used in the preparation of the EIA Report.

Proposed Project

3. The Transmission Project includes design, supply, installation, and commissioning of two 230 kilovolt (kV) transmission lines and related substations:

- about 16.6 km 230 kV transmission line between Ahlone and Thida sub-stations with 230/66/11 kV 150 MVA Ahlone substation and 230/66/11 kV (3 x 150 MVA) GIS Thida substation; and,
- 289.1 km 230 kV Mawlamyine - Ye - Dawei transmission line with 230/66/11 kV (2 x 50 MVA) Ye substation and 230/66/11 kV (2 x 50 MVA) Dawei substation.

4. The proposed line route for 230 kV Double Circuit Transmission Line Ahlone – Thida including new indoor 230/66 kV GIS Thida substation forms part of the future 230 kV ring around central area of Yangon City.

5. The Mawlamyine – Ye – Dawei line stretches from Mawlamyinge in Mon State in north to Dawei in Taninthayi Region in the south. The line closely follows the road (Route 8) between Ye and Dawei which is the area that is most densely forested. The transmission line project includes new substations at Ye and Dawei. These are to be located on land already owned by MoEE or other Government Agencies, so no resettlement is expected. The new substations are not located on protected areas but there are some forested areas within the plots. The Ye Substation has an approximate area of 63.4 acres (25.6 ha) and the Dawei substation has a 20-acre footprint.

6. Some improvements are foreseen to several existing substations that will receive the Project transmission lines. The improvements are necessary to receive the extra lines from the project. To connect the new lines the Mawlamyine, Ahlone, and Thida substations must be extended by one 230 kV field. Additionally, in Thida a new transformer is needed to connect the 66 kV network.

Environmental Categorization

7. The Project has been screened and categorized under the Myanmar EIA Procedure (2015). Initial Environmental examinations are required for both transmission lines. That is, an Initial Environmental examination (IEE) is required for the Ahlone-Thida transmission line., and a separate IEE is required for the Mawlamyine – Ye – Dawei transmission line and its substations.

8. In accordance with the ADB Safeguard Policy Statement (2009), the project was screened by ADB. The project was assigned Category A requiring preparation of an Environmental Impact Assessment including an Environmental Management Plan.

Environment Description

9. Chapter 4 of the EIA presents a summary of the existing baseline environmental and social conditions in Myanmar that apply in general to all the proposed projects, with more detailed project-specific information where appropriate. The following topics are covered:

- Physical (covering geophysical issues such as seismic danger, climate, flooding risk, slope, erosion, topography, and soils; water quality and water resources; air quality and noise; hazardous materials/waste; and, greenhouse gas emissions)
- Ecological (including protected areas, rare and endangered species habitats and wildlife corridors, important bird areas, and ecosystem services)
- Socio-economic (discussing general impacts on the national economy, local/regional, gender issues, agriculture, communities, indigenous and vulnerable people issues, and land use, including urban, agricultural/pastoral, and various types of forests)
- Cultural (including temples, archaeological and historic sites, visual resources, and touristic resources)

10. An ornithology study investigated the presence and possible impacts to bird species of IUCN 'Conservation Concern'. Myanmar supports at least 1,056 bird species, a greater diversity than in any other country in mainland Southeast Asia. Of these species, 47 are Globally Threatened with seven listed as Critically Endangered. Two of these species are probably extinct in the country, of which one (Pink-headed duck *Rhodonessa caryophyllacea*) is possibly globally so. In addition, the country holds seven endemic species.

11. The Key Biodiversity Areas (KBAs) of concern include the Taninthayi Nature Reserve near Dawei and the Mawlamyine KBA, south of Mawlamyine city. Mawlamyine-Ye-Dawei transmission line has designed to avoid these KBAs.

12. Myanmar's tangible cultural heritage is one of the richest and most diverse in the Southeast Asian region, and is comparable to that of Cambodia and Thailand. Due to the severe international isolation since 1962 there has been a void in the field of heritage conservation. Myanmar has one World Heritage Site, Pyu Ancient Cities. One of the ancient cities is located at Beikthano which is not near either of the proposed lines. Other Archaeological/historical sites of Myanmar are not yet as well documented. UNESCO has offered its assistance to Myanmar to conduct an inventory and develop conservation guidelines for the protection of other cultural heritage sites, such as the Bagan Archaeological Area which is a cultural heritage site of immense importance, covering a vast plain of 80 square km. and containing more than 2,500 monuments built between the 10th and the 14th century. None of the Project's transmission lines will approach these sites.

13. Anti-personnel mines pose a clear and present danger to civilians in the conflict areas of Myanmar. Existing data available on UXO and landmine victims indicate that Myanmar faces one of the most severe landmine problems in the world today. Relatively little is known about the actual extent of the problem, the impact on affected populations, communities' mine action needs and how different actors can become more involved in mine action. Some 55 townships (of a total of 325) in 10 states and regions are believed to suffer from some degree of mine contamination, primarily from anti-personnel mines. The townships that are affected by the Project are all along the Mawlamyine-Ye-Dawei line.

14. Myanmar has one of the lowest population densities in the South-East Asia region, with fertile lands, potential to increase its production, yields and profits in agriculture, and a rich endowment of natural resources. Its geographic location at the intersection of China and India, two of the world's most dynamic economies, makes it well positioned to resume its traditional role as a regional trading hub and a key supplier of minerals, natural gas and agricultural produce.

15. At least 70% of poor people in Myanmar live in rural areas, where they rely on agricultural and casual employment for their livelihoods. Many live near the poverty line and are sensitive to

economy-wide shocks. The main occupations in Myanmar are: Skilled agricultural, forestry and fishery workers (44.8 per cent); elementary occupations (15.8 per cent); service and sales workers (15.3 per cent); craft and related trades workers (11.2 per cent).

16. Among ASEAN countries, Myanmar has the lowest life expectancy and the second-highest rate of infant and child mortality. Just one-third of the population has access to the electricity grid and road density remains low at 219.8 kilometers per 1,000 square kilometers of land area. With the recent liberalization of the telecommunications sector, mobile and internet penetration has increased significantly from less than 20% and 10% in 2014, to 60% and 25% respectively.

Potential Impacts and Mitigations.

17. Impacts have been assessed and mitigation measures designed for (i) air quality and dust; (ii) noise and vibration; (iii) water resources (including hydrology, water quality, wetlands and irrigation systems; (iv) land degradation and soils (including erosion, soil contamination, and landslides); (v) solid waste and hazardous materials; (vi) forests; (vii) birds; (viii) biodiversity (including key biodiversity areas, terrestrial habitat, and aquatic habitat); (ix) physical culture resources; (x) community health and safety; xi) occupation health and safety; (xii) visual aesthetics; and (xiii) worker camps.

18. Climate change was considered from two perspectives 1) the effect of the transmission lines have on the production of greenhouse gases (GHG) that would contribute to climate warming, and 2) the effect of climate change on the transmission lines. A separate study on climate risk and vulnerability assessment has been prepared. It concluded that the climate risk is high.

19. There are no anticipated or identified global or transboundary impacts for the project. Cumulative impacts from further development of the electric transmission grid of Myanmar will in general be economically positive in terms of strengthening the system.

Alternatives

20. Two alternative alignments were considered for the Ahlone- Thida Transmission Line. The rejected alternative alignment, which would pass through a developed and congested urban area along the Strand Road was considered to have serious social and economic impacts. The Preferred Alternative passes through the most rural Dala township.

21. Two alternate alignments were proposed for the Mawlamyine-Ye-Dawei transmission. The rejected alternative, which would have passed through the Mawlamyine KBA and Taninthayi Nature Reserve, was considered to have significant impacts on biodiversity. The Preferred Alternative avoids both Mawlamyine KBA and Taninthayi Nature Reserve.

Public Consultation

22. Article 61 of the Environmental Impact Assessment Procedure (2015) specifies that consultation shall be carried out. The ADB Safeguard Policy Statement (2009) also specifies that meaningful pubic consultation needs to be carried out. During construction and operation, communities in and around the Project area will be kept informed of construction activities that are likely to cause noise and dust nuisance, or disruption to irrigation flows or roads and pathways.

23. Consultation for the Transmission Line Component consisted of four parts:

i. Consultation with MoNREC, ECD, to introduce the project and obtain their decision as to the category of the Transmission and Distribution Component;
ii. Consultation with MoNREC, Forest Department to discuss the project and obtain information, including the process required for clearing the ROW of trees;
iii. Two rounds of public meetings organized by DPTSC with a broad array of attendees at Townships affected by the proposed transmission lines: and

iv. Household surveys to obtain data required for preparation of the Resettlement and Ethnic Group Development Plan

24. Two rounds of public consultation meetings with over 700 attendees (27% women) in townships and villages along the transmission lines resulted in a clear indication that people are supporting the project and want it to proceed as fast as possible. Concerns about the timing of construction and possible impacts to the communities were raised, which indicates the need for a comprehensive and robust EMP to be implemented. Consultation also took place with concerned agencies and local government officials, especially ECD and the Forest Department of MoNREC.

Grievance Redress

25. Unforeseen problems and issues may arise due to construction and operational impacts. Therefore, to resolve these issues, the DPTSC will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance. It should be emphasized that the grievance redress mechanism proposed in the EIA relates only to the Project's environmental and social performance. Grievances associated with resettlement and compensation are addressed through a separate process described in the Resettlement and Ethnic Group Development Plan.

Emergency Response Plan

26. **Emergency Response Plans.** To address these hazards, emergency response plans are to be developed. The Transmission Line Construction Contractors will need to have emergency response plans for: (i) Fire and explosions; (ii) Hazardous Chemical Spills; (iii) Landslides and Slope failures during construction of towers; (iv) Extreme events (i.e. wild fire, typhoons, floods); and (v)Electrocution accidents. At substations, emergency response plans are needed to address (i) fires and explosions, (ii) oil leaks from transformers, (iii) electrical failures and equipment malfunctioning; and (iv) electrocution accidents.

Environmental Management Plan

27. An environmental management plan (EMP) has been prepared to guide implementation of the mitigation measures and monitoring programs. The plan outlines the institutional arrangement for supervision and of the EMP; summarizes the mitigation measures; outlines requirements; includes training and capacity development activities; and provides a cost estimate. The cornerstone of the implementation of the EMP, is the Contractor Environmental Management Plan (CEMP). The CEMP must be prepared prior to the start of the construction.

28. **Implementation Arrangements.** The MoEE and its DPTSC do not have environmental and social management systems to guide project preparation, project construction, operation, and maintenance of lines. Overall responsibility for implementation of the environmental management plan falls to the Project Management Unit (PMU) for this project. The PMU will be supported by a Project Implementation Consultant.

29. There are nine agencies that are involved in the implementation, supervision, and of the environmental management plan: (i) Contractors, (ii) Project Implementation Consultant, (iii) MOEE, (iv) DPTSC PMU, (v) Ahlone-Thida PIU, (vi) Mawlamyine-Ye Dawei PIU, (vii) Ministry of Natural Resources and Environmental Conservation, (viii) ADB, and (ix) independent, Environmental Quality Sub-contractors. The EMP outlines the responsibilities and reporting relationships for these agencies.

30. **Environmental** . Environmental includes (i) baseline environmental ; (ii) environmental quality , (iii) compliance , to ensure that mitigation specified in the EMP is carried out to an adequate standard, (iv) community feedback to obtain views and information on relevant environmental and social issues.

31. **Training**. DPTSC needs to provide capacity development and/or training programs to ensure staff in all involved agencies (i) fully understand the environmental management plan; (ii) understand their responsibilities; and (iii) are capable to undertake their responsibilities. DPTSC needs to hire a qualified contractor to conduct these necessary training and capacity development programs.

32. **Cost**. The total cost for environmental mitigation and monitoring costs (inclusive of access roads and substations) is estimated for each transmission line. The total cost for Ahlone-Thida line is $ 629,118 of which, $429,197 is for mitigation measures to be implemented by the contractor and $199,291 for supervision and monitoring by the Project Implementation Consultant. The total cost for the Mawlamyine-Ye- Dawei line is $3,899,745 of which, $3,350,866 is for mitigation measures to be implemented by the contractor and $548,879 is for supervision and monitoring by the Project Implementation Consultant. The total environmental management cost for the Project is $4,528,863.

Conclusion

33. Assuming that mitigation measures and monitoring requirements in the Environmental Management Plan are effectively implemented, the project is not expected to have a significant adverse environmental impact.

1 INTRODUCTION

1. The Asian Development Bank (ADB) has been requested by the Government of the Republic of the Union of Myanmar (the "Government") to provide financial assistance for the Power Network Development Project (the "Project"). In accordance with ADB's requirements for the provision of financial assistance, ADB is procuring a project preparatory technical assistance (PPTA) to conduct a due diligence of the project and pre-pare the relevant project documents for the Project as a condition for the further steps in the financial assistance approval process of ADB and the Government.

2. This document provides an Environmental Impact Assessment (EIA) of the Transmission Component (TC) which includes design, supply, installation, and com-missioning of two 230 kilovolt (kV) transmission lines and related substations:

- about 19 km 230 kV transmission line between Ahlone and Thida sub-stations with 230/66/11 kV 150 MVA Ahlone substation and 230/66/11 kV (3 x 150 MVA) GIS Thida substation; and,
- 286 km 230 kV Mawlamyine - Ye - Dawei transmission line with 230/66/11 kV (2 x 50 MVA) Ye substation and 230/66/11 kV (2 x 50 MVA) Dawei substation.

3. The responsible organization for this component is the Department of Power Transmission and System Control (DPTSC) of the Ministry of Electricity and Energy (MoEE).

4. This document provides an Environmental Impact Assessment (EIA) of the Transmission Component. Three additional related documents, bound separately, accompany this EIA: a Technical Feasibility Report, a Socio-Economic Impact Report, and a Resettlement and Ethnic Group Development Plan. A Supplementary Appendix to this document contains various supporting documents used in the preparation of the EIA Report.

2 DESCRIPTION OF THE PROJECT

2.1 Current Status of Myanmar Power Transmission Sector

5. To manage the increasing electricity demand and to offer access to electricity to as many regions as possible, MoEE has developed a comprehensive power system extension plan. It includes the development of transmission system up to the year 2022 and 2030 as well as construction of new generation capacity.

6. Most of the demand of the country is located in the Yangon area in the southern part of the country while a significant part of the generation (hydro power plants) is located in the central-northern part. Today, the power is transported through two main 230 kV transmission line corridors, from north to south, from Thapyeywa substation to Myaungtagar substation (West Corridor) and from Thapyeywa substation through Thazi to Kamarnat and Hlawga Substations (East Corridor).

7. The objectives of the Power Network Development Project (the Project) developed by the Government of the Republic of the Union of Myanmar (the Government) are as follows:

- increase energy security through the diversification and expansion of transmission and distribution network;
- improve power supply reliability in the country and regions;
- reduce transmission losses; and
- improve operational efficiency of the power sector.

2.2 Proposed Project Transmission Lines

8. The two proposed transmission line projects cross 11 townships in 3 regions/states. See Table 1 for list of regions/states and townships.

Table 1. Regions/States and Townships included in proposed transmission line projects

TC Project	Region/State	Township
230 kV transmission line between Ahlone and Thida sub-stations	Yangon Region	Ahlone Township
		Lanmadaw Township
		Kyauktada Township
		BotahtaungTownship
		DalaTownship
230 kV Mawlamyine - Ye - Dawei transmission line	Mon State	Mawlamyine Township
		Mudon Township
		Thanphyuzayat Township
		Ye Township
	Tanintharyi Region	Yaephyu Township
		Dawei Township

Source: DPTSC 2017

9. The geographic extent of the project is shown in Figure 1. The proposed lines are described further in the following sections.

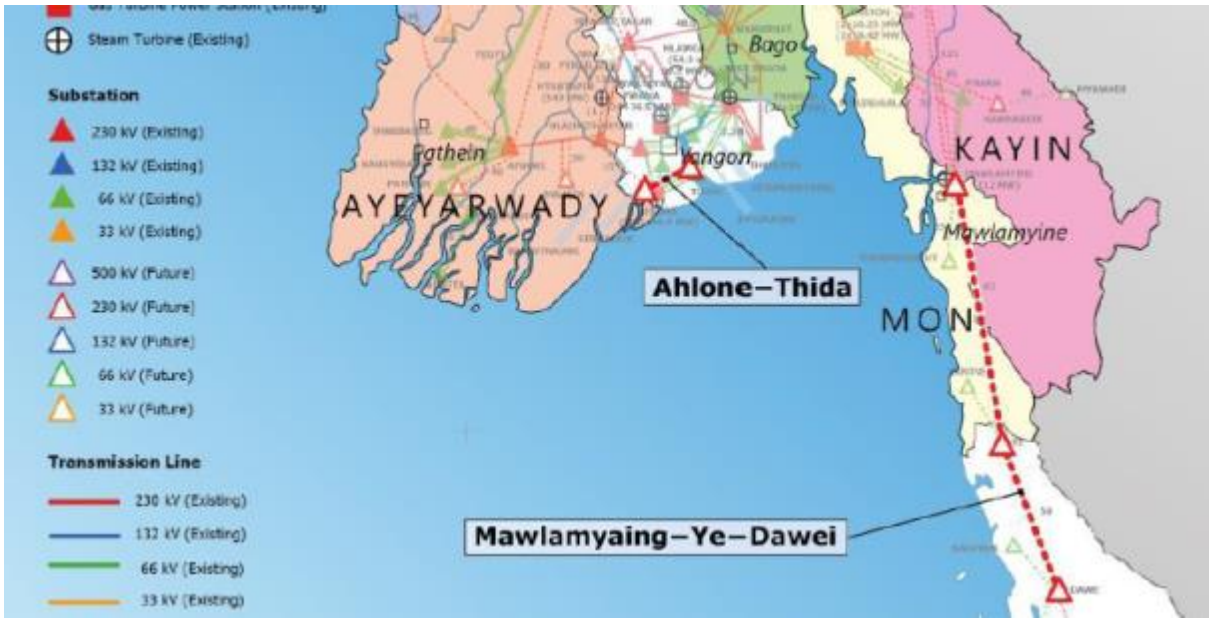


Figure 1 Geographic Distribution of the Transmission Lines

230 kV Double Circuit Transmission Line Ahlone - Thida

10. The proposed line route for 230 kV Double Circuit Transmission Line Ahlone – Thida including new indoor 230/66 kV GIS Thida substation, presented in Figure 2, forms part of the future 230 kV ring around center area of Yangon. The load-flow simulation of Myanmar Network Model shows that the line will improve the voltage level at Thida and Ahlone Substations which is needed as the voltage level is currently low at these nodes of the network, and, as part of the loop around Yangon, this line will improve the reliability of the Yangon power supply.

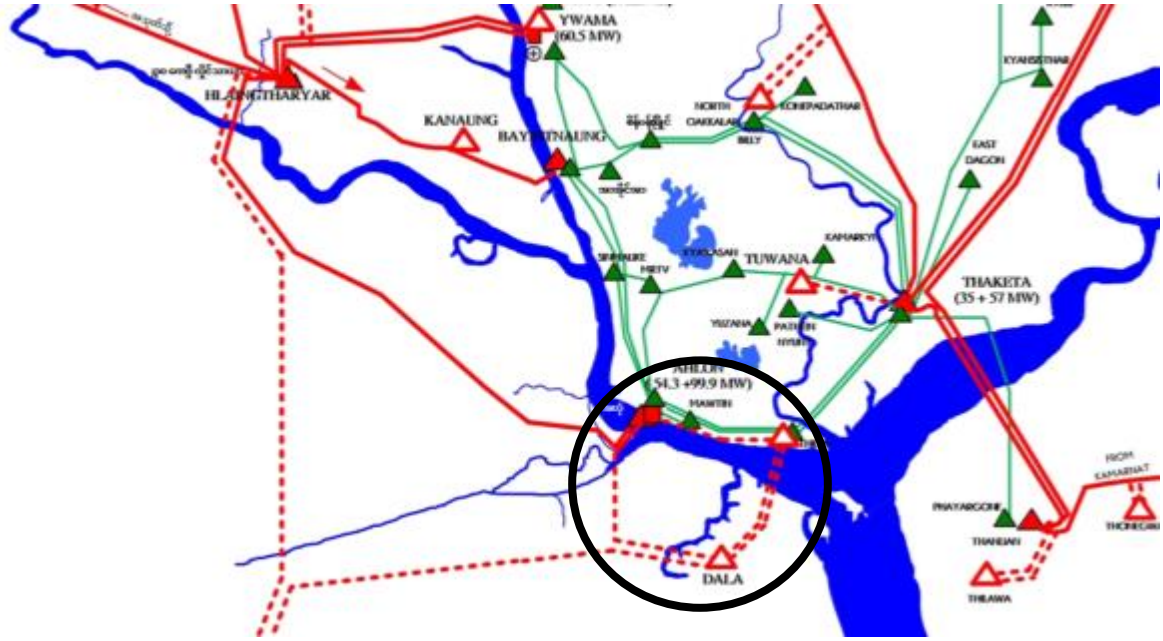
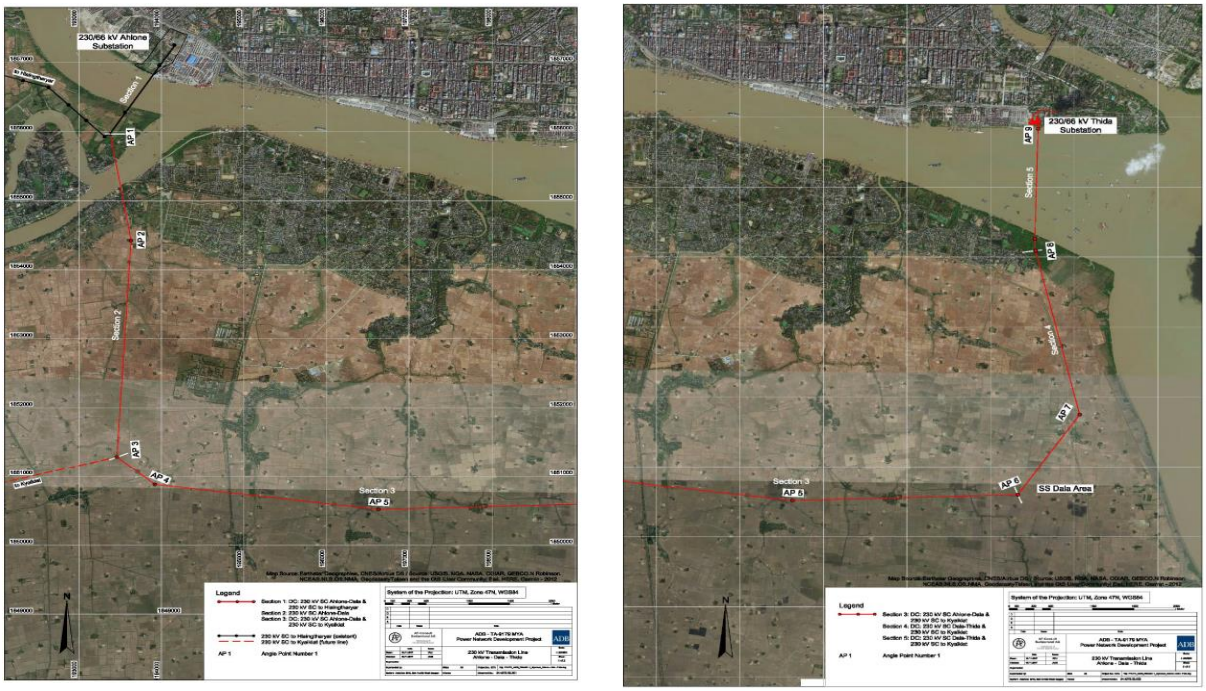


Figure 2 Network section influenced by Ahlone – Thida Project

11. The proposed 230 kV Double Circuit Transmission System Ahlone – Thida may include a new 230/33 kV Dala substation that will supply Data township and serve as connection to future planned Combined Cycle Gas fired (LNG) power plant expected to be located (see Figure 3) on the banks of Yangon Pyapon river.

Figure 3 Ahlone – Thida via Dala Transmission Route



230 kV Double Circuit Transmission System Mawlamyine – Ye – Dawei

12. The parts of Myanmar national grid that will be influenced by 230 kV Double Circuit Transmission System Mawlamyine – Ye – Dawei is presented in Figure 4. The final selected routing of the Mawlamyine- Ye – Dawei line in shown in Figure 5. As can be seen, it closely follows Route 8 between the Ye and the Dawei substations. The line represents new electrification of Ye and Dawei and surrounding areas.

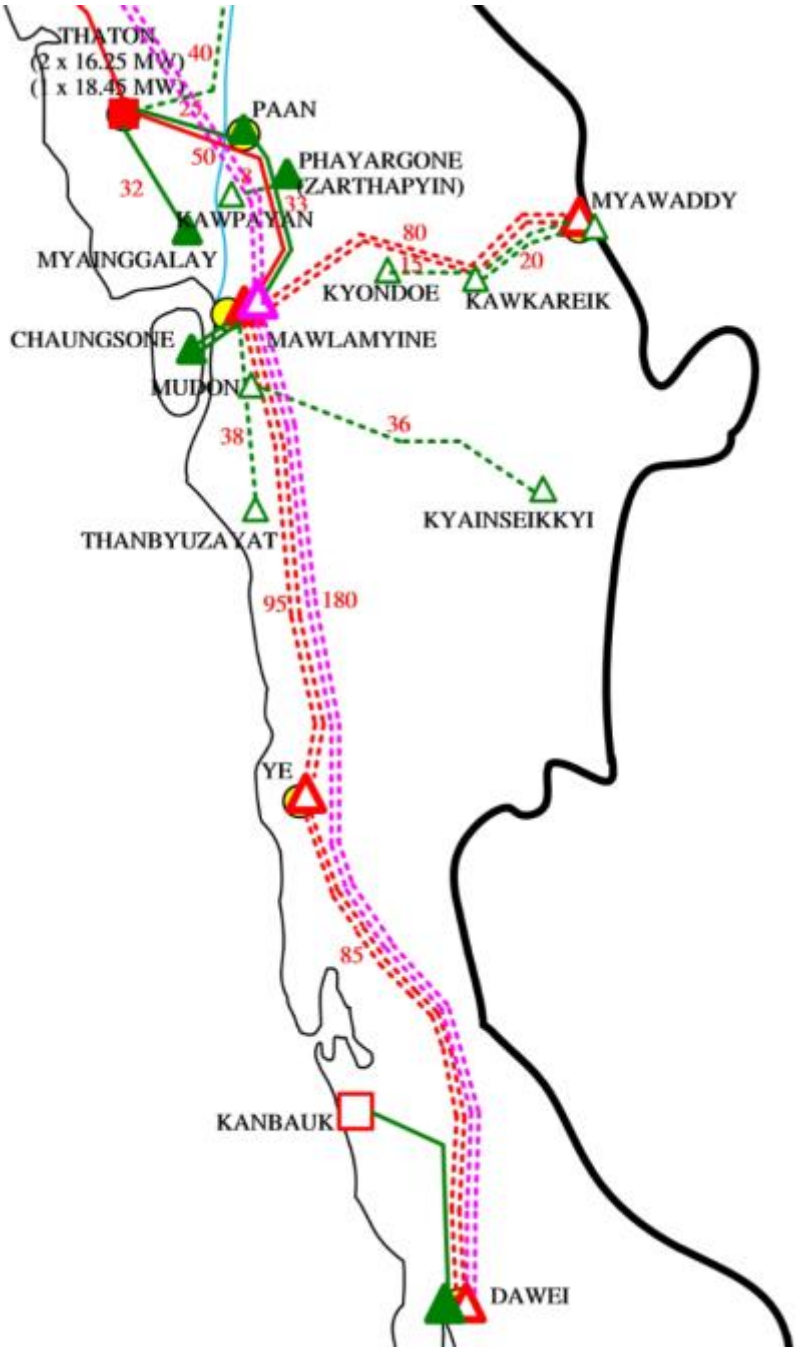


Figure 4 Network section influenced by Mawlamyine – Ye – Dawei Project

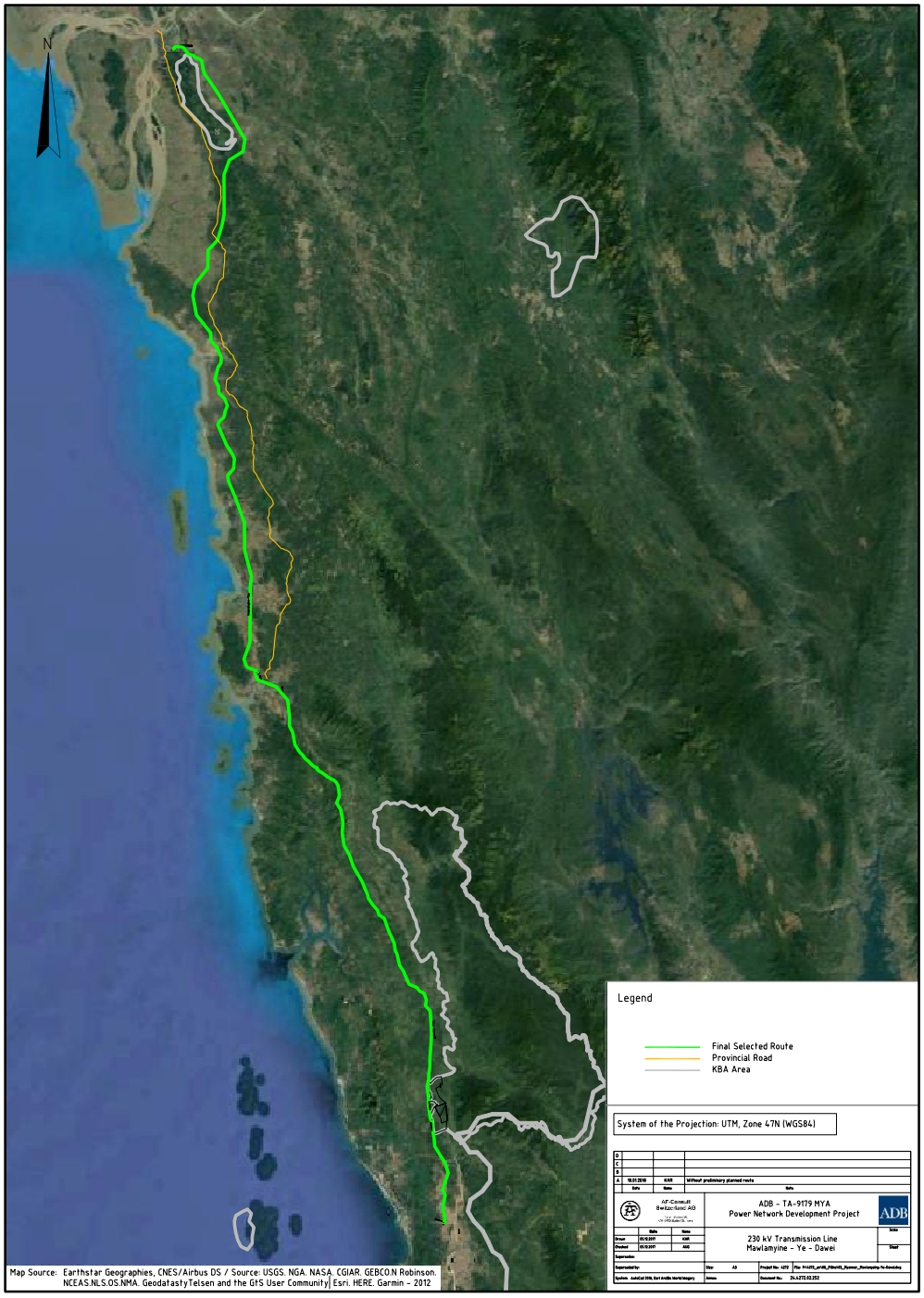


Figure 5 Overview of the Mawlamyine-Ye-Dawei Transmission Line

2.3 New Substations at Ye and Dawei

13. The Mawlamyine-Ye-Dawei TL includes new substations at Ye (Figure 6) and Dawei (Figure 7). These are to be located on land already owned by MoEE or other Government Agencies, so no resettlement is expected. The new substations are not located on protected areas but there are some forested areas within the plots.

14. The Ye Substation has an approximate area of 63.4 acres (25.6 ha).

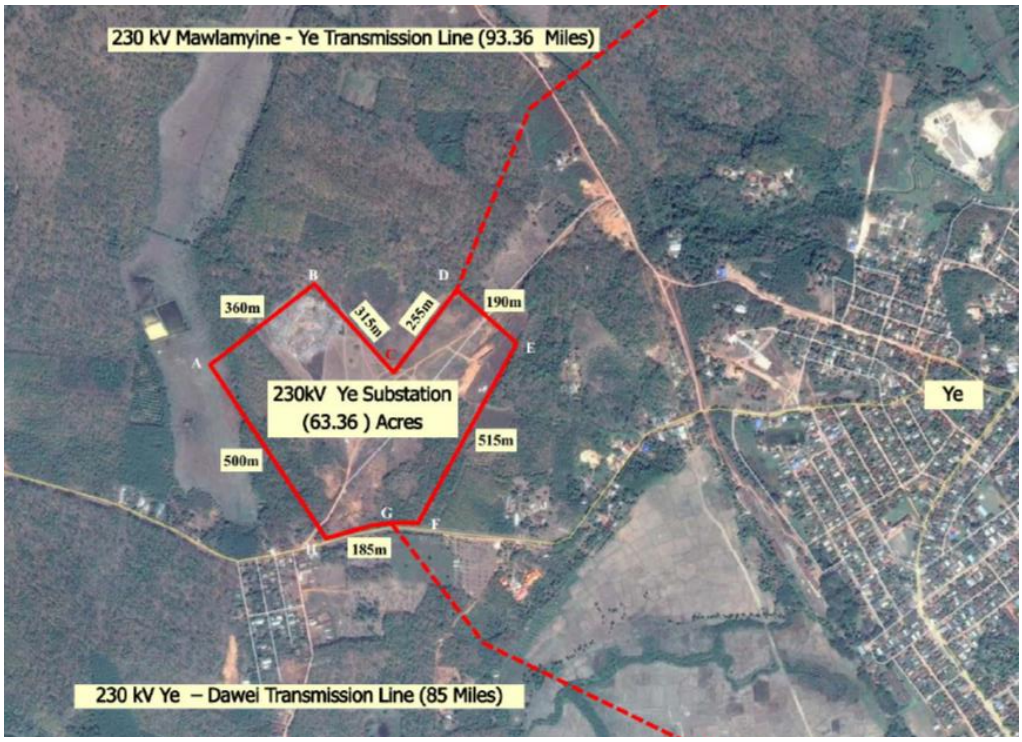


Figure 6 Proposed New Substation at Ye

15. The proposed new Dawei Substation has an approximate area of 20 acres (8.1 ha) and it is shown in Figure 7.

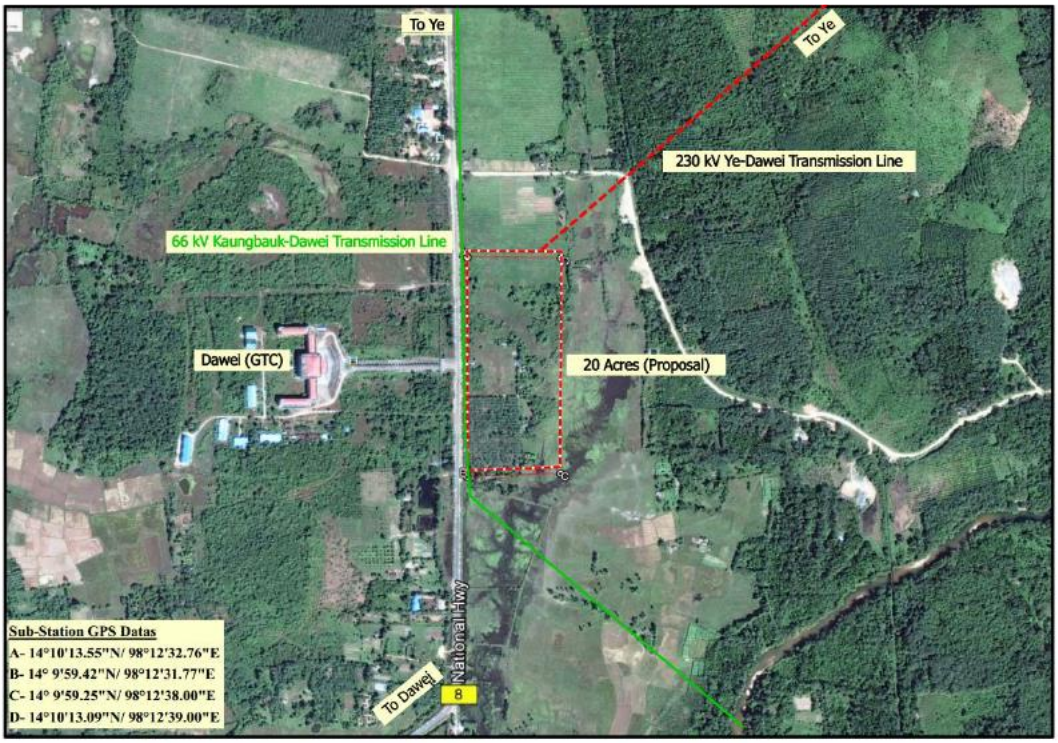


Figure 7 Proposed New Substation at Dawei

2.4 Potential Improvements at Existing Sub-Stations

16. Some improvements will be required to several existing substations to receive the extra lines from the Project. To connect the new lines, the Mawlamyine, Ahlone, and Thida substations must be extended by one 230 kV field. Additionally, in Thida a new transformer is needed to connect the 66 kV network. The layouts of these substations are shown in the following figures 8, 9, and 10.

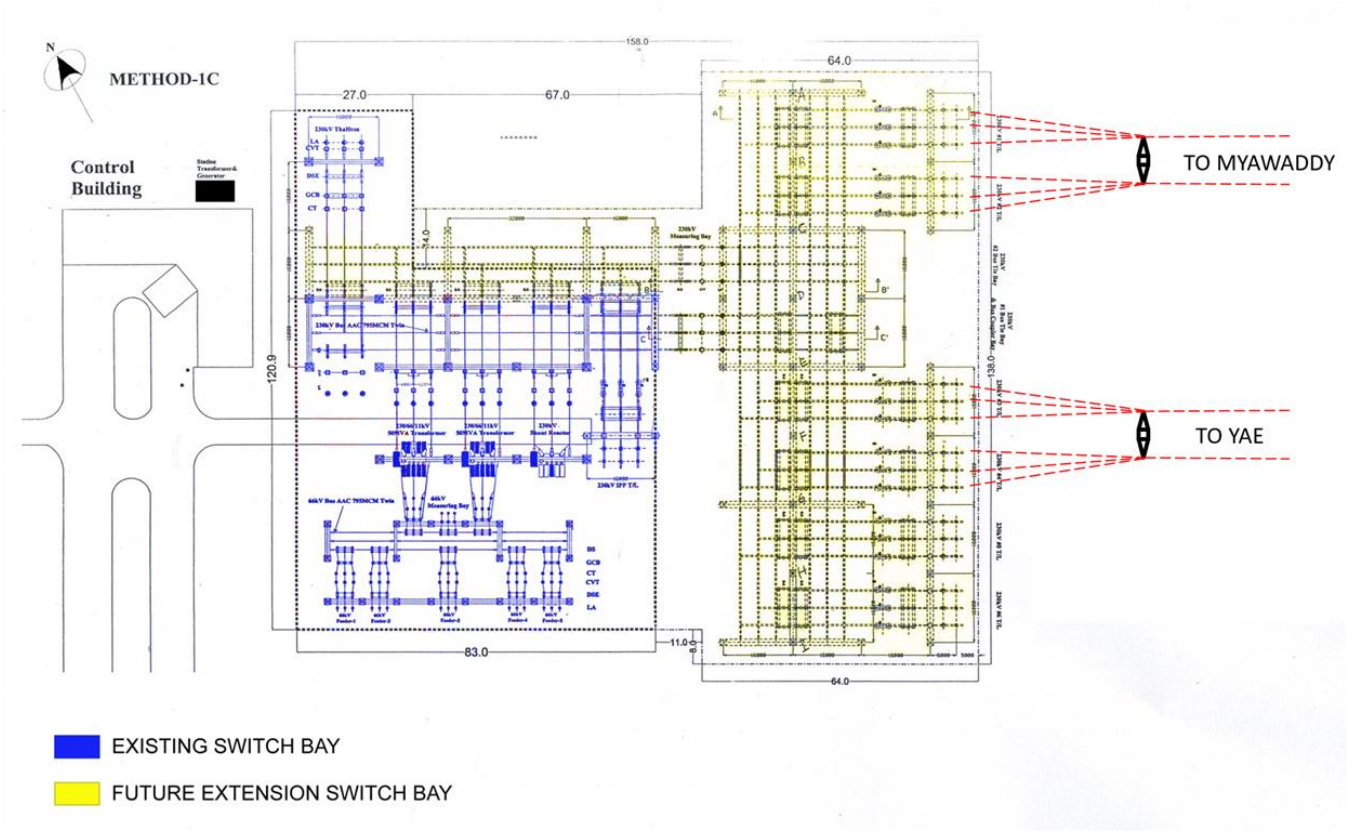


Figure 8: Layout of Existing Sub-Station at Mawlamyine, with future extensions

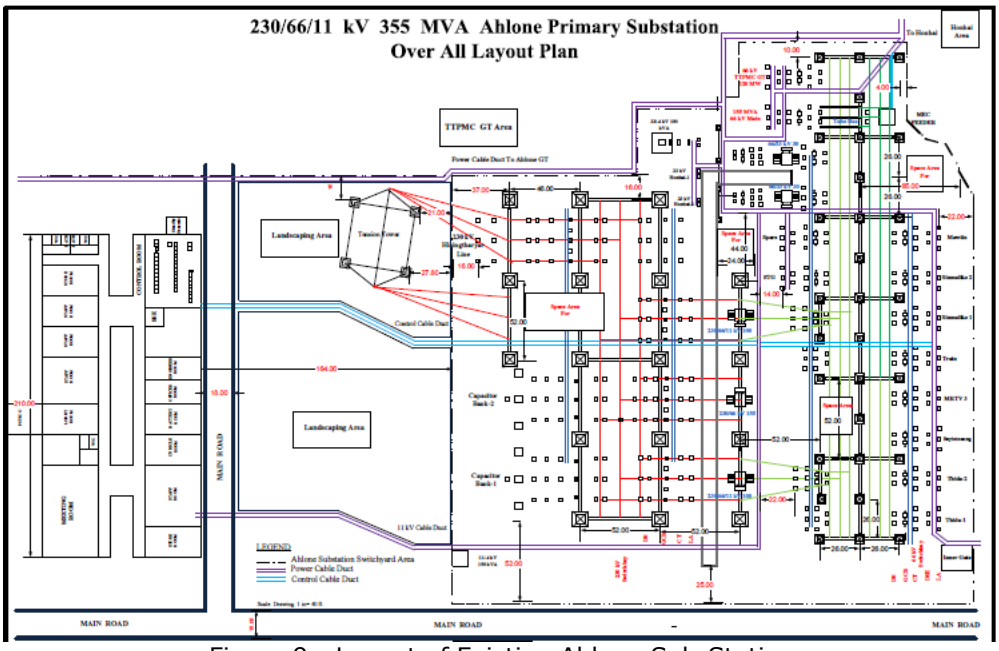


Figure 9: Layout of Existing Ahlone Sub-Station

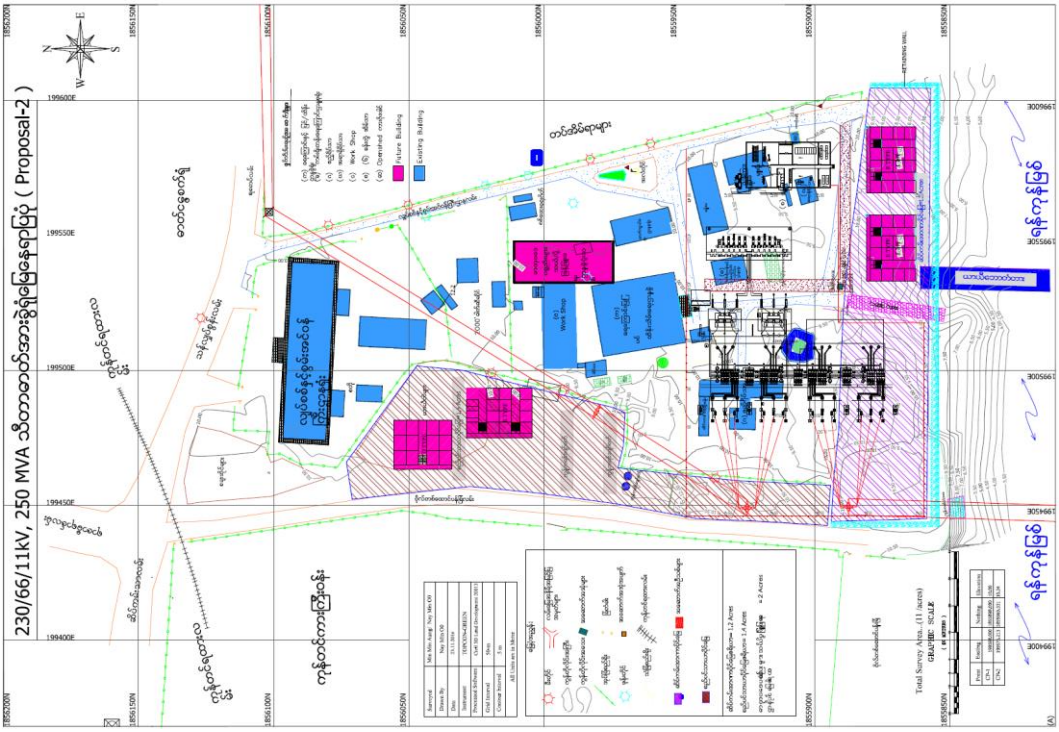


Figure 10: Layout of Existing Thida Sub-Station

2.5 Construction Activities and Requirements

17. The main construction activities involved in implementing the PNDP include:

For the transmission Lines

- Routing and Impact Assessment
- Surveying and staking the line and tower locations
- Clearing of Right-of-Way (ROW)
- Building access roads as necessary
- Establishing foundations for the towers
- Erecting the towers
- Stringing the conductors and earth wires.

For the New Substations

- Clearing of the substation land
- Building access roads as necessary
- Fencing
- Establishing foundations for the substation components
- Erecting the various components and buildings
- Stringing the conductors and earth wires into the substation

For the Existing Substations

- Installing additional equipment
- Fencing (maybe the fence has to be replaced, SS to be extended)

2.5.1 Routing and Impact assessment

18. This is the first step in the construction of transmission lines and substations. Generally, this step involves delineating a route that addresses the following criteria:

- Minimum environmental impact
- Lowest possible social cost, including land acquisition
- Most cost-effective construction
- Best operational efficiency (reducing losses) and lowest maintenance costs
- Location of necessary substations.

2.5.2 Clearing of ROW for Transmission Lines

19. The right-of-way (ROW) width is defined in the technical specifications. The complete clearing of the ROW should be limited to a strip right and left of the center line as defined in the plans and specifications in forested areas to allow stringing of the conductors. Outside this strip but within the ROW all vegetation above 4 m height needs to be cleared including high trees outside the ROW which could fall into the line.

2.5.3 Access roads

2.5.3.1 General

20. In some areas additional access roads have to be built. The planning of these roads has to be done carefully, and public existing access has to be used as much as possible. The access roads shall be natural roads, reinforced by a gravel bed. The cutting of only necessary trees or any other agricultural plants is possible only upon express permit, any direct or indirect damages to any private agricultural production, fencing, private access to properties and land property shall be negotiated and borne by the contractor, in general contractor shall make effort as much as possible in order to avoid the cutting of trees during the access road constructions, erection works, demobilization.

21. A map showing all access roads (existing ones and ones to be constructed) has to be prepared and submitted to the PIU/PIC for approval and shared with the local communities.

22. All new access roads required shall be located as far as possible within the ROW easement, and the number of new access routes between existing roads and the easement shall be kept to a minimum. Finger roads are preferable instead of a continuous access along the line. The Contractor will negotiate with the landowners about permission and compensation.

2.5.3.2 Access road construction

23. The Contractor shall (after getting permission for the routes) do what is necessary to make the access suitable for his use and shall take all reasonable precautions to avoid damage, including, if required the erection of temporary fences or gates where permanent fences, hedges or gates have been removed. The Contractor shall not be entitled to any additional payment in the event of a particular access being difficult.

24. Access roads shall not be cut into a hillside immediately below a tower. Plans for access roads in steep terrain will be submitted to the Project Management Unit or the Project Implementation Consultant[1] (PMU/PIC) for approval. Stability of slopes over 30 percent shall be checked and approved by the PMU/PIC prior to selection of foundation to be used. Access roads will be graded and sloped to prevent unnecessary flow of water across the tower sites and to minimize soil erosion.

25. New earth access tracks shall be 4 m suitably compacted. The final surface level shall be at least 0.5 m above the existing ground level and shall be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent properties. Junctions between new tracks and existing roads shall not impede or damage the latter nor any associated drainage channels, irrigation infrastructure, etc.

2.5.3.3 Maintenance and Handing Over

26. The Contractor shall be responsible for maintaining all agreed access routes, without undue widening, in a usable condition for the duration of the Contract and the landowner shall not be put to any inconvenience in gaining access to his land or buildings. All necessary measures connected with the access, transport and maintenance are in the responsibility of the Contractor.

27. For the PNDP, it is expected that some of the access roads will remain for later use in maintenance operations. However, to the extent practicable, temporary access roads will be removed and land restored after construction ends.

2.5.4 Tower Foundation works

2.5.4.1 Earthworks

28. Tower sites will be sloped as necessary to prevent erosion. Natural flows will be diverted around the site and the site protected by grading, placing rip-rap, or other erosion control measures.

29. The execution of tower foundations shall be done in accordance with applicable standards as determined by the PIC Engineer. In addition, the following requirements shall be observed. Fill materials will be tested and quality control carried out to ensure that both select and ordinary fill meet applicable standards. Ordinary fill is required for all fill and backfill where special fill or select fill have not been specified on the drawings. Tests shall be performed for each 500 m^3 of fill but not less than once per shift. Material such as fill materials will be obtained from available government or commercial sources and not from adjacent property owners

[1] A Project Management Unit will be created within DPTSC. This Unit will be supported by a Project Implementation Consultant.

30. The Contractor shall be responsible for making well all settlements of filling due to any cause whatever which may occur up to the end of the period of maintenance. The maximum permitted tower leg/stub tolerances shall be as detailed in the design drawings and specifications.

2.5.5 Concrete

31. Concrete shall not be dropped into place from a height exceeding 1.5 meters. Trunks and chutes to PIC Engineer's approval shall be used for any concrete to be deposited from a height exceeding 1.5 m. The temperature of the mixed concrete shall not exceed 30°C. The Contractor shall take special measures in the mixing, placing and curing of concrete. These measures shall include the shading of aggregates, spraying of aggregates with water, cooling of the mix constituents and reduction of transportation time to the minimum. During placing suitable measures shall be provided to prevent premature setting of concrete placed in contact with hot surfaces. All concreting areas, formwork and reinforcement shall be shielded from the direct rays of the sun and sprayed with water when necessary.

32. Immediately after the compaction of the concrete has been finished, the Contractor shall ensure adequate protection from the weather. The concrete surface shall be covered with a layer of sacking, canvas, straw mats or similar absorbent material, a permanent water layer or special protection sprays kept constantly moist for at least 7 days.

2.5.6 Tower Erection

2.5.6.1 General

33. The Contractor shall erect the towers and tower accessories in accordance with the approved detailed drawings. No steel tower shall be installed until at least seven days after the last placing of concrete in the foundation, and back-filling has been completed.

34. In addition, specification requirements shall be observed with respect to bolt tightening, damaged members, site testing of zinc coat, damaged galvanizing, and painting of towers.

2.5.7 Conductor and ground wire stringing

2.5.7.1 General

35. At least one month before stringing commences, the Contractor shall submit a fully detailed stringing schedule to the PMU/PIC for approval. This schedule shall indicate locations of conductor and earth wire drums and winches, the proposed position of mid-span joints, together with temporary staying of towers and all other relevant information required for the stringing operations including the maximum tensions to be used during running out of pilot wires, conductors and ground wire.

36. The special instructions for stringing of the ground wire advised by the manufacturer shall be followed. The Contractor shall engage the manufacturer erection supervisor for the duration of the entire stringing works. In addition, the following requirements shall be observed.

2.5.7.2 Crossing of roads, power lines etc.

37. Scaffolding shall be provided over roads, power and communication lines, houses etc. The cost of all scaffolding shall be included in the stringing price. Technical values, including clearances, should refer to the technical specification.

38. Drawings of the scaffold complete with details of the clearance plates and earthing arrangement, together with supporting, calculations shall be submitted to the PMU/PIC for approval.

2.5.7.3 Repair of damaged conductors and ground wires

39. Any damage caused to a conductor or ground wire shall immediately be reported to the PMU/PIC whose decision to replace or repair will be final. Repair of the damage shall be carried out in the manner indicated or approved by the PMU/PIC at the expense of the Contractor.

2.5.7.4 Jointing of conductors and ground wires

40. Joints in the conductors shall be of the compression type. Conductors shall be terminated at tension towers by means of compression type dead-end assemblies.

41. Jointing of all conductors shall be performed as nearly as practicable at the same position. All compression joints shall be filled and finished with emery cloth to produce a smooth surface, free of flash and sharp points, which might be a source of corona or radio interference. The Contractor shall furnish all necessary tools, including compression tools required.

42. All conductor joints shall be located in the span at least 5m away from a suspension clamp or tension clamp or compression dead-end. There shall be not more than one such joint per conductor in any one span.

2.5.8 Line hardware and insulator string set installation

43. Insulators and fittings shall remain in their crates and shall be removed only just prior to erection and shall be handled carefully to avoid damage.

44. The execution of line hardware and insulator string set installation shall be done in accordance with applicable international standards.

2.5.9 Final checking, Testing and Commissioning

2.5.9.1 Final checking & Testing

45. After completion of the works, final checking of the line shall be carried out by the Contractor to ensure that all foundation works, tower erection and stringing have been done strictly according to the specifications and as approved by the PIC Engineer. All the works shall be thoroughly inspected in order to ensure that:

- Sufficient backfilled earth covers each foundation pit and is adequately compacted;
- Earthing resistance and ground connections;
- All tower members are used strictly according to final approved drawing and are free from any defect or damage whatsoever;
- All bolts are properly tightened, punched, tack welded and painted with zinc rich paint;
- The stringing of the conductors and ground wire has been done as per the approved sag and tension charts and desired clearances are clearly available;
- All conductor and earth wire accessories are properly installed;
- All other requirements for completion of works such as fixing of danger plate, phase plate, number plate, etc. have been fulfilled;
- Wherever required, that proper revetment (erosion protection) is provided;
- The original tracings of profile and route alignment as well as foundation design & working drawings, tower design, structural drawings, bill of material and shop drawings of all towers are submitted to the PMU/PIC for reference and record;
- The insulation of the line as a whole is tested by the Contractor through provision of its own equipment, labor etc., to the satisfaction of the PIC Engineer;
- Transfer spare parts and Manual;
- The line is tested satisfactorily for commissioning purpose.

- Test of the telecommunication link
- Any defect found as a result of testing shall be rectified by the contractor forthwith to the satisfaction of the PMU/PIC without any extra charges.
- Before taking over the line by the PMU, the line shall be energized and kept in this state for 24 hours at full specified voltage.
- Rehabilitation and tree re-planting as required by the Forest Department has been done.
- For those access roads that are to be removed after construction rehabilitation of the road ROW has been completed.

3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Relevant Laws, Rules and Policies

46. The environment-related Myanmar policies, laws, and regulations pertinent to the Project are briefly described in Table 2.

Table 2 Myanmar Environmental Policies, Laws, and Regulations

Law, Rule or Policy	Description
The Myanmar **Constitution** (2008)	In Article 45 the Constitution states: "The Union shall protect and conserve natural environment." Additionally, Article 390 (b) states that "every citizen has the duty to assist the Union in carrying out the following matters: Preservation and safeguarding of cultural heritage; Environmental conservation; Striving for development of human resources; Protection and preservation of public property." http://www.burmalibrary.org/docs5/Myanmar_Constitution-2008-en.pdf
Environmental Policy (1994, updated 2016)	Building on the 1994 National Environmental Policy of Myanmar, this Policy reiterates the following core values: - The wealth of the nation is its people, its cultural heritage, its environment and its natural resources. - It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations. - Environmental protection should always be the primary objective in seeking development. The purpose of this National Environmental Policy is to provide long-term guidance for government, civil society, the private sector and development partners in Myanmar on environment and sustainable development objectives in Myanmar. The Policy will guide detailed strategic frameworks and action plans for the environment sector, including Green economic development, climate change and waste management strategies, as well as provide guidance for the mainstreaming of environmental considerations into all other plans and policies developed in Myanmar. https://businesshumanrightsburma.files.wordpress.com/2016/12/national-environmental-policy-statement-2016_eng_nov20_final_clean_ta.pdf
Myanmar Agenda 21 (1997)	The National Commission for Environmental Affairs (NCEA) formulated Myanmar Agenda 21 in 1997 as the expression of the political commitments by the government for achieving sustainable development in Myanmar. It was intended to serve as a framework for integrating environmental considerations into future national development plans as well as for sectoral development programs. It was followed by the National Sustainable Development Strategy (NSDS) in 2009. http://www.un.org/esa/agenda21/natlinfo/countr/myanmar/eco.htm
National Sustainable Development Strategy NSDS (2009)	"The vision for Myanmar NSDS is set as 'wellbeing and happiness for Myanmar people' with 3 overarching goals: i) sustainable management of natural resources, ii) integrated economic development, and iii) sustainable social development. A total of 26 areas have been identified to achieve the goals. Ecosystem management has been given top priority to ensure the sustainability of the ecosystem services. Myanmar will focus on sustainable production and consumption, energy efficiency, and forest based eco-tourism as part of its integrated economic development. One of the major objectives of the Sustainable social development is to create a knowledge based society. A total of

Law, Rule or Policy	Description
	129 indicators have been identified to monitor the progress on economic, social and environmental goals and objectives. The Myanmar NSDS proposes the preventive measures, besides traditional reactive policies, to address the emerging environmental issues, man-made disasters and the climate change." Foreword by Young-Woo Park, Regional Director UNEP ROAP, Bangkok http://extwprlegs1.fao.org/docs/pdf/mya152933.pdf
Environmental Conservation Law (2012)	Objectives are to enable the emergence of a healthy and clean environment and to foster the conservation of natural and cultural heritage for the benefit of present and future generations. The law also aims to reclaim ecosystems which are starting to degrade and disappear as may be possible, and to enable sustainable management of natural resources. Article 7 of the ECL states the duties and powers of the Ministry of Environmental Conservation and Forestry (MOECAF, *now MoNREC*), which include: • Prescribing environmental quality standards on emissions, effluents, solid waste, production procedures, processes and products; • Facilitating the settlement of environmental disputes; • Specifying categories and classes of hazardous wastes generated from the production and use of chemicals or other hazardous substances used in industry, agriculture, mineral production, sanitation and other activities; • Prescribing categories of hazardous substances that may significantly affect the environment; • Prescribing the terms and conditions for effluent treatment in industrial estates, buildings, and other sites and emissions of machines, vehicles and mechanisms; • Developing and implementing a system of environmental impact assessment (EIA) and social impact assessment (SIA); • Enforcing compensation by polluters for environmental impacts; collecting funds from organizations which benefit from natural ecosystems and revenues from businesses which explore, trade and use natural resources, in order to support environmental conservation works. http://www.altsean.org/Docs/Laws/Environmental%20Conservation%20Law.pdf
Environmental Conservation Rules (2014)	Implementing regulations for the Environmental Conservation Law (2012). Specifies the meaning of EIA, IEE, and EMP. http://www.dica.gov.mm/en/environmental-regulation
Myanmar Investment Law (2011) Official translation 18 October 2016	The first objective of this Law is as follows: (a) to develop responsible investment businesses which do not cause harm to the natural environment and the social environment for the interest of the Union and its citizens; Additional objectives are: (b) to protect the investors and their investment businesses in accordance with the law; (c) to create job opportunities for the people; (d) to develop human resources; (e) to develop high functioning production, service, and trading sectors. (f) to develop technology, agriculture, livestock and industrial sectors; (g) to develop various professional fields including infrastructure around the Union; (h) to enable the citizens to be able to work alongside with the international community; (i) to develop businesses and investment businesses that meet international standards.

Law, Rule or Policy	Description
	http://www.dica.gov.mm/sites/dica.gov.mm/files/document-files/myanmar_investment_law_official_translation_3-1-2017.pdf
Myanmar Investment Rules (2013)	Specifies rules on ownership and environmental documentation required for various types of foreign investments. In the area of energy generation the rules indicate that generally the investor must prepare an Environmental Impact Assessment for approval by MoNREC. The rules do not mention transmission lines. Two notifications comprise the Myanmar Investment Rules. Notification 1/2013 identifies permitted activities for foreign investors some of which require a joint venture with a National organization. Notification 11/2013 provides guidance on complying with regulations for applying for an investment license ("MIC Permit"), the use of land, transfer of shares, remittance of foreign exchange and the taking of security on land and buildings. http://www.dmr.go.th/ewt_dl_link.php?nid=78950&filename=res
National Biodiversity Strategy and Action Plan, 2015-2020 (NBSAP) (October, 2015)	The first NBSAP was prepared in 2011 to initially address the requirements of the Convention on Biological Diversity (CBD). The NBSAP (2015-2020) provides a strategic framework for the conservation of Myanmar's biodiversity to address new and emerging challenges arising from political, economic and social reform in Myanmar, as well as take into account new opportunities, and align targets and actions with the CBD's Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. This NBSAP provides a comprehensive account of and identifies the primary threats to the country's biodiversity; describes the key efforts, achievements and gaps in its management; presents strategic approaches, theme-specific strategies and associated priorities for actions; and outlines implementation arrangements. World Cultural and Natural Heritage (known as the World Heritage Convention or WHC) identifies World Heritage Sites (WHS). As of 2015, Myanmar had seven natural sites on its WHS Tentative List, of which the Tanintharyi Forest Corridor is relevant to the Project. https://www.cbd.int/doc/world/mm/mm-nbsap-v2-en.pdf
NAPA (2012)	Under the UN Framework Convention on Climate Change (UNFCCC) Myanmar's National Adaptation Programs of Action (NAPA) specifies 32 priority activities referred to as Priority Adaptation Projects for effective climate change adaptation for eight main sectors/themes, namely i) Agriculture; ii) Early Warning Systems; iii) Forest; iv) Public Health; v) Water Resources; vi) Coastal Zone; vii) Energy and Industry; and viii) Biodiversity. http://unfccc.int/resource/docs/napa/mmr01.pdf
Myanmar Action Plan on Disaster Risk Reduction [MAPDRR] (2012)	The Goal of MAPDRR is to "make Myanmar safer and more resilient against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains." To achieve the Goal, the objectives of MAPDRR are as follows: 1. To build a more resilient and safer community through conceptualization, development and implementation of appropriate disaster risk reduction programs and culture of safety; 2. To provide a framework for implementing Myanmar's commitments at the global and regional levels; 3. To provide a mechanism where the disaster risk reduction initiatives of all Government Ministries and Departments, supported by UN organizations and other stakeholders, can be coordinated and monitored; 4. To provide a conducive environment for mainstreaming Disaster Risk Reduction (DRR) into development plans, and programs at the National, State, Division, Township, and Village Tract levels; and 5. To support mutually beneficial partnerships between the Myanmar Government and their development cooperation partners in DRR programs.

Law, Rule or Policy	Description
	https://reliefweb.int/sites/reliefweb.int/files/resources/RDD_FILE_1340609699_MAPDRR_English_June%202012.pdf
Myanmar Climate Change Alliance (MCCA)	The Program works as a platform to mainstream climate change into the Myanmar policy development and reform agenda, but it also supports all ongoing actions and activities on climate change from the National Government, Local Authorities, NGOs, Development partners, Civil Society and the Private Sector. It aims to raise awareness and disseminate knowledge and science of climate change so that policy-makers and society more broadly are able to address climate change in their decisions and daily life. The MCCA has a core technical unit based within the Ministry of Natural Resources and Environmental Conservation (MoNREC) with a Chief Technical Adviser, a National Technical Adviser, Monitoring and Evaluation Officer, Financial Officer and Assistant Officer. The MCCA also works with a Technical Working Group composed of almost all line Ministries, the three main cities (Yangon, Naypyidaw and Mandalay), Academia, Civil Society, NGOs and technical development partners. It also cooperates with important partners such as WWF, UNDP, and RIMES among others. http://myanmarccalliance.org/en/about-mcca/
Environmental Impact Assessment Procedure (2015)	The Ministry of Natural Resources and Environmental Conservation in exercise of the power conferred by sub-section (b) of Section 42 of the Environmental Conservation Law, issued Notification No. 616 / 2015, on December 29, 2015. This presents the regulations for development of EIAs, IEEs, and EMPs.
Environmental Quality Guidelines (2015)	The guidelines will support the country's emerging environmental impact assessment (EIA) system by specifying the environmental thresholds that must projects should not exceed. The guidelines will be finalized based on feedback from the workshop and are expected to come into effect during the next few months. The guidelines will be used as interim measure while the country develops National Environmental Quality Standards during the next few years. http://www.gms-eoc.org/events/draft-national-environmental-quality-standards-consultation-workshop
The Forest Law, (1992)	Includes provisions to conserve water, soil, biological diversity and the environment; sustain forest produce yields; protect forest cover; establish forest and village firewood plantations; sustainably extract and transport forest products. http://www.dica.gov.mm/files/uploads/pdf/myanmar_legislation_related_to_environment_website.pdf
The Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law (1994)	Contains provisions on the protection of fauna and flora and their habitat (including living and non-living organisms, migratory and endangered species); the conservation of natural areas; guidelines for scientific research; and the establishment of zoological and botanical gardens. http://www.dica.gov.mm/files/uploads/pdf/myanmar_legislation_related_to_environment_website.pdf
REDD + Strategy (2016)	Having signed the United Nations Framework Convention on Climate Change (UNFCCC) on 11 June 1992 and ratified the convention on 25 November 1994 and the Kyoto Protocol in 2003 as a non-Annex 1 party, Myanmar is fully aware of the causes and potential impacts of climate change. Hence, whilst undertaking political reform and aiming at rapid economic development, Myanmar is striving to reduce its greenhouse gas (GHG) emissions. The government of Myanmar has recognized the potential of the REDD+ initiative to contribute to green development by protecting global environmental resources (forest carbon stocks, but also biodiversity), helping to reverse land degradation, helping to improve the livelihoods of the rural poor and aiding adaptation to climate change. http://www.myanmar-redd.org/

Law, Rule or Policy	Description
Land Acquisition	Key institutions engaged in land acquisition activities, including the system of land classification: The Constitution (2008) The Land Acquisition Act (1894) The Farmland Act (2012) The Vacant, Fallow and Virgin Land Act (2012) Special Economic Zone Law (2011)

3.2 International Agreements and Conventions

47. Myanmar is signatory to the international environmental agreements listed in Table 3.

Table 3 Myanmar and International Environmental Agreements

Theme	Convention/treaty/agreement	Status*	Focal point
Climate	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification (UNCCD), Paris, 1994	Accession (1997)	MoNREC/FD
Air and climate change	United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992	Ratification	MoNREC/ ECD, MOT/DMH
	Kyoto Protocol to the Convention on Climate Change, Kyoto, 1997	Accession (2003)	MoNREC/ ECD
	Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985	Ratification (1993)	MoNREC/ ECD
	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987 + amendments	Ratification (1993, 2012 for recent amendments)	MoNREC/ ECD
	ASEAN Agreement on Transboundary Haze Pollution, Kuala Lumpur, 2002	Ratification (2003)	MoNREC
	Paris Agreement to combat climate change and adapt to its effects, 2016	Ratification (2017)	MoNREC?
Pollution control	Stockholm Convention on Persistent Organic Pollutants (POPs), Stockholm, 2001	Accession (2004)	MoNREC/ ECD
	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Basel, 1989	Accession (2015)	MoNREC/ ECD
	International Convention for the Prevention of Pollution from Ships (MARPOL), London, 1973 + amendments in 1978	Accession 4/8/1988	MOT
Biodiversity and natural resources	Convention on Biological Diversity (CBD), Rio de Janeiro, 1992	Ratification (1994)	MoNREC/ ECD
	Cartagena Protocol on Biosafety to the CBD, Cartagena, 2000	Ratification (2008)	MoNREC, MOAI
	Nagoya Protocol on Access and Benefit Sharing (ABS) to the CBD, Nagoya, 2010	Accession (2014)	
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES),	Accession (1997)	MoNREC/FD

Theme	Convention/treaty/agreement	Status*	Focal point
	Washington, D.C., 1973 + amendments (1979 Bonn, Germany)		
	Agreement on Establishment of ASEAN Regional Centre for Biodiversity	Ratification (2009)	MoNREC/ FD
	ASEAN Agreement on the Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	Signatory (1997)	MOFA
	Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 + amendments in 1982 and 1987	Accession (2004)	MoNREC/ FD
	MRC Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin – April 1995	Became Dialog Partner with MRC in 1996	Directorate of Water Resources and Improvement of River Systems (DWIR) Ministry of Transport (?)
	Agreement between International Union for Conservation of Nature (IUCN), and the government of the Republic of the Union of Myanmar to establish an IUCN Office in Myanmar. This laid the foundation for future collaboration on addressing challenges and maximizing opportunities related to biodiversity conservation and sustainable development in the country.	31 March 2016 Host Country Agreement (HCA) signed	Forest Department, MoNREC
	Mangroves for the Future (MFF) – MFF was founded on the vision, "Healthy coastal ecosystems for a more prosperous and secure future for coastal communities." The vision was supported by a mission statement, "To promote healthy coastal ecosystems through a partnership-based, people focused and policy relevant approach that builds and applies knowledge, empowers communities and other stakeholders, enhances governance, secures livelihoods, and increases resilience to natural hazards and climate change." https://www.mangrovesforthefuture.org/what-we-do/focus-areas-and-objectives/	In 2014, Myanmar joined as the 11th member country.	National Coordinating Body (NCB), which is chaired by the Director General of the Forest Department.
Cultural heritage	The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972	Acceptance (1994)	MOC
	Declaration on ASEAN Heritage Parks	Signatory (2003)	MoNREC/ FD
	Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, 1970	Ratified	National Cultural Central Committee
	Convention for the Safeguarding of the Intangible Cultural Heritage, 2003	Ratified	National Cultural Central Committee

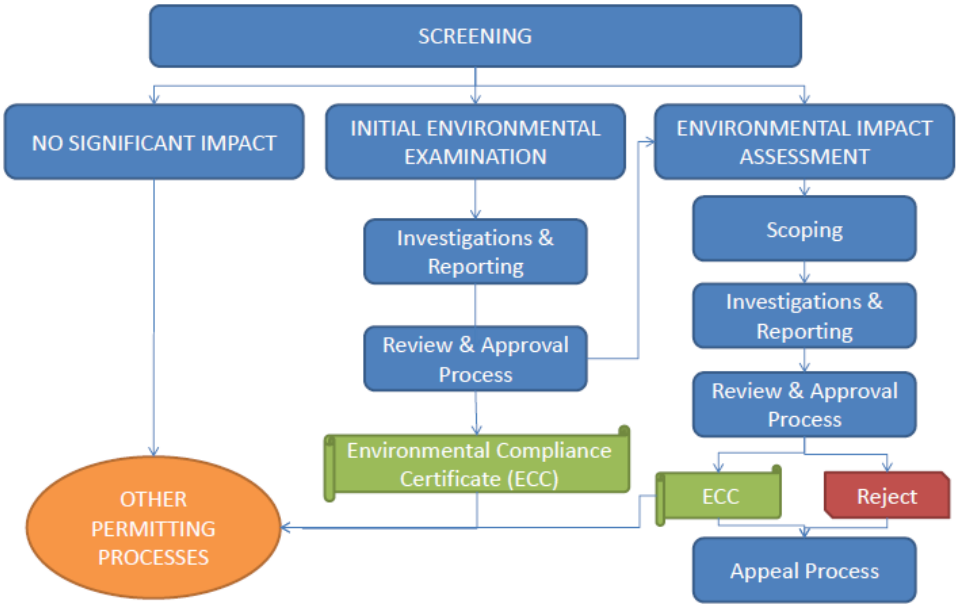
*) All of the terms (Ratification, Accession, Approval and Acceptance) signify the consent of a state to be bound by a treaty and consequently their legal implications are the same. All countries that have ratified, acceded to, approved or accepted a treaty are therefore Parties to it and legally bound by it. (The primary distinction is only between ratification and accession, as only states which have signed a treaty when it was open for signature, can proceed to ratify it. Afterwards, states which have not signed a treaty during the time when it is open for signature can only accede to it. The terms "acceptance" and "approval" are of more recent origin and apply under the same conditions as those that apply to ratification. The uses of these terms have to do with the diversity of legal systems.)

Source: Adapted from: Mikael Hildén, Kirsi Mäkinen, Jorma Jantunen, Mikko Jokinen, Raimo Lilja, Maung Maung Than, Salla Rantala, Thiri Aung; "Needs Assessment For Effective Implementation Of The Environmental Conservation Law In Myanmar", UNDP 2016; http://unfccc.int/paris_agreement/items/9444.php ; and http://www.mrcmekong.org/publications/agreements/

3.3 Government's Requirement on IEE/EIA

48. The requirements for the preparation of and approval of environmental documents is found in the Environmental Impact Assessment Procedure (2015), and illustrated in Figure 11. The MoEE submitted a Project Proposal to MoNREC to allow a preliminary screening and determine whether the Project would require an EIA or IEE.

Figure 11 EIA Procedure in Myanmar



Source: https://www.env.go.jp/policy/assess/7-1asiaeia2016_pdf/asiaeiaconference2016-g2.pdf (Accessed September 28, 2017)

3.3.1 Myanmar Regulations on Project Category

49. The proposed project has been screened under the EIA Procedure (2015). Initial Environmental examinations are required for both transmission lines. That is, an Initial Environmental examination (IEE) is required for the Ahlone-Thida transmission line., and a separate IEE is required for the Mawlamyine – Ye – Dawei transmission line.

3.3.2 Registration

50. The Environmental Impact Assessment Procedures, Articles 17-22, specify that third parties who are preparing an EIA or IEE must be registered with ECD. For this Project, U Myint Soe, a member of the AF Consult Team, has registered with ECD and received approval of his application.

3.4 ADB Safeguards Project Categorization

51. ADB uses a classification system[2] to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally

[2] ADB Safeguard Policy Statement (2009)

sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

(i) Category A. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.

(ii) Category B. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.

(iii) Category C. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

(iv) Category FI. A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Intermediary.

52. **Project Categorization** In accordance with the ADB Safeguard Policy Statement (2009), the project was screened by ADB. The project was assigned Category A requiring preparation of an Environmental Impact Assessment including an Environmental Management Plan.

3.5 Environmental Quality Standards.

53. The Myanmar National Environmental Quality (Emission) Guidelines (2015) were adopted for the environmental impact assessment contained this IEE. In cases where these Guidelines are not applicable, the World Bank Group Environment, Health, Safety Guidelines will be used. In cases, where Myanmar Guideline values and the World Bank Group Health and Safety Guideline values differ, the most stringent guideline value was applied.

4 DESCRIPTION OF THE ENVIRONMENT

4.1 General Environmental Context

54. This chapter presents existing baseline environmental and social conditions in Myanmar that apply in general to all proposed projects, with more detailed project-specific information where appropriate. The following topics are covered:

- Physical (covering geophysical issues such as seismic danger, climate, flooding risk, slope, erosion, topography, and soils; water quality and water resources; air quality and noise; hazardous materials/waste; and, greenhouse gas emissions)
- Ecological (including protected areas, rare and endangered species habitats and wildlife corridors, important bird areas, and ecosystem services)
- Socio-economic (discussing general impacts on the national economy, local/regional, gender issues, agriculture, communities, indigenous and vulnerable people issues, and land use, including urban, agricultural/pastoral, and various types of forests).
- Cultural (including temples, archaeological and historic sites, visual resources, and touristic)

PHYSICAL RESOURCES

4.1.1 Climate

55. Myanmar's climate can be described as tropical, with strong monsoon influences. There are three distinct seasons: Cool (November to February), Hot (March to May), and Rainy (June to October). In terms of Köppen Climate Classification (Figure 12), both the Ahlone-Thida and Mawlamyine-Ye-Dawei are within the "Aw" category, and may be subject to increased risks of tropical cyclones, sea level rise, and changes in hydrology. A comprehensive assessment of climate change risk was developed as a "Climate Vulnerability Risk Assessment (CRVA) Report," which is a Supplementary Appendix to this EIA. Temperature and Precipitation charts for four locations affected by the Transmission Line project are shown on **Error! Reference source not found.**.

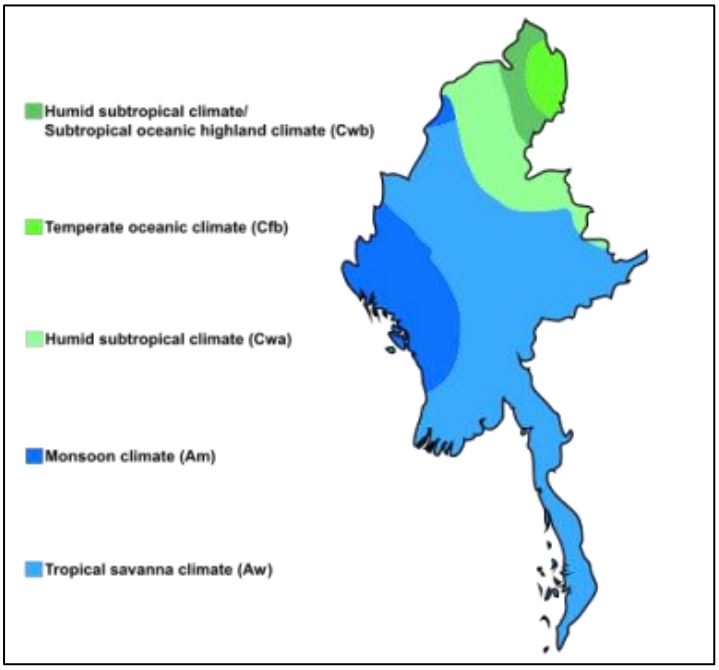


Figure 12 Myanmar map of Köppen Climate Classification

Source: Ali Zifan (Enhanced, modified, and vectorized). - Derived from World Koeppen Classification.svg., CC BY-SA 4.0,
https://commons.wikimedia.org/w/index.php?curid=47085379 (Accessed October 4, 2017)

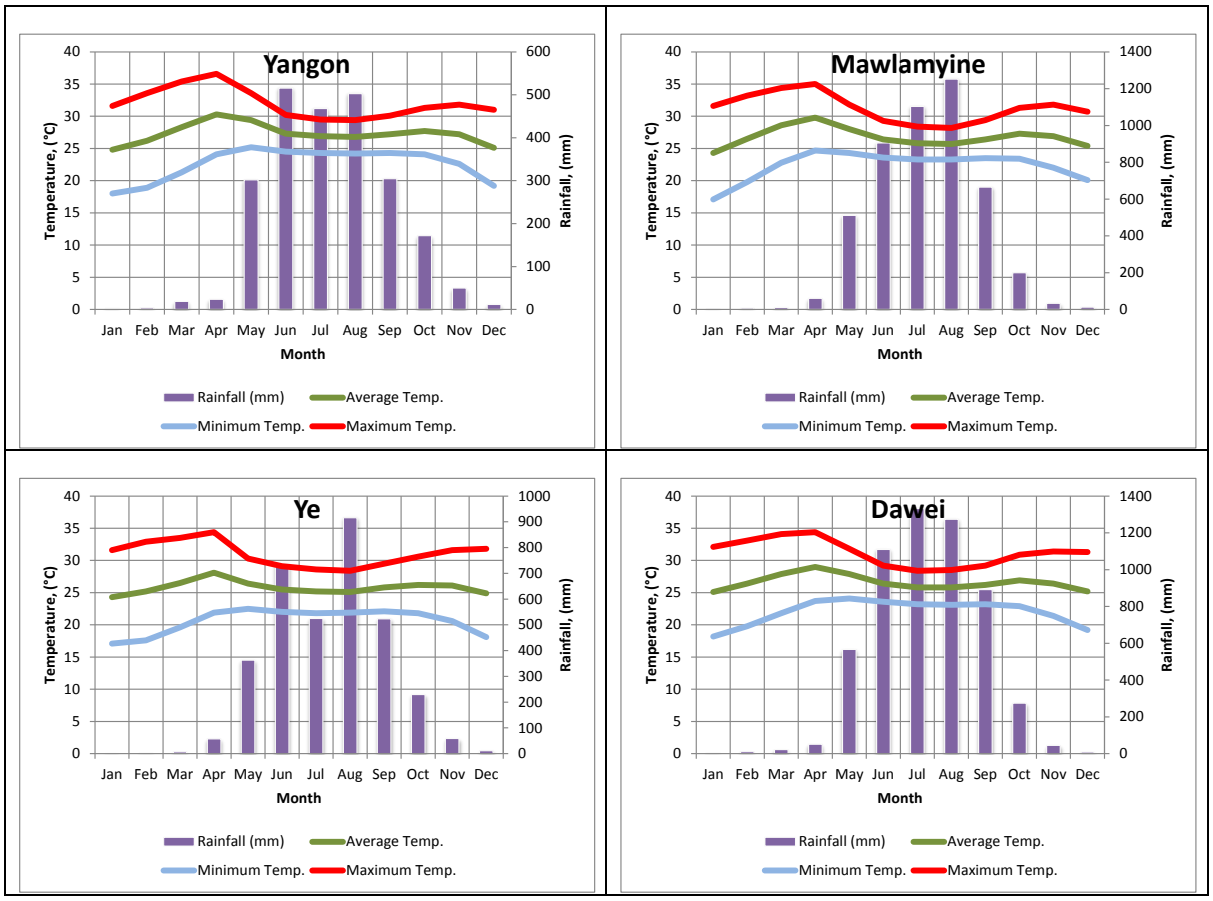


Figure 13 Temperature and Precipitation at Project Locations

Source: https://en.climate-data.org/

4.1.2 Topography, Geology, and Soils

56. The transmission line projects are situated in areas with different topographical and geologic features.

Topography:

57. The Union of Myanmar is situated in Southeast Asia between latitudes 09° 32' N and 28°31' N and longitudes 92° 10' E and 101 ° 11' E. Myanmar is bordered on the north and northeast by the People's Republic of China, on the east and southeast by the Lao People's Democratic Republic and the Kingdom of Thailand, on the south by the Andaman Sea and the Bay of Bengal and on the west by the People's Republic of Bangladesh and the Republic of India.

58. The total area of Myanmar is 261,228 square miles (676,577 square kilometers). It stretches for 936 kilometers from east to west and 2,051 kilometers from north to south.[3] Myanmar is generally a forested, mountainous country, with plateaus, valleys and plains. The general incline of the country is from north to south, and all rivers flow in the same direction. The Ayeyarwady, Chindwin,

[3] http://www.modins.net/myanmarinfo/facts/land.htm (accessed 4 Oct 2017)

Sittaung and Thanlwin constitute the four major river channels, and the basins of the first three, with deltaic Ayeyarwady as the most extensive, form the major crop lands of the country.[4]

59. Prominent features of the Mon and Tanintharyi coastal regions, (where the Mawlamyine-Ye-Dawei TL is located) are narrow strips of plains along the sea coast. The gradient gradually rises towards the inland on the east climaxing in high mountain ranges called Tanintharyi Yomas. Short small rivers traverse the narrow plains in both regions. And with an annual rainfall varying from 150 to 200 inches, coastal regions form the main area for plantation crops such as rubber, cocoa, oil palm and coconut.[5]

60. The Ahlone-Thida TL lies in and to the south of Yangon, near the mouth of the Yangon River, which is a marine estuary formed by the confluence of the Pegu and Myitmaka rivers. It empties into the Gulf of Martaban of the Andaman Sea. The TL crosses a relatively flat area that includes wetlands and agricultural land.

61. The Mawlamyine-Ye-Dawei TL is primarily in Mon State, whose topography is characterized by hilly ridges on the east, and coastline, beaches and islands on the west. For the most part the TL stays on flat agricultural and wetlands areas close to the coast. Near Mawlamyine it crosses a hilly forested area that has been designated a Key Biodiversity Area (KBA). Further south it crosses more hilly and forested lands with short rivers emptying into the Andaman Sea. A segment of the line south of Ye is in the Tanintharyi region. Prominent features of the Tanintharyi coastal region are narrow strips of plains along the sea coast. The gradient gradually rises inland on the east climaxing in mountain ranges called Tanintharyi Yomas. Short small rivers traverse the narrow plains, and with an annual rainfall varying from 150 to 200 inches, coastal regions form the main area for plantation crops such as rubber, cocoa, oil palm and coconut.[6]

Soils:

62. Due to the wide range of climate and soil forming parent rocks, the soils of Myanmar vary considerably (see Figure 14 and Figure 15). There are three agriculturally important soil groups; namely, alluvial soils, black soils and red lateritic soils:[7]

(a) Alluvial soils occupy some 50% of the total sown area and are generally deep and variable in structure, ranging from sticky clay to sandy loam. These soils are located along the Ayeyarwady, Chindwin and Thanlwin river basins, as a result of alluvial processes; in lower Myanmar, the old alluvial soils are acidic.

(b) Black soils occur in about 30% of the area and are generally found in regions with an annual rainfall ranging from 20 to 40 inches. Agriculture requires irrigation on such soil, while at the same time drainage and erosion are serious problems. These soils contain 40-60% clay and are plastic and sticky when wet and very hard when dry.

(c) About 20% of the total sown area is red lateritic soils which are generally associated with undulating topography and having an annual rainfall ranging from 40-120 inches. These soils are low in lime and magnesium and deficient in nitrogen. Available phosphate and organic matter content are also relatively low.

[4] Ministry of Agriculture and Irrigation, http://www.myanmargeneva.org/e-com/Agri/expind/agri-index/myanmar.com/Ministry/agriculture/topography.htm
[5] Ibid
[6] http://www.myanmargeneva.org/e-com/Agri/expind/agri-index/myanmar.com/Ministry/agriculture/topography.htm Accessed 9 November 2017
[7] Ministry of Agriculture and Irrigation, http://www.myanmargeneva.org/e-com/Agri/expind/agri-index/myanmar.com/Ministry/agriculture/land.htm

63. With the exception of rich alluvial flats along the main rivers and their tributaries plus the Ayeyarwady delta area, the soils of Myanmar are generally low in organic matter and nitrogen.

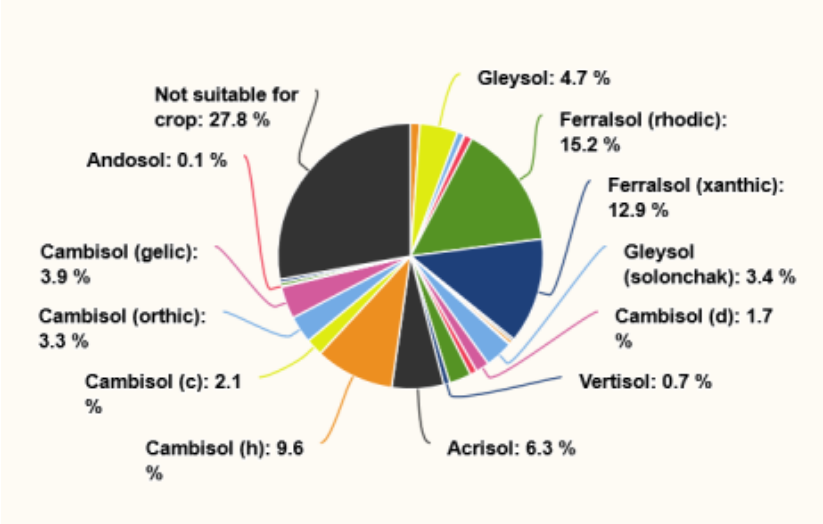


Figure 14 Soil Types in Myanmar

Source: *http://mya.gms-eoc.org/charts/overview/soil-types-of-myanmar (Accessed October 4, 2017)*

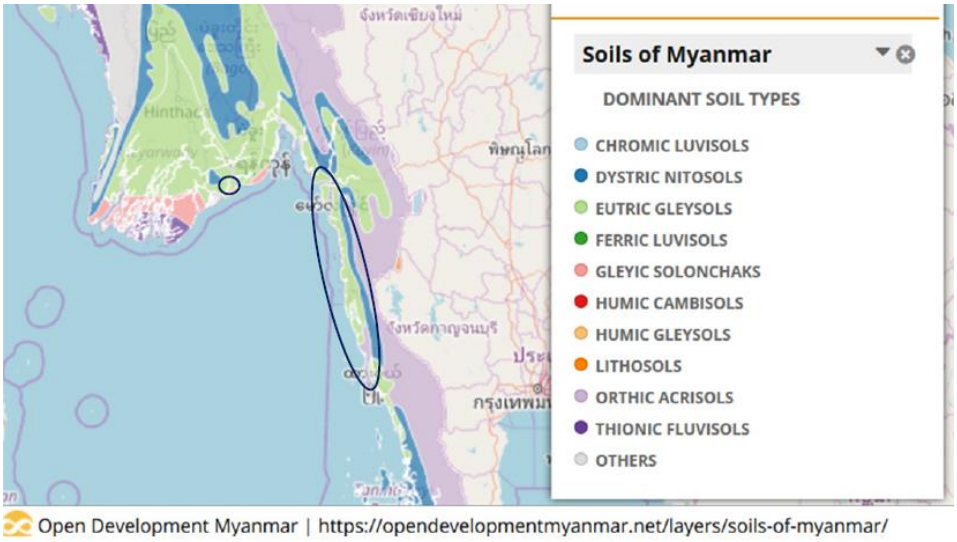


Figure 15 General Soils Map of Myanmar

Geology:

64. Myanmar has been subdivided into three geologic provinces: namely, the Western Fold Belt (WFB) in the west, the Central Lowland (CL) in the middle (where the TLs are situated), and the Eastern Highland (EH) in the east. The fertile alluvial plain is the Central Lowland, intermittently cropped out by the mountain range and hills running in north south direction and also enhanced by Mount Popa, a dormant volcano in its central part. A large active fault, the Sagaing Fault, passes through the eastern margin of this province.[8] A geologic map of the areas where the projects are located is shown in **Error! Reference source not found.**6. Rock types in Myanmar are mapped on F igure 17.

[8] Dr. Ir. Subagyo Pramumijoyo, "Report on Regional Geology of Myanmar", April 2010 http://myan-mar-review.iwmi.org/sites/default/files/Documents/regional_geology_of_myanmar.pdf

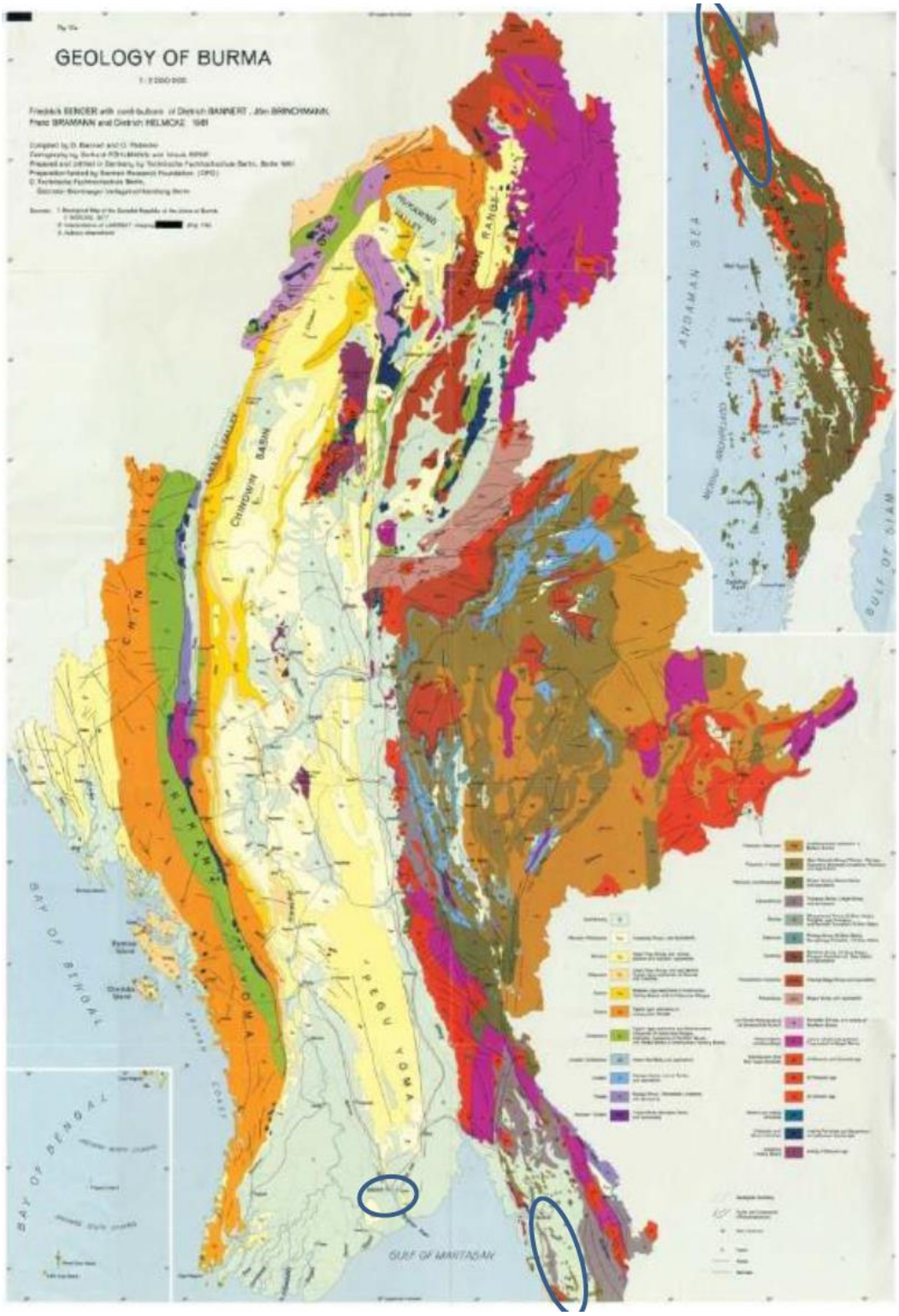


Figure 16 Geologic Map of Myanmar (showing Project Areas)

Source: Dr. Ir. Subagyo Pramumijoyo, "Report on Regional Geology of Myanmar", April 2010 http://myanmar-review.iwmi.org/sites/default/files/Documents/regional_geology_of_myanmar.pdf (accessed October 4, 2017)

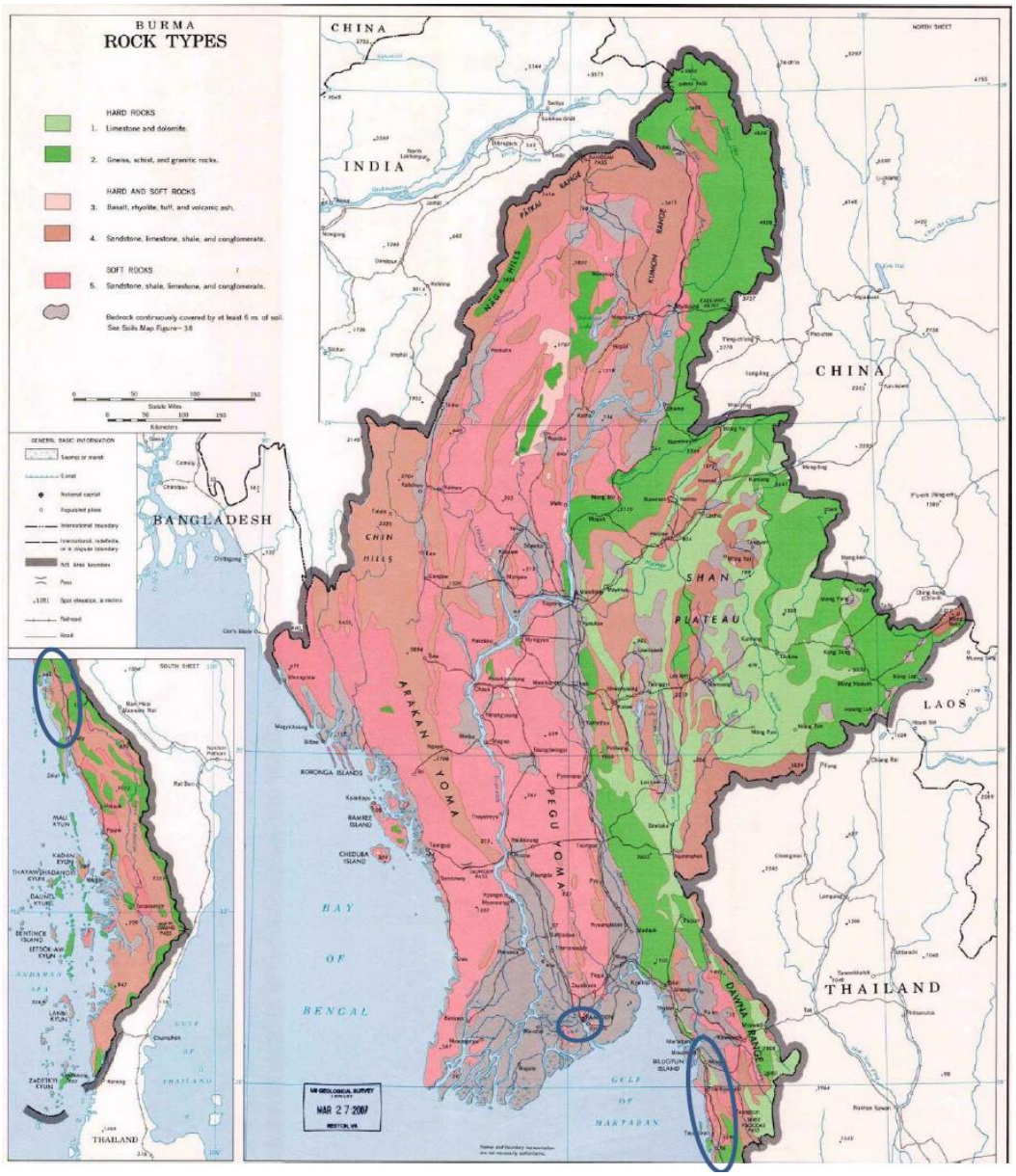


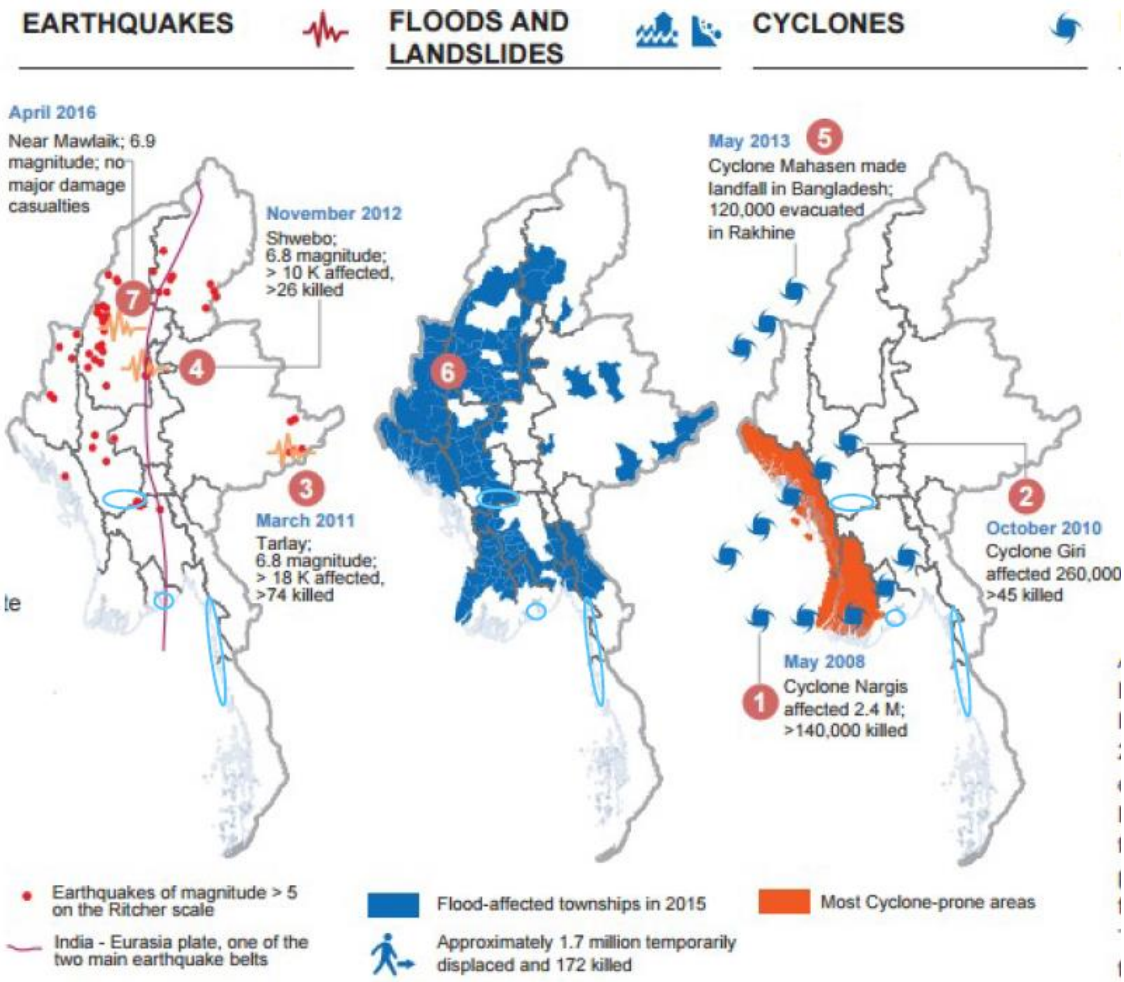
Figure 17 Rock types in Myanmar (showing Project Areas)

Source: US Geological Survey, March 27, 2007. http://www.mappery.com/Myanmar-Burma-Rock-Types-Map (Accessed October 4, 2017)

4.1.3 Natural Hazards

65. Myanmar is subject to severe natural hazards including earthquakes, floods, and cyclones. A summary of these hazards is shown on Figure 18.

66. .



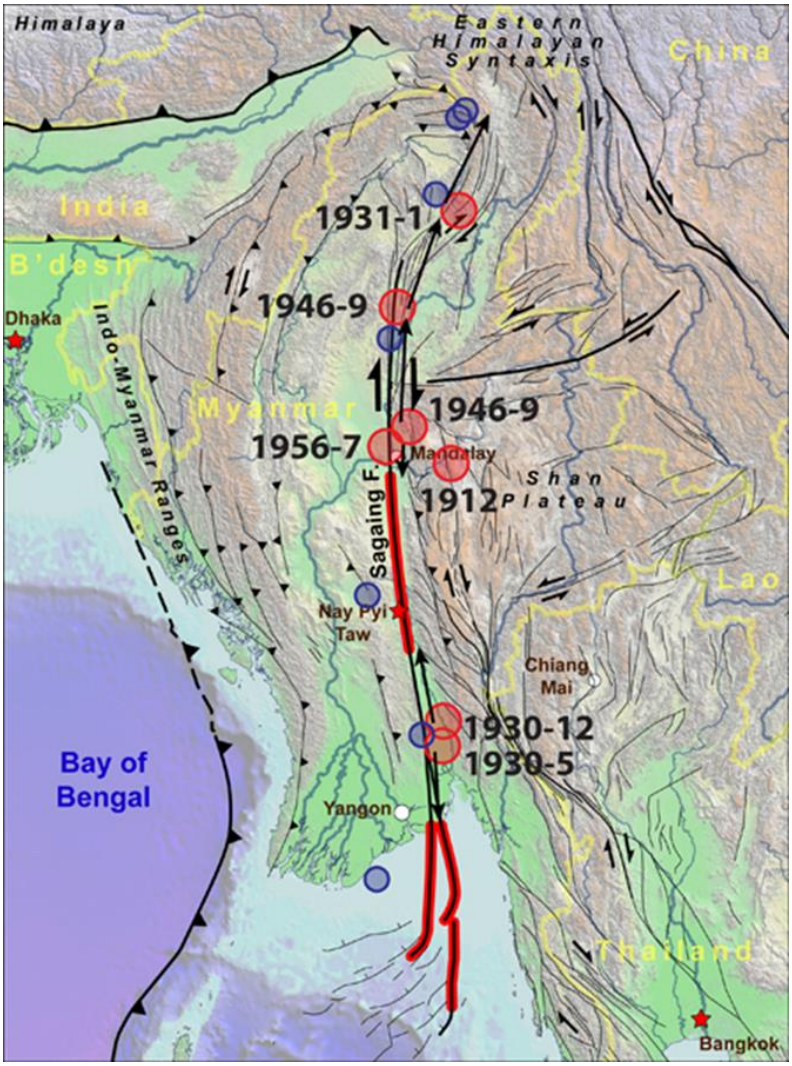
Source: https://www.acaps.org/country/myanmar/country-pofile (accessed October 5, 2017)

Figure 18 Recent Natural Disasters in Myanmar (Project areas outlined in light blue)

Seismicity

67. As can be seen, the TL project areas are not generally located in high hazard prone areas. However, Myanmar can expect to experience numerous earthquakes along the Sagaing Fault which runs in a north-south direction through the middle of Myanmar. Large earthquakes along the fault will affect most areas of the Project (see **Error! Reference source not found.**). The fault is a continental transform fault between the India and Sunda plates that connects spreading centers in the Andaman Sea and the continental convergence zone along the Himalayan front. Several earthquakes greater than magnitude 7 have occurred along the fault in the last century. Cities such as

Bago, Swa, Phyu, and Pyinmana were severely affected by earthquakes generated from the movement of Sagaing fault. The fault zone is quite wide (about 20 km) south of Bago, and rather narrow (< 2km) in many other areas.[9]



Source: http://www.sagaingfault.info/ (Accessed October 5, 2017)

Figure 19 Large magnitude earthquakes along the Sagaing Fault since 1900

68. Low earthquake death tolls along the Sagaing Fault in the past were largely due to a small urban population and predominantly timber and bamboo houses. The economy and urban population of Myanmar is presently growing rapidly, with new poorly constructed multi-story concrete buildings appearing in Mandalay, Naypyidaw and elsewhere. It is clear that many more people are now at risk from Sagaing Fault earthquakes than were during the first half of the 20th Century.[10] Earthquake-resistant building codes have recently been introduced in Myanmar[11] but are not yet widely used or enforced.

[9] Dr. Ir. Subagyo Pramumijoyo, "Report on Regional Geology of Myanmar", April 2010 http://myanmar-review.iwmi.org/sites/default/files/Documents/regional_geology_of_myanmar.pdf
[10] http://www.sagaingfault.info/ (Accessed October 5, 2017)
[11] Myanmar National Building Code (2016)

4.1.4 Water Resources

69. Myanmar is endowed with vast water resources. The north-south direction of Myanmar's mountain ranges is reflected in the flow of its major rivers tending to flow north to south due to Myanmar's topography. There are major six river basins:

- Ayeyarwady-Chindwin river basin drains 58% of the territory. It consists of three sub-basins: Upper Ayeyarwady, Lower Ayeyarwady and Chindwin.
- Sittaung river basin to the east of the downstream part of the Ayeyarwady drains 5.4% of the country.
- Thanlwin (Salween in Thailand, Nu in China) river basin drains 18.4% of the country, mainly the Shan plateau in the east.
- Mekong (Lankang in China) river basin drains 4.2% of the territory in the Far East and forms the border with Lao People's Democratic Republic. Myanmar is not a member of the Mekong River Commission but joined as a Dialog Partner in 1996.
- Rakhine coastal basin in the west drains into the Bay of Bengal.
- Tanintharyi coastal basin in the south drains into the Andaman Sea.

70. Total surface water produced internally is an estimated 992.1 km^3/year. Groundwater resources have been estimated as 453.7 km^3/year, although a large portion of this is accounted for as the rivers' base flow.[12]

71. The Irrigation Department, which was established to coordinate the development and management of water resources for irrigation, has constructed about 200 irrigation projects, which receive water from constructed dams, weirs and sluices. A surface water runoff of about 15.46 km^3 has been stored in the constructed reservoirs and can irrigate about 1 million ha.

72. There are no piped water supply systems nationwide. Myanmar's largest cities, Yangon and Mandalay, have piped water systems, but they reach only a part of the population and the quality is not always up to standards – untreated surface water from open reservoirs is also supplied through the networks. In rural areas, most households have to treat the water they find, often in open ponds. During the dry season open ponds disappear, meaning villagers have to walk farther to find water. During the dry season in 2016, some 2,000 villages suffered from water shortages.[13] Figure 20 shows the access to water supply and sanitation in rural areas as of the 2014 Census, based on a total rural population of 34,203,208 comprised of 7,828,400 households.[14]

http://www.myanmarthilawa.gov.mm/sites/default/files/thilawa/Download-file/02%20-%20MNBC%20Myanmar%202016%20-%20Part%201%20%26%202.pdf (Accessed October 5, 2017)

[12] http://www.fao.org/nr/water/aquastat/countries_regions/MMR/ (Accessed October 5, 2017)

[13] Ibid.

[14] Department of Rural Development, Department of Basic Education and Department of Public Health "National Strategy for Rural Water Supply, Sanitation and Hygiene (WASH) ; WASH in Schools and WASH in Health Facilities, 2016 – 2030" May 2016 2016 http://themimu.info/sites/themimu.info/files/documents/National_Strategy_for_Rural_Water_Supply_Sanitation_Hygiene_WASH_2016-2030_ENG.pdf

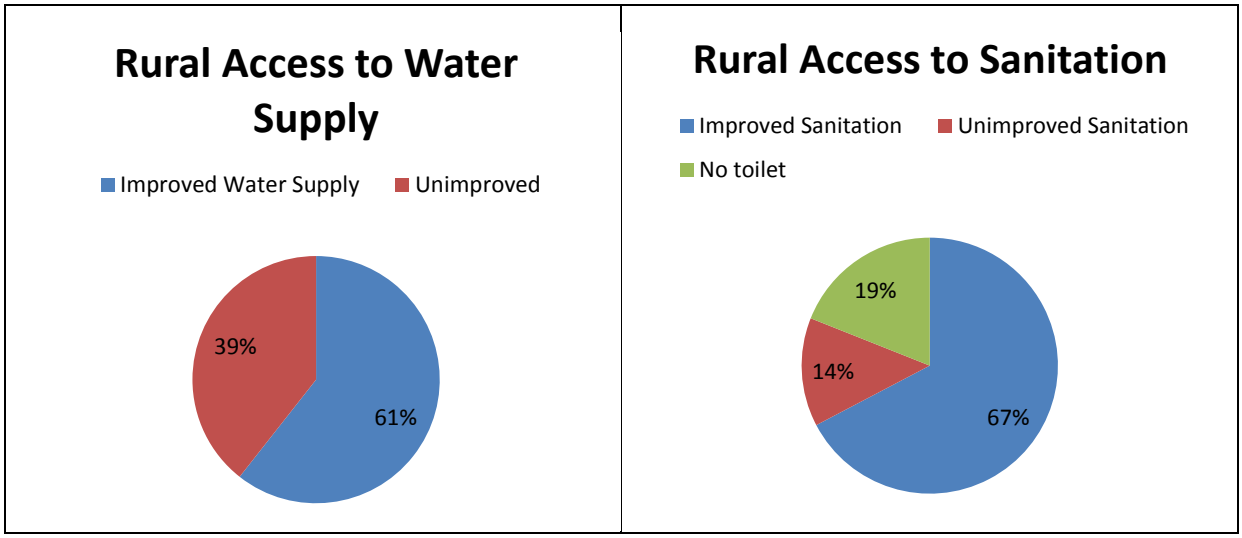


Figure 20 Water Supply and Sanitation in Rural Areas of Myanmar

73. Table 4 shows a summary of the streams and wetlands that are crossed or in the immediate vicinity of the TLs.

Table 4 Streams and Wetlands along the Transmission Lines

	Numbers of water bodies potentially affected			
Transmission Line	Minor	Medium	Major	Wetlands
Ahlone-Thida (Dala Option)	0	2	Yangon River (crossed twice, near Ahlone and Thida. Ahlone is existing)	1
Mawlamyine-Ye	72	4	0	6
Ye-Dawei	9	1	0	1
totals	81	7	2	8

74. Water Quality baseline data was not collected for this EIA because of time constraints, but more importantly due to that the locations of potentially significant sources of water pollution, such as construction camps, are not known at this time. However, as more information about the specific locations of significant water pollution sources is known it is advisable to collect this information. Accordingly, baseline water quality information at potentially affected areas such as stream crossings and wetlands is recommended in the EMP.

4.1.5 Air Quality

75. As of this writing there are no measurements of air pollution in Myanmar, with the exception of a program to measure and record the air quality index (AQI) in Yangon. This work is being carried out by the Yangon City Development Committee (YCDC), and is scheduled to be completed in October 2017[15]. However, information on air quality in Yangon and other cities has been discussed in the media for some time. A World Health Organization spokesperson was quoted in the media as indicating that the main sources of outdoor air pollution in Myanmar include "inefficient modes of transport, inefficient combustion of household fuels for cooking, lighting and heating, coal-fired power plants, industrial agriculture and waste burning."[16] Further, the large influx in recent years of

[15] The Global New Light of Myanmar, 27 September 2017
[16] Myanmar Times, 27 September 2017 https://www.mmtimes.com/national-news/22840-myanmar-s-air-pollution-among-the-worst-in-the-world-who.html (accessed September 28, 2017)

second-hand cars from abroad and low quality fuels contributes to a worsening ambient air quality problem in many parts of Myanmar.

76. Some information on ambient air monitoring has been reported, although this information does not represent a comprehensive air quality monitoring program. No information was given about the type of instruments used or length of the measurement period, so at best this information is indicative. As can be seen in Table 5 the reported measurements for particulate matter are well in excess of the WHO Ambient Air Quality Guidelines.

Table 5 Measured Roadside Ambient Air Quality in Yangon

Pollutant	Location (Yangon)	Measured value	WHO Guideline
Total Suspended Particulates (TSP)	- commercial area - residential area - industrial area	342.58 µg/m^3 168.61 µg/m^3 127.32 µg/m^3	WHO no longer uses TSP as an indicator of air quality
Respirable Particulate Matter (PM_{10})	- commercial area - residential area - industrial area	177.69 µg/m^3 68.59 µg/m^3 66.95 µg/m^3	PM_{10}: 20 µg/m^3 annual mean 50 µg/m^3 24-hour mean

Source: "Ministerial Statement on Global Environment and Energy in Transport "Pollution Control and Air Quality Management in Myanmar" by H.E Col: Nyan Htun Aung, Deputy Minister for Transport (Undated)

77. Air Quality baseline data was not collected for this EIA because of time constraints, but more importantly due to the facts that: (1) the locations of potentially significant sources of air pollution, such as borrow pits, access roads, and construction camps are not known at this time; and (2) with the exception of a short length of the Ahlone-Thida line the transmission lines are in predominantly rural areas where air pollution is not a major concern. However, as more information about the specific locations of significant air pollution sources is known it is advisable to collect this information. Accordingly, baseline air quality information is recommended in the EMP, together with required air pollution emission controls for vehicles and dust.

4.1.6 Noise

78. Noise is becoming a significant form of pollution in urban areas of Myanmar. It is a public nuisance and affects people's health physically and psychologically, by increasing irritation, tension, nervousness, and anxiety. The Current Legal Framework, published in 2009, brings up the following two mentions:[17]

- The Specific Relief Act (1877): Chapter X: Of Perpetual Injunctions Illustration … [Person] A rings a bell or makes some other unnecessary noise so near a house as to interfere materially and unreasonably with the physical comfort of the occupier, B. B may sue for an injunction restraining A from making the noise.
- The City of Rangoon Municipal Act (1922): 235. … Rules may thereunder may provide for or regulate all or any of the following purposes and matters, namely: (b) the prohibition and regulation of the use of whistles, trumpets, and noise-producing instruments operated by any mechanical means

79. The Draft Myanmar Environmental Quality Guidelines (16 December 2014) provide the following: "Noise impacts should not exceed the levels presented below, or result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site." Further it proposes ambient noise level limits as shown in Table 6.

80. Ambient noise baseline data was not collected for this EIA because of time constraints, but more importantly due to the facts that: (1) the locations of potentially significant sources of noise,

[17] Myanmar Times, 10 November 2014; https://www.mmtimes.com/special-features/200-property-2014/12232-sounding-off-on-noise-violations.html

such as haul roads through communities, new access roads, and construction camps are not known at this time; and (2) with the exception of a short length of the Ahlone-Thida line, the transmission lines are in predominantly rural areas where noise is not a major concern. However, as more information about the specific locations of significant noise sources is known it is advisable to collect this information. Accordingly, baseline air quality information is recommended in the EMP, together with required noise control mitigation measures.

Table 6 Myanmar Maximum Ambient Noise Levels

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 – 22:00	Nighttime 22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

ECOLOGICAL RESOURCES

4.1.7 Forests

81. Nearly half of the area of Myanmar is forested, but Myanmar ranks third in the world in annual deforestation. Drivers of deforestation and forest degradation include logging for domestic consumption and export, expansion of agriculture and tree plantations (especially rubber and oil palm plantations), shifting cultivation, infrastructure development, and poverty.[18]

82. The current state of forests in Myanmar is illustrated in Figure 21. This map was created by a consortium of international organizations and environmental non-governmental groups, using freely-available public domain data and open source software tools.[19] Additional information for this assessment was obtained from the Forest Department, MoNREC.

83. The location of the Mawlamyine-Ye-Dawei transmission lines with respect to the Forest Cover Map is shown on Figure 22. The Ahlone-Thida TL is routed through urban and agricultural land and does not impact forests.

84. As in other parts of Southeast Asia, deforestation by the timber industry poses the greatest threat to wildlife habitats. The state-owned Myanmar Timber Enterprise (MTE) accounts for most of the logging undertaken throughout the country. The most valued woods are teak and cherry-wood (padauk). Reportedly the company follows a sustainable 'selective tender' system devised by the British in 1856 to maintain forest cover. The latest government plan calls for the complete elimination of all log exports, figuring that the greatest potential revenue comes from processed wood products rather than raw timber. If this plan is carried out, cutting should slow even further.[20] Along certain parts of the TL alignments it will be necessary to cut down taller trees that pose a danger to the lines. The Forest Department, MoNREC controls this type of cutting, including the permitting, imposition of fees and the requirement for reforestation.[21]

[18] Kyaw Thu Moe, Junchang Liu (2016) "Economic Contribution of Non-timber Forest Products (NTFPs) to Rural Livelihoods in the Tharawady District of Myanmar", International Journal of Sciences, Research Article, Volume 5, January 2016

[19] Bhagwat T, Hess A, Horning N, Khaing T, Thein ZM, Aung KM, et al. (2017) Losing a jewel—Rapid declines in Myanmar's intact forests from 2002-2014. *PLoS ONE* 12(5): e0176364. doi.org/10.1371/journal.pone.0176364

[20] https://myanmars.net/myanmar/19205-ecology-environment?hitcount=0 (Accessed October 5, 2017)

[21] Personal communication, U Tin Htun, Director, Planning and Statistics Division, Forest Department, MoNREC, September 22, 2017.

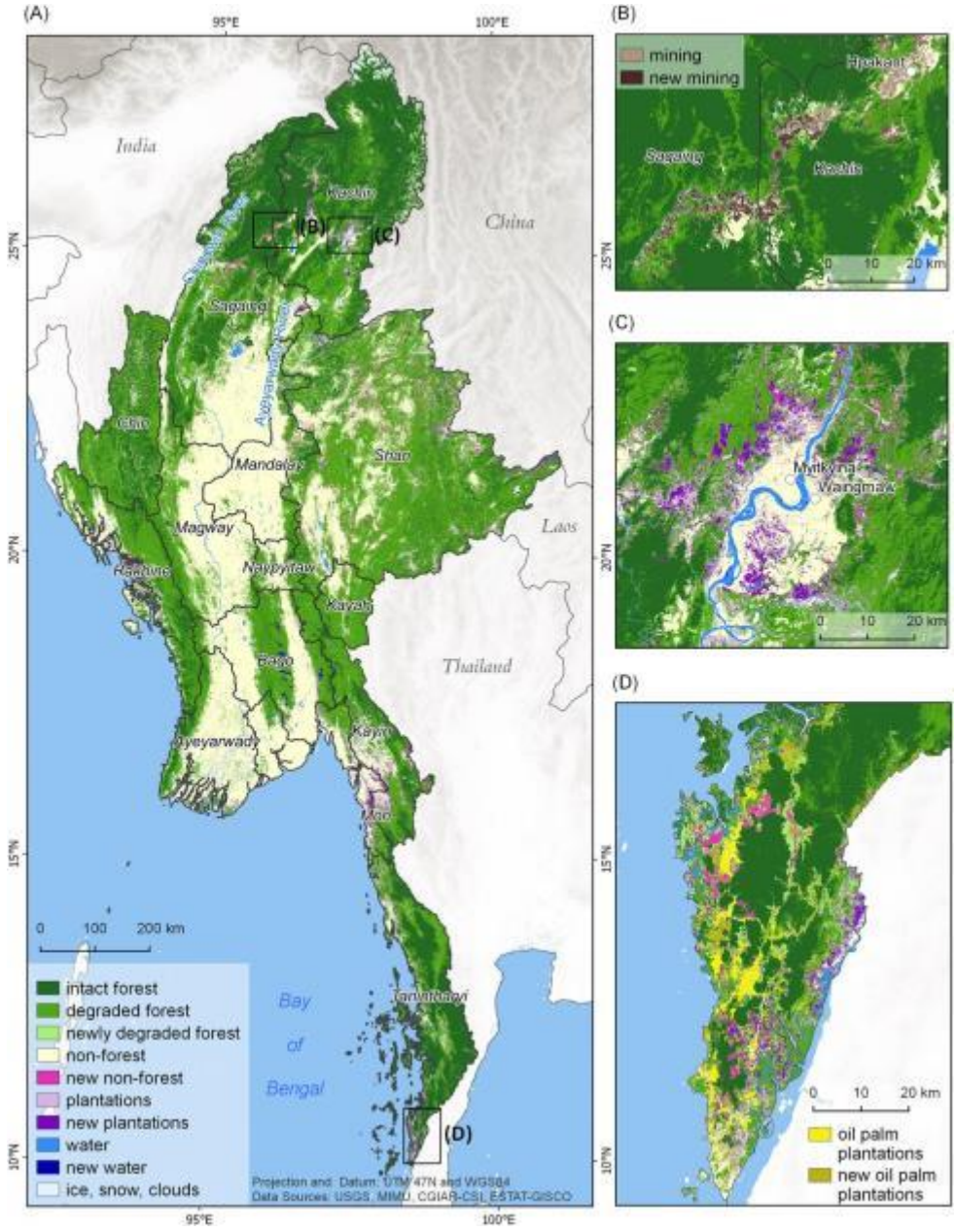


Figure 21 State of Forest Cover in Myanmar

Source: Bhagwat T, Hess A, Horning N, Khaing T, Thein ZM, Aung KM, et al. (2017) Losing a jewel—Rapid declines in Myanmar's intact forests from 2002-2014. PLoS ONE 12(5): e0176364. doi.org/10.1371/journal.pone.0176364

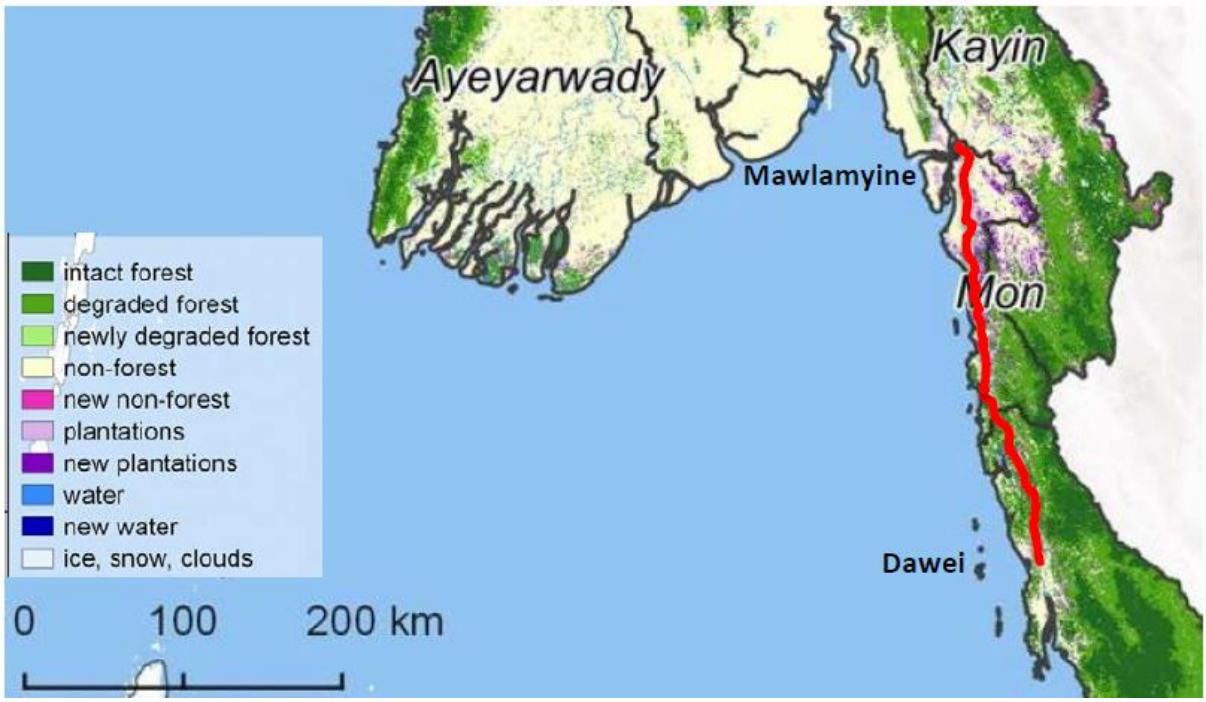


Figure 22 Forests and the Location of the Mawlamyine-Ye-Dawe Transmission Line

85. Myanmar forests suffer from natural and man-made forest fires, particularly in the dry season[22]. If underlying growth is left unchecked, or slash from routine maintenance of the transmission lines is left to accumulate, sufficient fuel can accumulate that may promote forest fires[23]. The susceptibility of forest fires in Myanmar was studied by (Biswas, et al, 2015) as shown in Figure 23, where the higher the index value (the redder the indicator) the more likely that forest fires will occur. Fire susceptibility along the Mawlamyine-Ye-Dawei lines is shown on Figure 24 It can be seen that there is higher susceptibility of forest fires along the Mawlamyine-Ye-Dawei line.

[22] Biswas S, Vadrevu KP, Lwin ZM, Lasko K, Justice CO (2015) "Factors Controlling Vegetation Fires in Protected and Non-Protected Areas of Myanmar". PLoS ONE 10(4): e0124346. doi:10.1371/ journal.pone.0124346

[23] IFC. "Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution" April 30, 2007

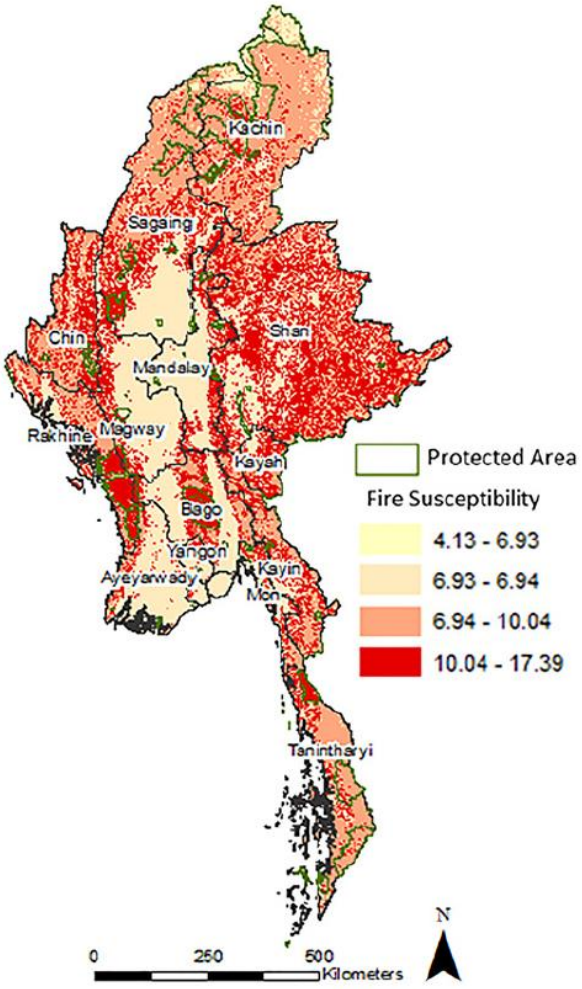


Figure 23 Susceptibility of forest fires in Myanmar

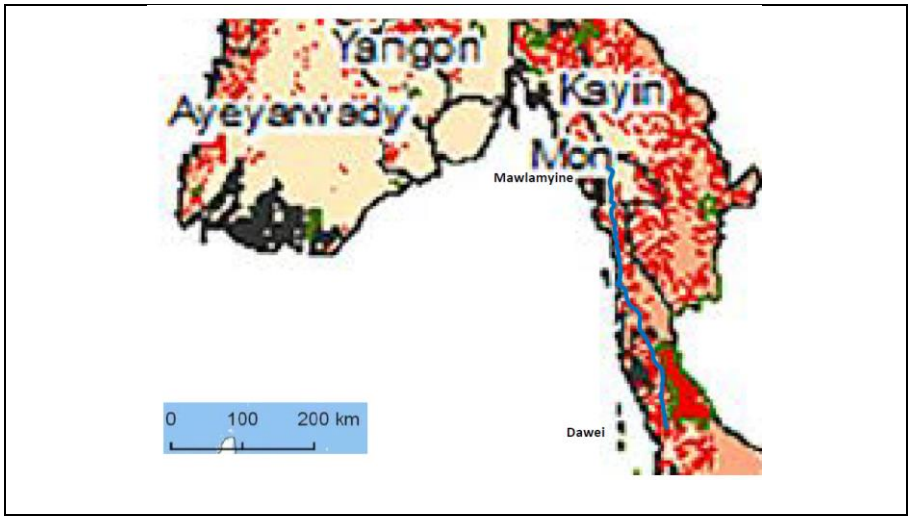


Figure 24 Susceptibility of forest fires along Mawlamyine-Ye-Dawei Line

4.1.8 Birds

86. A preliminary assessment of the project identified "Key Biodiversity Areas (KBAs) near Dawei and Mawlamyine where transmission lines may pass through or very near those areas. The ornithology report (Supplementary Appendices - Appendix 3) investigated the presence and possible impacts to bird species of IUCN 'Conservation Concern'

87. Myanmar supports at least 1,056 bird species, a greater diversity than in any other country in mainland Southeast Asia (NBSAP 2011). Of these species, 47 are Globally Threatened with seven listed as Critically Endangered. Two of these species are probably extinct in the country, of which one (Pink-headed duck *Rhodonessa caryophyllacea*) is possibly globally so (MBCIV 2013). In addition the country holds seven endemic species.

88. Power lines are one of the major causes of unnatural deaths for birds in a large part of the African-Eurasian Flyways. For example, it is estimated that there many millions of collision victims each year in Germany (Hoerschelman et al., 1988). In several European countries a relative high proportion of collision victims involve endangered species of Appendix I of the Birds Directive, e.g. European Spoonbill (*Platalea leucorodia*) and Black-tailed Godwit (*Limosa limosa*) in the Netherlands, and bustards and eagle species in Spain and Portugal.

89. Due to their size and prominence, above ground electrical infrastructures potentially represent significant risks for birds if certain precautionary measures are not taken. Most above ground power lines (both medium voltage distribution lines and medium to high voltage transmission lines) present potentially fatal risks for birds through risks of collision with overhead wires and the risk of electrocution. A bird collision occurs when a flying bird physically collides with an overhead cable. The bird is typically killed by the impact with the cable, the subsequent impact with the ground, or dies from the resulting injuries.

90. Electrocution of a bird occurs when it bridges the gap between two energized components or an energized and an earthed (also called 'grounded') component of the pole structure. This results in a short circuit, with electric current flowing through the bird's body, and electrocution, often accompanied by an outage of the electricity supply.

91. Other potential impacts on bird species associated with the provision of transmission lines are:

- Loss of habitat, e.g. if the new habitat associated with the line replaces existing habitat of higher ecological value (e.g. forest);
- Habitat fragmentation, e.g. if the route of the transmission line passes through habitat of higher ecological value (e.g. forest); and
- Disturbance to birds, particularly to feeding and roosting areas, and particularly during the construction phase.

92. A potentially highly significant indirect impact of the routing of transmission lines is the provision of easier access routes into habitats (e.g. forests / wetlands) potentially enabling increased killing / capture of birds for food or other purposes, both by construction workers and members of the wider communities.

93. During the site visits, in addition to observing presence / absence of bird species which might be susceptible to collision risk, a number of interviews ('snapshots') were conducted in local villages to gather information about the presence / absence of these species in the local area. This was accompanied by showing the interviewee a field guide and allowing him / her to use this as part of the discussion. The full list of questions employed is given in Appendix 3, Appendix 1, and the summary of bird observations / interviews is tabulated in Appendix 3. There were no large birds of prey or storks observed along the alignments during any of the site visits. The largest bird species observed during the site visits were great egret (*Ardea alba*) and grey heron (*Ardea cinerea*). There appears to be some doubt as to whether green peafowl persists within the Mawlamyine KBA.

94. The responses from the interviews conducted tended to record larger numbers of duck, storks, and larger birds of prey as being present in the dry (winter) season, and it is likely that these records relate to dry season visitors. Although the site visits and village interviews enabled only a snapshot of information to be obtained, it was evident that presence of large birds which might be susceptible to collision risk with wires does not represent a major project risk. Within south-east Asia, many large bird populations have declined markedly and Myanmar is no exception. In particular, large bird species are susceptible to hunting.

95. Overall, the data collated indicates that large bird species are present at certain times of year, particularly during the dry season, when flocks of storks and ducks, and wintering birds of prey may be present.

4.1.9 Biodiversity, Ecological Zones and Protected Areas

96. Myanmar has 132 Key Biodiversity Areas (KBAs), as shown in Figure 25 and Table 7. Using international criteria, stakeholders identified and prioritized 132 Key Biodiversity Areas (KBAs) throughout the country. These sites are defined as areas holding significant populations of species of high conservation concern. The information used to identify and prioritize KBAs is patchy and often outdated, and new information is required. As of 2013, only 25% of these KBAs were afforded legal protection.

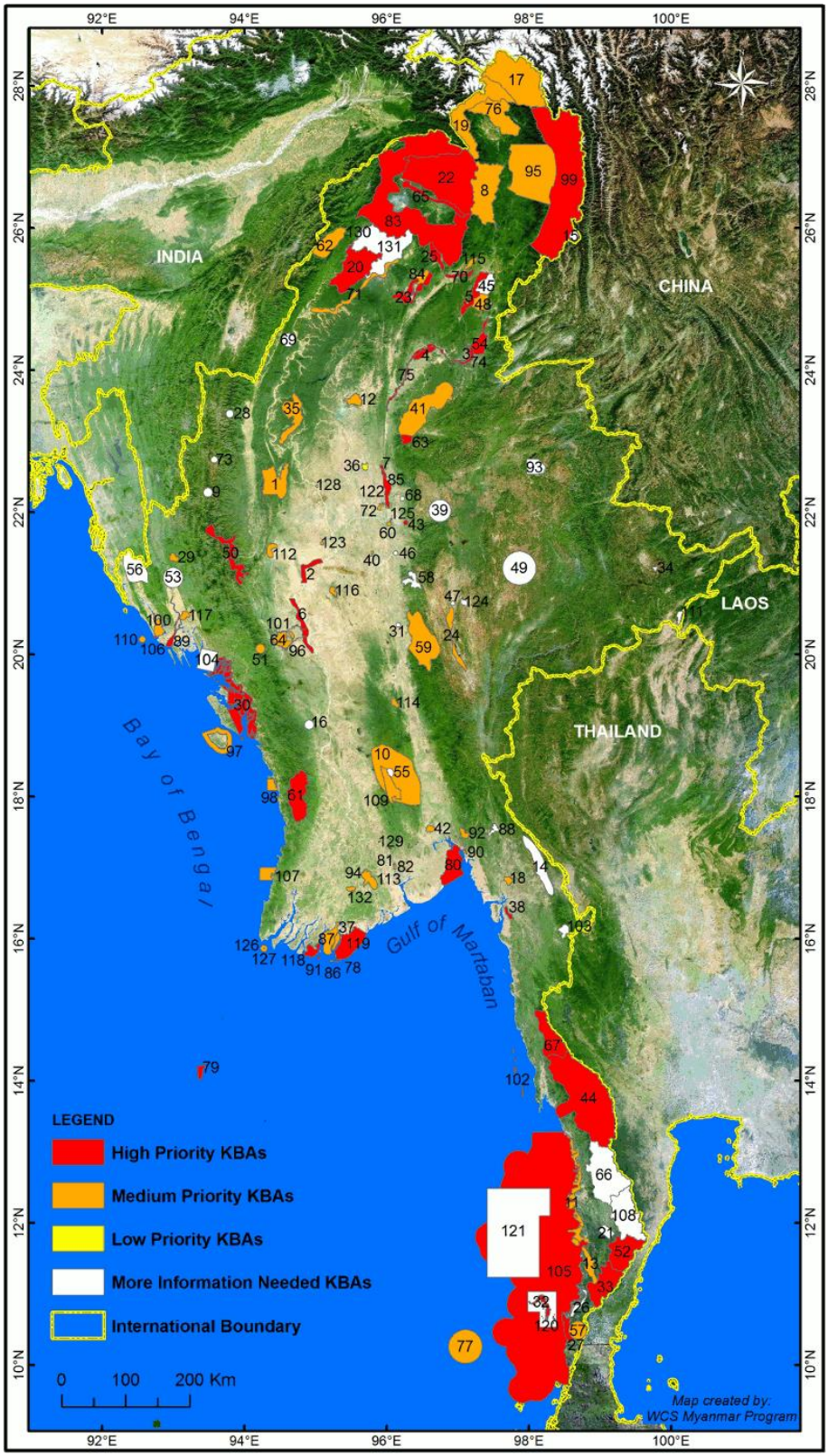
Table 7. Status of Key Biodiversity Areas in Myanmar

National Status of KBAs	#KBAs
Notified Protected Area – Terrestrial	32
Proposed Protected Area – Terrestrial	6
Notified Protected Area – Aquatic	3
Reserve Forest	20
Other Land Management Category	71
Total	**132**

International Status of KBAs	#KBAs
ASEAN Heritage Park	6
RAMSAR Site	1
Important Bird Area	53
Alliance for Zero Extinction Site	3
Total	**63**

Management Status of KBAs	#KBAs
Nature & Wildlife Conservation Division	21
Forest Department	37
Department of Fisheries	21
General Administration Department	7
Yangon City Development Committee	2
Other types of management	44
Total	**132**

Priority level of KBAs	#KBAs
High Priority KBAs	42
Medium Priority KBAs	56
Low Priority KBAs	1
Data deficient KBAs	33
Total	**132**



Source: https://myanmarbiodiversity.org/key-biodiversity-areas/ (Accessed October 5, 2017)

Figure 25 Key Biodiversity Areas (KBAs) of Myanmar

97. Two KBAs are of particular concern with respect to the Mawlamyine- Ye- Dawei transmission line route. These are the Tanintharyi Nature Reserve which is located northeast of Dawei; and, Mawlamyine KBA, lies to the south of Mawlamyine city

Taninthayi Nature Reserve.

98. The transmission line route is within the area Taninatharyi River Basin in both Mon and Tanintharyi Rergion. The Tanintharyi Basin is exceptional for its forests and biodiversity. WWF considers the basin to be one of the most biodiverse areas in the world. By area, 41.2% of the basin has been designated as Key Biodiversity Areas –i.e., areas of biodiversity of international importance. Protected areas cover 3.4% of the basin[24]..The Taninthayi Nature Reserve in located north of Dawei (see Figure26).

99. Taninthayi Nature Reserve (TNR), established in 2005, is a 168,998ha protected area in Taninthayi Region. The eastern boundary of the reserve lies on the border with Thailand. The reserve is predominately forested. Land cover on 80% of the reserve consists of mature forest formations, with evergreen dipterocarp forest on higher ground and semi-evergreen in lower areas in the west. The remainder consists of heavily degraded forest and secondary vegetation closer to villages in the west, some deforested hilltops near the Thai border, and extensive areas of bamboo in valley bottoms. [25]

The reserve supports a number of mammals, birds, reptiles and plant species, including elephant, tapir, barking deer, monkeys (langur), pythons, hornbills, and others including some endemic species. As of 2011, there are 277 plant species, 80 orchid species, 67 mammals, 246 bird species, and 69 species of reptiles[26]

The reserve has three zones:

i. Core Zone (136,347 ha) for biodiversity conservation. No villages, roads, or other infrastructure are allowed in this area, and access is restricted.

ii. Buffer Zone (extending one mile from the western and southern boundaries adjacent to the villages). Subsistence collection of forest products, community forestry and subsistence agriculture are allowed in this area.

iii. Transportation Corridor. This zone, traversing the TNR from the Myanmar Coast in the west to the Thai Border in the east, encompasses the pipelines, service track and metering stations. It was originally designated as a belt 100 m either side of the service track, which was wide enough to include the track and the first pipeline. Two new pipelines have since been built, parts of which are outside this corridor.

[24] ICEM and IFC, May 2017. SEA of the Hydropower Sector in Myanmar Baseline Assessment Report - May 2017. Final Biodiversity Baseline Assessment.

[25] E. H. B. Pollard, Soe Win Hlaing and J. D. Pilgrim. October 2014. Review of the Taninthayi Nature Reserve Project as a conservation model in Myanmar.

[26] Forest Department. 2011. Taninthayi Nature Reserve Project,

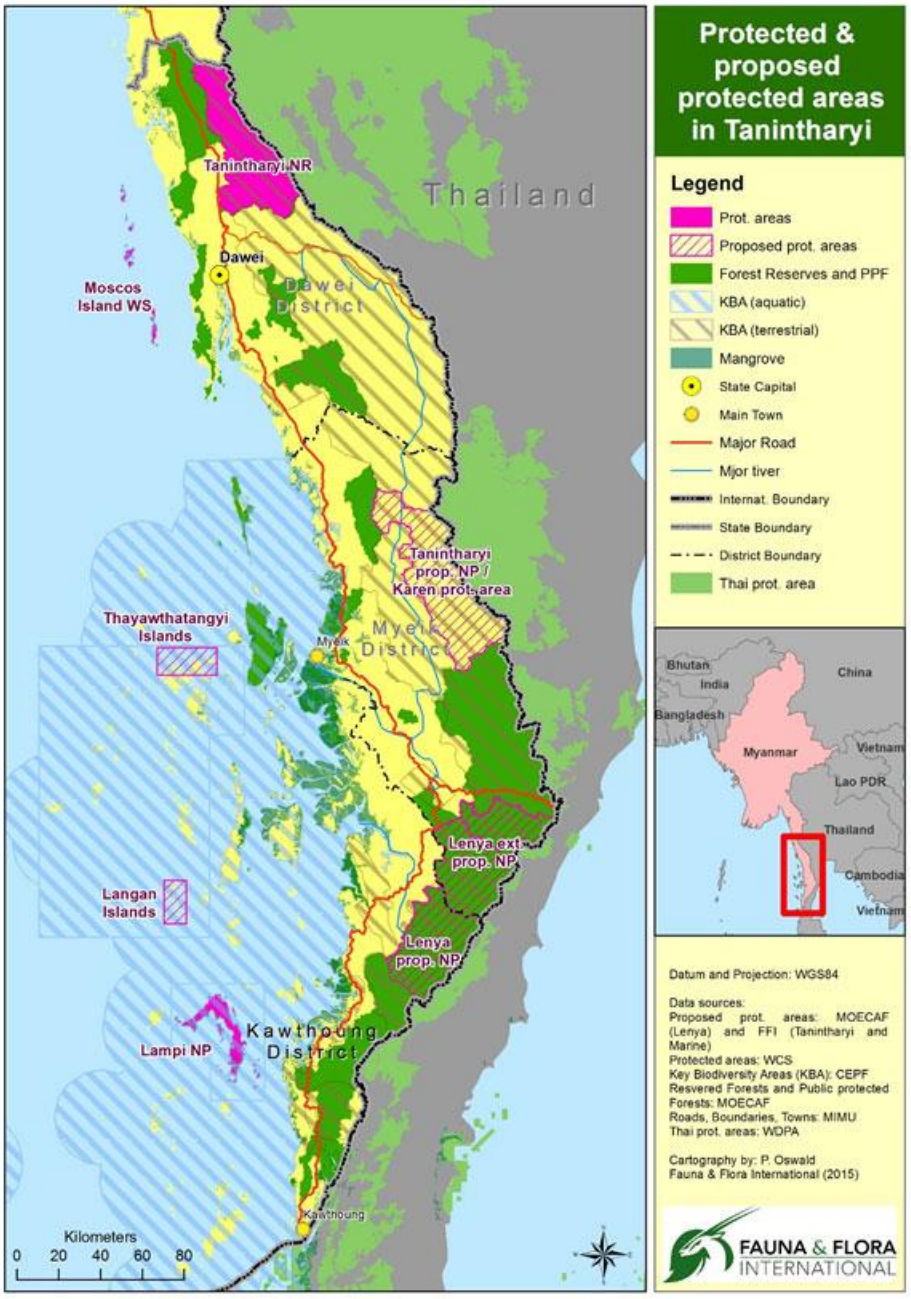


Figure 26 Protected and Proposed Protected Areas in Tanintharyi Region.

100. **Mawlamyine Key Biodiversity Area.** This site (Figure 27), of approximately 9000ha, has been identified as a KBA based on presence of significant populations of the globally threatened Hog-nosed Bat (*Craseonycteris thonglongyai)*[27] , This KBA is believed to support populations of the globally endangered green peafowl (*Pavo muticus*). It is described by Birdlife International as a majestic species with a very rapidly declining and severely fragmented population, primarily owing to intense habitat conversion and high hunting levels, with both negative population trends and habitat fragmentation projected to continue. It is also believed to support the Asian Brown Tortoise, Asiatic Softshell Turtle, Yellow Tortoise, and Asian Leaf Turtle[28].

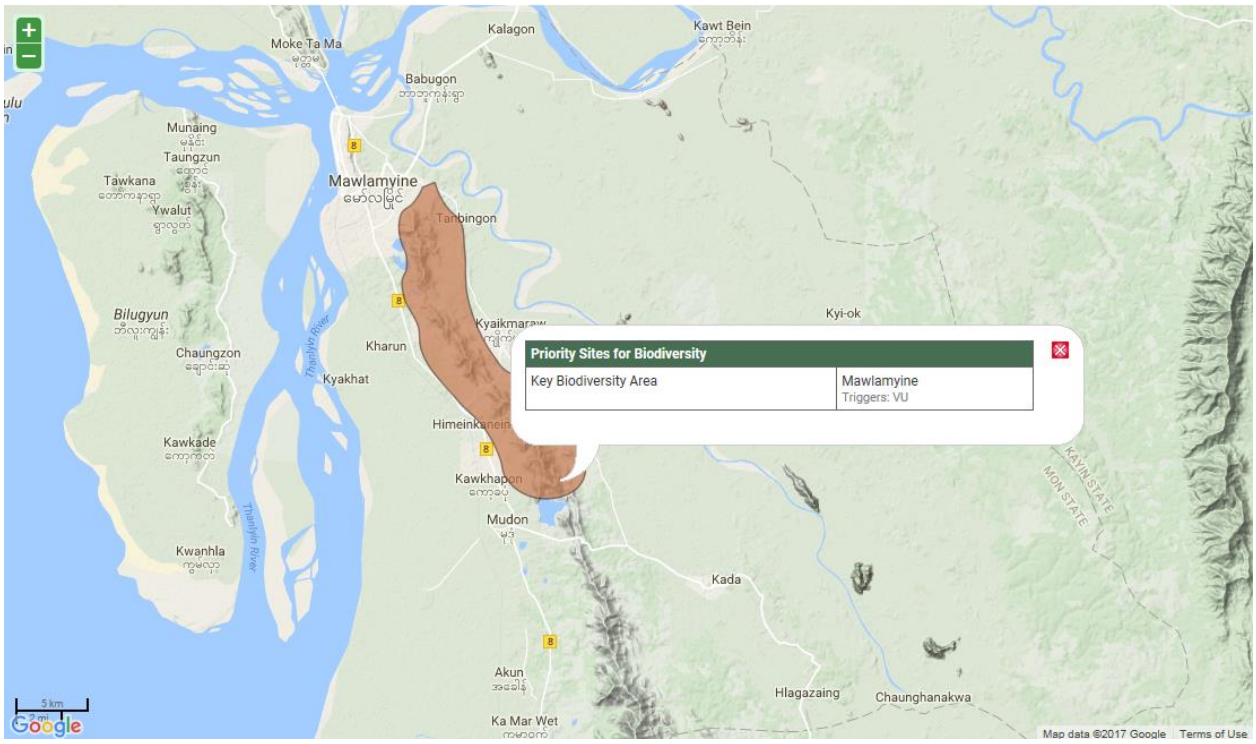


Figure 27 Mawlamyine Key Biodiversity Area

4.1.10 Cultural Resources

101. For the purpose of this assessment, "Cultural Resources" are defined as "tangible and moveable or immovable objects, property, sites, structures, or groups of structures, with archaeological, paleontological, historical, cultural, artistic, and religious values as well as unique natural features or objects that epitomize cultural values, and certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles, are considered as cultural resources.[29]"

102. Myanmar's tangible cultural heritage is one of the richest and most diverse in the Southeast Asian region, and is comparable to that of Cambodia and Thailand. The severe international isolation since 1962 has led to a void in the field of heritage conservation and most archaeological sites lie idle in ruinous conditions due to protracted periods of neglect.[30]

[27] See IUCN Red List. http://www.iucnredlist.org/details/5481/0
[28] Source: https://myanmarbiodiversity.org/key-biodiversity-areas/
[29] IFC 2012 Performance Standard 8 Cultural Heritage
[30] Facchinetti, S., "Cultural Heritage Management in Myanmar: A Gateway to Sustainable Development", EIAS Briefing Paper 2014|06; October 2014

103. As introduced earlier, Myanmar has one World Heritage Site, Pyu Ancient Cities. One of the ancient cities is located at Beikthano, near Taungdwingyi Other Archaeological/historical sites of Myanmar are not yet as well documented. UNESCO has offered its assistance to Myanmar to conduct an inventory and develop conservation guidelines for the protection of other cultural heritage sites, which are still on the Tentative List for World Heritage status. Currently, Myanmar's cultural proprieties on Tentative List include:

- The Ancient Cities of Upper Myanmar: Innwa, Amarapura, Sagaing, Mingun, Mandalay;
- Badah-lin and the Associated Caves;
- The Inle Lake;
- The Mon Cities: Bago, Hanthawaddy;
- The Myauk-U Archaeological Area and Monuments;
- The Wooden Monasteries of Konbaung Period: Ohn Don, Sala, Pakhangyi, Pakhannge, Legaing, Sagu, Shwe-Kyaung; and
- The Bagan Archaeological Area and Monuments.

104. Bagan has become a primary target for national development and international cooperation projects in the field of cultural conservation, it being the richest and the most internationally renowned of Myanmar, and a key tourist destination. The Bagan Archaeological Area is a cultural heritage site of immense importance, covering a vast plain of 80 square km. and containing more than 2,500 monuments built between the 10th and the 14th century.[31]

Figure 28. Location of the Beikthano Ancient Cities World Heritage Site

105. In addition to these recognized archaeological and historical sites Myanmar has thousands of pagodas and other religious sites. It is likely that some of these sites may fall within the right of way of the Project.

4.1.11 Mines and UXO

106. Anti-personnel (AP) mines pose a clear and present danger to civilians in the conflict areas of Myanmar. Existing data available on UXO and landmine victims indicate that Myanmar faces one of the most severe landmine problems in the world today. Relatively little is known about the actual extent of the problem, the impact on affected populations, communities' mine action needs and how different actors can become more involved in mine action. Until 2012, the Government of Myanmar prohibited almost all forms of mine action with the exception of a limited amount of prosthetic assistance to people with amputated limbs through general health programs. Currently Mine Risk Education (MRE) is also being conducted by many NGOs operating in Myanmar under the umbrella of

[31] Ibid.

the Mine Risk Working Group that is co-chaired by the Ministry of Social Welfare, Relief and Resettlement and UNICEF. However large scale clearance activities have yet to commence, as the clearance of landmines is intrinsically linked to the country's ongoing peace process which is moving slowly.[32]

107. The extent of UXO contamination in Myanmar as of 2010 is shown on Figure 29. Some 55 townships (of a total of 325) in 10 states and regions are believed to suffer from some degree of mine contamination, primarily from anti-personnel mines[33]. The townships that are affected by the Project are shown in bold font. They are all along the Mawlamyine-Ye-Dawei Line:

- Mon state: Bilin, Kyaikto, **Mawlamyine**, **Thanbyuzayat**, Thaton, and **Ye**
- Tanintharyi region: Bokpyin, **Dawei**, Tanintharyi, Thayetchaung, and **Yebyu**

108. Research conducted by Landmine Monitor used data sources such as casualty information, sightings of mine warnings, and reports by NGOs and other organizations of use, as well as interviews with field staff and armed forces personnel. The survey included casualty data from January 2007 through September 2015. In their most recent report, they characterized the performance of Myanmar as very poor: "Myanmar is the lowest ranked mine action programme in this year's report [2016], with the government's refusal to allow mine clearance preventing a peace dividend from being realized.

109. Since 2012, the Ministry of Social Welfare Relief and Rehabilitation, has co-chaired with UNICEF a national Mine Risks Working Group comprising 10 different ministries and 28 national and international NGOs and UN agencies to enhance coordination.[34]

110. Among many organizations working on UXO issues in Myanmar are Norwegian People's Aid, Halo Trust, Mine Advisory Group, and Danish Demining Group. These organizations are capable of evaluating project sites ("marking and fencing") and providing mine risk evaluations and conducting MRE for the project.

[32] "Humanitarian Impact of Landmines in Burma/Myanmar – 2011" report prepared by Geneva Call with technical assistance from DCA Mine Action

[33] http://www.mineactionreview.org/assets/downloads/Clearing_the_Mines_2016_Myanmar.pdf (Accessed October 6, 2017)

[34] http://www.mineaction.org/taxonomy/term/1070

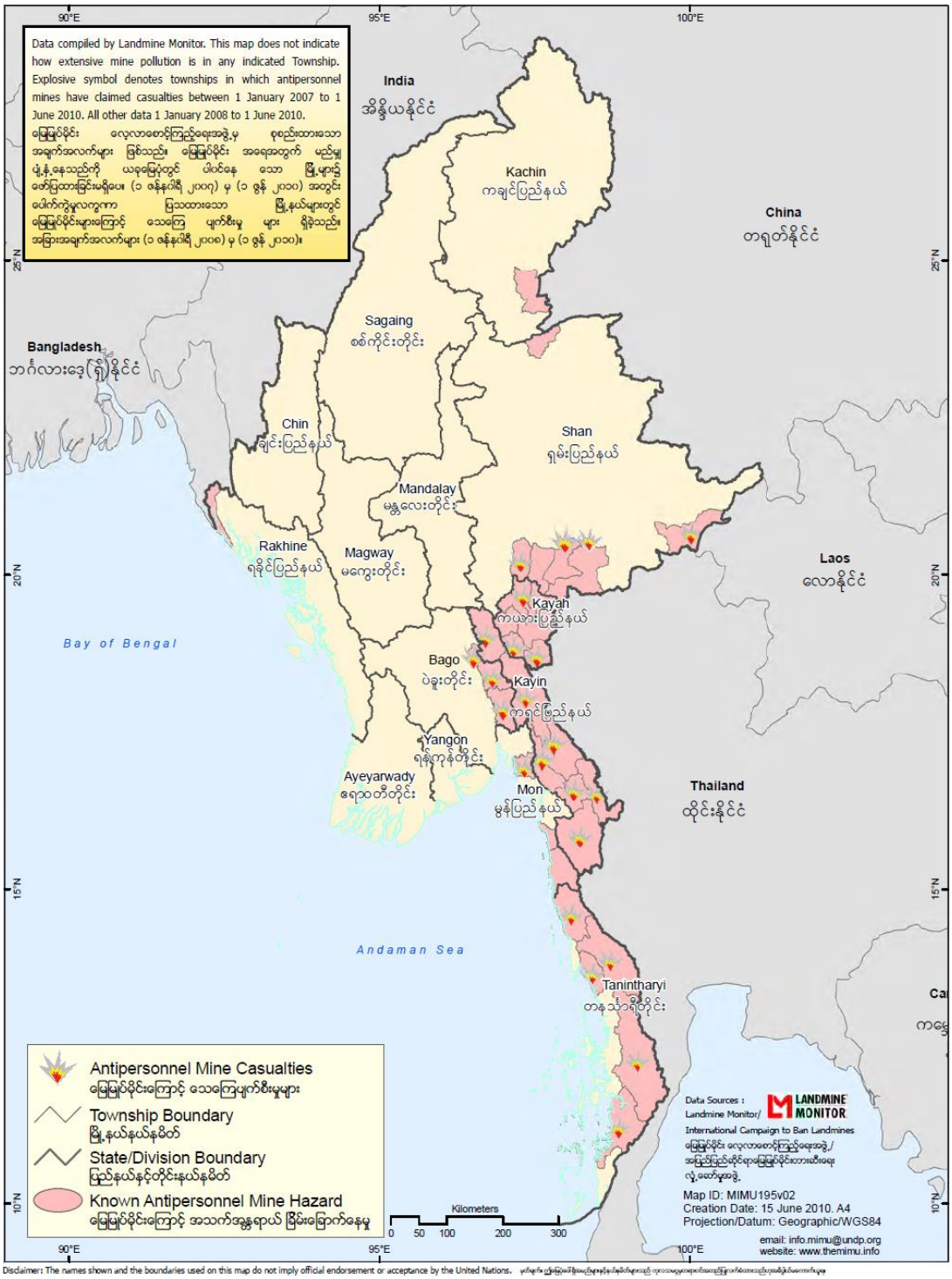


Figure 29 UXO Situation in Myanmar as of 2010

4.2 General Social and Gender Context

111. Myanmar has one of the lowest population densities in the South-East Asia region, with fertile lands, potential to increase its production, yields and profits in agriculture, and a rich endowment of natural resources. Its geographic location at the intersection of China and India, two of the world's most dynamic economies, makes it well positioned to resume its traditional role as a regional trading hub and a key supplier of minerals, natural gas and agricultural produce.[35]

112. The World Bank expects economic growth in Myanmar to drop somewhat from 7.3% in 2015-2016 to 6.5% in 2016-2017. The pace of recovery in agriculture from the floods of 2015 was hampered by longstanding productivity constraints in the sector. Medium-term growth is currently projected to average 7.1% per year.

113. At least 70% of poor people in Myanmar live in rural areas, where they rely on agricultural and casual employment for their livelihoods. Many live near the poverty line and are sensitive to economy-wide shocks. The main occupations in Myanmar are: Skilled agricultural, forestry and fishery workers (44.8 per cent); elementary occupations (15.8 per cent); service and sales workers (15.3 per cent); craft and related trades workers (11.2 per cent).[36]

114. The World Bank team has conducted a poverty analysis jointly with the government of Myanmar using recently collected household data. The analysis shows that poverty has declined between 2009-2010 and 2015. The assessment, however, signals that poverty remains substantial.

115. Among ASEAN countries, Myanmar has the lowest life expectancy and the second-highest rate of infant and child mortality. Just one-third of the population has access to the electricity grid and road density remains low at 219.8 kilometers per 1,000 square kilometers of land area. With the recent liberalization of the telecommunications sector, mobile and internet penetration has increased significantly from less than 20% and 10% in 2014, to 60% and 25% respectively. Establishing a credible and consistent policy and regulatory environment in the telecommunications sector can help ensure steady private investments and growth.

116. A detailed socio-economic profile of the areas that will be affected by the PNDP project, Transmission Component is found in the separately-bound Socio-Economic report.[37]

4.2.1 Sensitive Receptors

117. The presence of sensitive receptors such as residential households, temples, monasteries, mosques, and hospitals/health clinics within close proximity to the transmission line ROWs and substations need to be identified. These sensitive receptors are anticipated to experience adverse impacts of dust, noise and traffic during the construction period, and exposure to electrical equipment during the operational phase. A survey of sensitive receptors is to be undertaken prior to the start of construction.

[35] This background section largely adapted from World Bank's Country Overview, as of April 2017: http://www.worldbank.org/en/country/myanmar/overview#1 (Accessed October 10, 2017)
[36] Ministry of Labor, Employment and Social Security and Central Statistical Organization
In collaboration with the International Labor Organization; "Myanmar labor force, child labor and school to work transition survey 2015"
[37] AF Consult, 2017. "Socio-Economic Report for the PNDP"

5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Method of Assessment

118. Potential impacts have been assessed by means of site visits, discussions with local authorities and beneficiaries and the use of secondary sources of information such as similar projects elsewhere. This section summarizes the potential environmental impacts and required mitigation, which is incorporated into the Environmental Management Plan (see Chapter 9).

119. Impact were assessed for the five elements that comprise the Transmission Line Project:

- Construction of Ahlone-Thida line
- Construction of Mawlamyine–Ye–Dawei line
- Construction of temporary access / village roads
- Construction of New Substations
- Modifications to Existing Substations

120. Typical transmission line and substation impacts have been characterized as[38]:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas, access roads, and site preparation activities;
- Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities. Potential presence of PCBs and other pollutants in old transformers;
- Terrestrial and avian habitat alteration
- Bird and bat collisions or electrocutions
- Aquatic habitat alteration at river crossings
- Health and Safety issues, including electric and magnetic fields (EMF)

121. Taking into consideration the baseline information reported earlier in this document, the typical expected impacts as well as the different phases of the project development (Pre-construction, construction, operation), impacts were estimated for the following resources in their respective zones of influence (Table 8).

[38] Adapted from: IFC. "Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution" April 30, 2007

Table 8 Zone of Influence for Resources Studied.

Resource	Zone of Influence
Air Quality	Receptors within 100 m, potentially impacted by construction vehicle emissions and dust
Noise	Receptors within 100 m, potentially impacted by construction activities and vehicle noise.
Water resources, including water supply and wastewater	Streams and wetlands crossed by transmission lines Populated areas adjacent to or near (within 500 m) construction camps and substations
Land/soils	Area within 500m of TL
Solid Waste	Populated areas adjacent to or near (within 500 m) construction camps and substations
Land Use	Populated areas adjacent to or near (within 500 m) construction camps and substations
Forests, especially Protected forests, and the potential for forest fires along right-of-ways during the dry season	Area within 500m of TL
Biodiversity, including protected areas, key biodiversity areas (KBAs), wildlife corridors, and other ecologically–sensitive sites	Area within 1 km of TL
Birds, particularly with regards to dangers of collision with the transmission lines and habitat loss	Area within 1 km of TL
Physical Cultural Resources	Area within 100m of TL
Community Health and Safety	Populated areas adjacent to or near construction camps and substations
Occupation Health and Safety	Construction camps and substations Along Transmission lines for line workers
Resettlement and compensation	Area within the ROW
Income, at local and national levels	Populated areas adjacent to or near (within 5 km) substations
Ethnic Minorities	Populated areas adjacent to or near (within 5 km) substations
Unexploded Ordnance and mines (UXO)	Area within 100m of TL
Climate	Area within the ROW for GHG emissions.

5.2 Overall Project Impacts and Mitigation Measures

123. The analysis of impacts and mitigation was documented in spreadsheet form in order to be able to capture visually in one place many very different types of impacts resulting from the Project activities. The impacts are illustrated on Figure 30 and the residual impacts after mitigation are shown on Figure 31. The detailed impact analyses for each of the environmental resources are found in Supplementary Appendices - Appendix 6.

124. The results presented in Figure 30 and Figure 31 are qualitative. The results indicate that, with very few exceptions, there are not expected to be any significant residual negative impacts from the implementation of the PNDP, given the mitigation measures that have been proposed and which are discussed in the EMP.

Activities and Project Impacts Table - With Anticipated Mitigation Measures											Transmission Line Component						
Output/Activity	Air	Noise	Water and Waste-water	Land/soils	Solid/Liquid Waste	Land Use	Forests	Biodiversity	Birds	Cultural	Education & Health	Safety	Resettlement	Income	Ethnic Minorities	UXO	Climate
Pre-Construction																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	-5	-5	0	0	0	0	0	0	0	0	0
Access roads	0	0	0	0	0	0	-5	0	0	0	0	0	0	0	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Access roads	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Access roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 30 Illustration of Total Project Anticipated Impacts before Mitigation

Activities and Project Impacts Table - With Anticipated Mitigation Measures											Transmission Line Component						
Output/Activity	Air	Noise	Water and Waste-water	Land/soils	Solid/Liquid Waste	Land Use	Forests	Biodiversity	Birds	Cultural	Education & Health	Safety	Resettlement	Income	Ethnic Minorities	UXO	Climate
Pre-Construction																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	-5	-5	0	0	0	0	0	0	0	0	0
Access roads	0	0	0	0	0	0	-5	0	0	0	0	0	0	0	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Access roads	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation																	
Ahlone-Thida Line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Mawlamyine–Ye–Dawei line	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Access roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Existing Substations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 31. Illustration of Residual Impacts with Mitigation Applied

5.3 Environmental Impacts Related Design and Preconstruction

5.3.1 Design

The primary impacts associated with the pre-construction phase are related to poor location of the facilities (with respect to environmental and social issues), and inadequate design that does not take into account needed mitigation measures. This includes:

i. Final of the detailed alignment of Transmission Lines to ensure avoidance of protected areas, key biodiversity areas and important bird areas all of which are near the proposed alignment;
ii. Finalization of design of measures to reduce the risk of bird collisions;
iii. Finalization of tower placements and avoid sensitive receptors
iv. Specifications for materials with the lowest embedded GHG emissions;
v. Preparation of an EMF Risk Assessment; and
vi. Emergency Response Planning.

5.3.2 Pre-Construction Activities

Land Acquisition and Resettlement

125. Impact: Although the exact number of structures that would be impacted by the new sub-stations and the number of tower pads to be located in forested and cultivated area are not known at this time, it is expected that some adverse impact on land with structures, and forest and agri-culture land would be unavoidable. The impact of acquisition land with structures particularly resi-dences would be very significant as the affected persons would face physical and potential economic displacement.

126. Impact: Although the exact number of structures that would be impacted by the new sub-stations and the number of tower pads to be located in forested and cultivated area are not known at this time, it is expected that some adverse impact on land with structures, and forest and agri-culture land would be unavoidable during construction. The impact of acquisition land with structures particularly residences would be very significant as the affected persons would face physical and potential economic displacement Table 9 presents the estimated potential impacted households and affected area. Any land acquisition and compensation would be completed prior to construction. However, certain impacts may occur during construction from the activities of the contractors, in-cluding impacts due to contractors' temporary use of land.

127. Mitigation: The Resettlement and Ethnic Group Development Plan addresses land acquisition and other compensation issues in detail. Any land acquisition and compensation would be completed prior to construction.

Table 9 Estimated Potential Resettlement Impacts

	Estimated Number of Af-fected Households	Estimated Area (in hectares) of Transmission Line Corridors
Ahlone-Thida TL (Dala)	28	76.4
Ahlone-Thida TL (Strand Rd)	290	37.7
Mawlamyine-Ye- Dawei TL	417	1329

Source: Resettlement Plan, October 2017, updated December 2017

Loss of Standing Crops

128. Impact: In the cultivated land through which the transmission line passes the potential loss of standing crops in the land falling within the ROW, during construction, is another significant impact as this would affect the livelihood of the cultivators. Moreover, the adjoining land areas at the verges of ROW and tower pads may be affected due to movement of construction machinery and labor force.

129. Mitigation: Mitigation would be in the form of compensation for loss of income and measures to minimize the loss of standing crops, as specified in the Resettlement and Ethnic Group Development Plan.

UXO

130. Impact: For the Mawlamyine-Ye-Dawei line there is a possibility that UXO may be present along portions of the alignment. UXO would pose a serious threat to the safety of workers building the line and the access roads, as well as local villagers, resulting in severe injury and fatal events to public.

131. Mitigation: Considering that the understanding of the exact nature and location of the mines and UXO contamination in Myanmar is currently limited, for safety reasons it could be useful to first conduct a non-technical survey (NTS) along and around the area where the Mawlamyine-Ye-Dawei Line will be constructed. This survey could potentially be undertaken with the assistance of the Myanmar Defense Services or more specifically the Corps of Engineers, with technical assistance provided by an international mine action operator upon request. Once the non-technical survey is complete, it would be possible to identify specific areas or hotspots that would need further investigation and the potential clearance of mines or UXO before the construction project begins. This initial non-technical survey would limit the exposure of construction workers and other personnel to the danger posed by mine and UXO contaminated areas along the proposed Mawlamyine-Ye-Dawei line.

132. International organizations working on UXO issues in Myanmar include Norwegian People's Aid, Halo Trust, Mine Advisory Group, Danish Demining Group and Danish Church Aid. These organizations are capable of providing Mine Risk Education both for individuals directly involved in the construction work of the project, and in the surrounding villages, upon request.

133. These organizations also have the technical capacity and could advise on further evaluation of the project sites including conducting an initial evaluation of risk through a non-technical survey of the project area. However, this would need to be undertaken upon request, and have the initial permission granted by the Myanmar government and all relevant stakeholders for these activities to take place.

Contractors' Environmental Management Plans

134. Prior to start of construction, all Contractors will be required to prepares a Contractor's Environmental Management Plan for the implementation of all construction stage mitigation measures and monitoring requirements under their responsibility (see Chapter 9).

5.4 Environmental Impacts Related Construction.

5.4.1 Air Quality/Dust

135. Impact: Airborne dust from access road construction and use, wind erosion of material stockpiles, emissions from vehicles and construction equipment, disposal of waste have potential to adverse impact sensitive receptors in the Project area. Emissions associated with the project will contribute to increase concentration of the GHG in the atmosphere.

136. Mitigation measures include:

- All heavy equipment and machinery must be in full compliance with the national regulations.
- Use Euro IV diesel fuels when those fuels are available.
- Wet stockpiled soil and sand before loading, particularly in windy dry conditions.
- Enclose stockpiles of sand and aggregate greater than 20 m^3 in volume in walls extending above the pile and beyond its front face.
- Ensure acceptable all-weather surface for areas within the site where there is a regular movement of vehicles.

- Store cement and other such fine-grained materials delivered in bulk in closed silos fitted with a high-level alarm indicator; vent weigh hoppers to a suitable filter.
- Employ fuel-efficient and well-maintained haulage trucks with proper exhaust baffles to minimize exhaust emissions and noise.
- Turn off the engines for all vehicles, while parked on the site.
- Use efficient equipment, machinery and vehicles with regular checks to affect necessary corrections or repairs and ensure compliance with safety and air pollution requirements.
- Cover soil, sand, and other construction material in storage and in transit.
- Use effective water sprays during the delivery and handling of all sand and aggregate and other similar material when dust is likely to be created.
- Provide barriers in locations where strong winds are likely to blow away dust and debris.
- Spray bare areas and roads used for haulage of material with water.
- Wash tires and lower bodies of vehicles when moving out from the construction site.
- Select sites for material extraction away from residential areas to reduce impact of dust.

5.4.2 Noise and Vibration

137. Impact: Increase noise levels during construction operations may cause disturbance to sensitive receptors. Vibration may cause damage to building and infrastructure.

138. Recommended mitigation measures include:

- Fitting all powered mechanical equipment and machinery with noise abating gear, such as mufflers for effectively reducing sound, in full compliance with the applicable regulations.
- If possible, operating heavy equipment, including pile drivers, during daylight hours.
- Terminating works at the established time (e.g., work during daylight hours), and avoiding increases of noise during peak hours.
- Isolating construction equipment that generates excessive noise/vibration.
- Using well-maintained haulage trucks with speed controls.
- Taking reasonable measures, such as installing acoustic screens to minimize noise near noise-sensitive areas such as schools, clinics and places of worship.
- Ensuring the contractor takes responsibility for rectifying damages caused by vibration generated from or by the use of any equipment, machinery, and haulage vehicles.

5.4.3 Water Resources

Wetlands, Streams and Aquatic Habitats

139. Impact: Aquatic habitats found in streams and wetlands that are traversed by, or in the vicinity of, the transmission lines and access roads will be subjected to degradation from construction or construction related activities. Wetlands attract large birds such as storks, cranes, and flocks of ducks and geese, waders as well as large birds of prey so these species will be potentially at risk from any transmission lines close, adjacent to, or traversing wetlands.

140. Mitigation: Mitigation would include designing and routing the linear features so as to avoid disturbing wetlands and other aquatic habitats by routing the transmission lines away or around wetlands and siting access roads, towers, and substations to avoid wetlands and aquatic habitats. Recommendations for avoiding contamination of wetlands and protection of aquatic habitats include (these are discussed in the EMP):

- Use of silt screens and other appropriate measures to avoid contamination of wetlands and aquatic habitats
- Maintaining fish access when road crossings (access roads) of watercourses are unavoidable by utilizing clear span bridges or open-bottom culverts

- Minimizing clearing and disruption to riparian vegetation
- Restoration of wetlands after construction.[39]

Hydrological Impacts

141. Impact: Potential hydrological impacts of the proposed projects are obstructions to surface runoff and flood damage to project facilities at substations and downstream locations. This applies primarily to the access roads and the substations.

142. Mitigation: Measures to mitigate adverse hydrological impacts are designs to facilitate efficient and uninterrupted peak surface runoff and design of cost-effective drains to collect and appropriately treat runoff water prior to discharge to local water courses to prevent waste streams from project facilities.

5.4.4 Land Degradation and Soil Erosion

Soil Erosion

143. Impact: Project construction activities including excavation for borrow material and quarrying and spoil, and the construction of access roads could result in some degree of soil erosion.

144. Mitigation: Mitigation would include utilizing already used areas for earth borrowing, quarries, and disposal sites wherever possible and implementing erosion protection measures as gabions, gravel/or vegetation cover, particularly on steep slopes and along river banks, according to best practice standards. As discussed in the EMP, the following measures should be taken:

- In the short-term, protecting all areas susceptible to erosion, flood damage, and silt transport/sedimentation with either temporary or permanent drainage works.
- Taking measures to prevent pooling of surface water and scouring of slopes.
- Using silt traps where earthworks are carried out adjacent to water bodies including wetlands.
- Developing measures to strengthen the steep slopes and river banks with vegetation, grass and plants, or gabions. Work with local communities to choose appropriate methods and implement these measures.
- Developing efficient methods for disposal or backfilling of extracted soils.
- Avoiding the use of arable land for earth borrowing. If unavoidable, the topsoil (ca 30 cm) should be removed, stored, and refilled after the operation is completed.
- Restoring landscapes to their quasi-original conditions after the completion of works and after use of quarries; restoring the vegetation cover in accordance with the design constraints of transmission lines.
- In the case of access roads, these will be removed and the area rehabilitated after construction unless MoEE decides to maintain some permanently for maintenance. In that case MoEE will be responsible for their maintenance to avoid soil erosion, dust, and other negative impacts.

Borrow Pits, Quarries and Waste Disposal Sites

145. Impact: Extraction of material from borrow pits and quarries could cause erosion and dust generation in addition to enhanced noise levels. The topography of the area could be altered and the sites may become aesthetically undesirable. While exhaust from construction machinery and haulage vehicles and dust could cause air quality deterioration from gases as NO_x, CO, and SO_x and particulate matter (PM_{10}, $PM_{2.5}$) disposal of construction waste and waste from contractor's camps

[39] IFC. 2007. Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution, International Finance Corporation, April 2007.

could contaminate water bodies in the vicinity. Further, extraction of material for access road embankments and other resources as water and energy would also cause environmental stress. If these roads are used for maintenance these could lead to increased levels of poaching and transportation of unauthorized forest products including timber. Borrow pits, quarries and waste disposal sites, if left unclaimed, could contaminate nearby streams, pose a danger to persons and animals, and become habitat for vermin and disease vectors such as mosquitoes.

146. Mitigation: Dust and noise control measures following IFC guidelines,[40] should be adopted and permits for operation of borrow pits and quarries and disposal of waste in approved areas should be obtained from respective local authorities. Further, use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible should be adopted to minimize the impact of road construction. It is anticipated that most of the access roads will be removed after construction. However, if some roads are to be used during operation phase for maintenance, suitable monitoring mechanisms to police poaching and unauthorized use of forest product would have to be put in place.

147. Borrow pits, quarries and waste disposal sites shall be rehabilitated after construction is completed, as directed and approved by the PIC Engineer.

Landslides

148. Impact: landslides could be a problem in landslide prone areas and may be triggered by use of heavy machinery and excavations and cutting into slopes. This applies primarily to the hilly portions of the Mawlamyine-Ye-Dawei line.

Mitigation: Designing towers and substations using landslide prevention design standards and locating the facilities in stable areas, as far as possible would avoid landslides. In addition, using best practices in construction is needed to prevent vibration from heavy machinery, excavation, grading and slope cutting to trigger landslides

5.4.5 Solid Waste and Hazardous Materials

149. Impact: Improper handling and disposal of solid waste may contaminate surface and groundwater; attract vermin (e.g., rats, scavenging birds); and pose a health risk.

150. Mitigation: Manage solid waste and sewage according to national and local regulations. As a rule, solid waste must not be dumped, buried, or burned at or near the project site, but must be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits.

151. Impact: Hydrocarbons and other hazardous materials may also cause soil contamination or pollution of waterways.

152. Mitigation. These risks can be mitigated by having a clearly defined and lined storage site at least 20m from any watercourse that is surrounded by a compacted earth bund of a suitable size such that it is able to contain the total volume of fluids stored within. The use of commercial fuel providers operating in the area is another option for the management and storage of these materials on the construction site. All waste hydrocarbons, including fuel and oil filters, will be deposited in sealed containers and removed from the site for recycling or safe disposal as appropriate.

5.4.6 Forests

153. Impact: Considering the land area under forest cover in Myanmar the lines traversing some forest areas is inevitable particularly for the Mawlamyine-Ye-Dawei line. The forest areas falling within the ROW (46 m wide corridor for 230 kV lines) will have to be cleared of trees which are taller

[40] IFC. 2007. Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution, International Finance Corporation, April 2007

than 3 m. This removal of trees would have to be carried out all along the ROW of the lines and this would generate many adverse impacts (Table 10):

- Contributing to release of sequestered carbon in the forest
- Segregation of wildlife habitats and obstructing corridors
- Loss of plantation areas
- Reduction in available non-timber forest products (NTFPs) with attendant loss of income.

Table 10. Construction Impacts to Forests

Output/Activity	Principal Potential Impacts	Degree of Negative Impact
Ahlone-Thida Line	Mangroves are nearby and could be impacted particularly at the Thida river crossing	**Moderate**
Mawlamyine–Ye–Dawei line	Numerous forest reserves are crossed with a clear-cut ROW, causing fragmentation, wildlife, and forest resource impacts	**Major**
Access roads	Short access roads may need to be built into forest reserves to construct towers, allowing ease of access to the forests resulting in illegal logging and hunting	**Major**
New Substations	Minor to None (land is owned by Government and not in forest)	**None**
Existing Substations	Minor to None (land is owned by Government and not in forest). Additional land not required.	**None**

154. Mitigation: An Agreement with the Forest Department for compensation for trees removed or the requirements for replanting at alternate sites must be made. It is likely that trees will be need be replanted and at a rate of 2 planted for every tree felled.

155. The ROW area cleared of trees could be revegetated with plants that do not exceed 3 m in height without any impact on the transmission lines above. Careful selection of plants that do not exceed height limitation and suitable for each impacted area would have to carried out with the assistance of the Forest Department. Plants or shrubs that could facilitate sustainable harvesting of NTFPs but do not attract birds would be ideal for revegetation. However, this revegetation would have to be monitored and managed carefully. A tripartite agreement where the transmission line owners, Forest Department, and other community or private user groups would be required to be signed when the revegetation is to be carried out by the communities and funding for initial revegetation and maintenance would have to be provided through project funds. When forests under the Forest Department are affected revegetation can be handed over to community based organizations under a tripartite agreement as above, but the area allocated for revegetation should have to be such that it would be feasible to generate adequate income for maintenance and a small profit. When the affected area is in a wildlife corridor the revegetation should be the responsibility of the Forest Department as community incursions to wildlife habitats would also render the habitat unsuitable for wildlife. Initial funding for both these instances should be from the project funds and for the vegetation maintained by the Forest Department.

5.4.7 Birds

156. Impact: As revealed through interviews with local villagers and discussions with international NGOs, birds, especially high-flying birds of prey such as eagles, raptors, storks and cranes, and large vultures use river valleys and ridges of land such as mountain / hill ranges as flyways. Powerlines across river valleys can cause bird deaths by electrocution and collision. This is also the case along ridges of land (large birds often use such features to be able to gain height to continue with their

onwards migration). Birds sitting on power poles or power lines are killed if they cause short circuits between energized lines or short-to- ground. The large wingspan of some of these birds appears to be the single most important factor in their susceptibility to electrocution. In addition to their size, the perching behavior of certain of these bird species puts them at greater risk. Species that prefer exposed high perches are more likely to be attracted to towers, as are the species that use a "still hunting" technique in which they perch and visually search the landscape for prey rather than hunting in flight. In flight, birds can collide into power lines as power cables are often difficult to see, particularly in adverse weather conditions offering poor visibility (rain, mist, fog, low clouds). In most cases the impact of collision leads to immediate death or fatal injuries and mutilations. The problem of collision particularly affects large, heavy birds with poor maneuverability. These impacts on birds can be more significant during migration when birds travel long distances through unfamiliar landscapes, whereas resident birds can adapt to obstacles in their habitat birds on migration and stop-overs can hardly adapt as they remain in the area only for a short time.

157. Mitigation: Most commonly used mitigation measures are attaching conspicuous orange fiberglass balls, bird deflectors, and/or solar powered reflectors to warn the birds of the obstruction by power lines, fixing auditory signal generating devices as wind chimes and maintaining canopy height above the lines outside of the ROW to induce birds to fly above the power lines. Bird electrocutions in general can be reduced by adopting safe electrical pole and line configurations or managing perching. Provision of platforms for safe perches and nesting locations on towers during the design would further mitigate impact on birds.

158. Other measures which should be investigated and adopted during the detailed design stage are specific technical solutions such as the marking of neutral lines or their removal / burial[41]. Another measure to that could be investigated is that power pylons with suspended insulators should be considered instead of pylons with an exposed loop of wire above the insulator.[42]

5.4.8 Biodiversity

Right of Way (ROW) Environmental Impacts. The objective of the EMP with regard to environmental impacts along the ROW during the design phase is to:

- Design a transmission line facility that will cause minimal adverse impacts to terrestrial and aquatic habitats.

Recommended mitigation measures include:[43]

- Site transmission and distribution rights-of-way, access roads, lines, towers, and substations to avoid critical habitat by using existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible.
- Install transmission lines above existing vegetation, when possible and safe, to avoid/minimize land clearing.
- Avoid construction activities during bird and wildlife breeding season and other sensitive seasons or times of day.
- Revegetate disturbed areas with native plant species, preferably with economic value

[41] Electrocution and collision of Birds with Powerlines. COP 10 Convention on Birds. https://www.regjeringen.no/contentassets/5480e0243522455687338a6c33ebd9f4/electrocution_of_birds_and_collision_with_power_lines_sorensen_111124.pdf. Accessed 21 Nov 2016

[42] Ferrer, M, De La Riva, M, and Castrovi, 1984. Electrocution of raptors on power lines in southwestern Spain. j. Field Ornithol., 62(2):181-190

[43] Adapted from International Finance Corporation, *Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution*, April 2007.

- Remove invasive plant species during routine vegetation maintenance. Implement an integrated vegetation management approach. The selective removal of tall-growing tree species and the encouragement of low-growing grasses and shrubs is the common approach to vegetation management in transmission line rights-of-way.

Aquatic Habitat. The objective of the EMP with regard to environmental impacts along the ROW that could disrupt aquatic habitats during the design phase is to:

- Design a transmission line facility that will cause minimal adverse impacts to terrestrial and aquatic habitats.

Recommended mitigation measures include:[44]

- Siting power transmission towers and substations to avoid critical aquatic habitat (e.g., watercourses, wetlands, riparian areas), as well as fish spawning habitat, and critical fish over-wintering habitat.
- Maintaining fish access when road crossings of watercourses are unavoidable by utilizing clear span bridges, open-bottom culverts, or other approved methods.
- Minimizing clearing and disruption to riparian vegetation, especially mangroves.

159. Impact: Access roads construction and clearance of the right-of-way for Mawlawyine-Ye-Dawei transmission will destroy habitat for wildlife (e.g., particular birds, mammals, and reptiles) and will destroy important wild plants. During construction the animals will be temporarily displaced. The creation of the right-of-way will create a corridor in the forested area, which may lead to habitat fragmentation for some species.

160. Mitigation: A map showing all access roads (existing ones and ones to be constructed) has to be prepared and submitted to the PIU/PIC for approval and shared with the local communities Minimize the area cleared, where possible, replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas. Remove and rehabilitate areas disturbed by temporary access roads (see Table 11).

Table 11. Impacts and Mitigation Measures for Birds and Biodiversity

	Principal Potential Impacts	**Degree**	**Mitigation Measures**	**Residual Impact**
Construction				
Ahlone-Thida Line	Habitat Loss, Habitat Fragmentation	**Moderate**	Temporary habitat loss and habitat fragmentation to secondary scrub and agricultural land only	**None**
Mawlamyine–Ye–Dawei line	Habitat Loss, Habitat Fragmentation, Hunting of Birds (as well as Mammals etc.) due to Increased Access to Forest Areas / Wetlands by increased numbers of people	**Moderate**	Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas; Work with Forest Department and local authorities to control increased access to sensitive forests / wetlands	**None**
Access roads	Habitat Loss, Habitat Fragmentation	**Moderate**	Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas. Close temporary access roads	**None**

[44] Ibid.

	Principal Potential Impacts	Degree	Mitigation Measures	Residual Impact
New Substations	Potential Minor Habitat Loss	**None**	None required	**None**
Existing Substations	Minor to none	**None**	None required	**None**

5.4.9 Physical Cultural Resources

161. Impact: Myanmar is a country where civilization has existed for thousands of years and encountering such monuments in construction related excavations is a distinct possibility. Thus, it is important that any chance findings during excavations for project activities be protected.

162. Mitigation: To protect cultural resources from accidental damage from construction, existing cultural property will be treated as sensitive receptors. They will be avoided where possible and subject to the control on air pollution and noise. Implement Chance Find Protocols as soon as historical/cultural monuments are encountered during construction activities. Stop work and inform the relevant authorities including the Ministry of Religious Affairs and Culture. The Ministry would implement measures to avoid damage to monuments and valuable features which the contractor is bound to follow.

5.4.10 Community Health and Safety

163. Impact: The existing and proposed improvements can pose health safety risk nearby communities during construction and operation. These impacts include:

- Potential impacts from work-place accidents to workers, local community.
- Increase in traffic accidents from additional traffic related to the construction of the Project
- Inadequate design of fencing and other measures to keep people away from towers and conductors could result in electrocution.
- Public perception that electric and magnetic fields (EMF) could affect nearby residents causing cancer and other illnesses
- Possible increase in STDs or other diseases from construction workers interacting with local population

164. Mitigation: Measures for this during construction to be taken by the Contractors as part of will include:

- Provision of adequate personal protective equipment to workers.
- Adequate signage, lighting, and control of construction sites.
- Traffic control measures to ensure public safety, especially when working near schools.
- Establishment of efficient emergency/ contingency plans, adequate facilities, equipment and trained staff for handling emergencies.

Electric and Magnetic Fields (EMF)

165. Impact: High voltage power lines may cause adverse impacts to nearby populations from EMF. This affects all the transmission lines and substations.

166. Mitigation: Though not established yet that EMF from powerlines could generate adverse health impacts adopting the precautionary principle the following mitigation measures[45] are proposed and discussed further in the EMP:

- Assessing the potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection

[45] Ibid.

- Siting the power transmission facilities to avoid or minimize exposure to the public. Avoiding installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools, clinics, or offices), should be avoided
- If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include:
  - Shielding with specific metal alloys
  - Burying transmission lines
  - Increasing height of transmission towers
  - Modifications to size, spacing, and configuration of conductors.

Public Safety Risk

167. Impact: If the transmission line facilities are not designed using safety measures it would be difficult to prevent injury and fatal events to public. This applies to all the PNDP project activities.

168. Mitigation: Mitigation measures include, designing the transmission line facilities using latest safety measures such as fences, signs, controlled entrances and other safeguards, awareness building training for public, including children, on the dangers of transmission lines, towers, and substations, and provide reflectors or other methods as appropriate to increase the visibility of these facilities

Loss of Accessibility

Impact:. During construction roads in the vicinity of the projects would be frequently used for haulage of construction equipment, machinery and materials causing access problems to the local community.

169. Mitigation: Mitigation measures would include providing access to all properties during the construction period and ensuring access for disabled persons in the designs of cross-walks and other required features in villages as appropriate.

Traffic Management and Construction Safety

170. Impact: During construction, road use for construction activities as haulage of construction materials, spoil, and equipment, would result in disturbances to vehicular traffic and pedestrians and may cause injury through road accidents.

171. Mitigation: Mitigation measures would include formulating and implementing a construction-related traffic management plan. The plan should include:

- Installing traffic warning signs, and strict enforcement of traffic regulations during transportation of materials, equipment, and machinery
- Conducting awareness programs for contractor's staff on safety and proper traffic behavior in densely populated areas near the construction sites
- Assigning traffic control personnel/flaggers
- Providing alternative access to pedestrians
- Arranging necessary measures for passer-by safety and all means of transportation safety
- Selecting quarry and borrow sites that are served by roads of adequate capacity for heavy trucks
- Controlling the loading and operating speeds of haulage vehicles
- Repairing damages to roads caused by haulage of construction materials, spoil and equipment, and machinery
- Obtaining approval from local authorities whenever local road are used for transportation;

Competition for Resources and Conflicts

172. Impact: During construction, a labor force assembled from different places with different religions and ethnic backgrounds may be employed by the contractors. Conflicts are likely to arise as a result of competition for use of resources such as food, water, rivers and other bodies in the vicinity for washing and recreation, and places of worship. Behavioral and cultural practices of the work force may lead to conflict where these are in conflict with traditional and cultural practices of the villagers, especially in areas where the culture and language are different. Sudden cash flow in project area and cash earning of workers creates opportunities for use of alcohol and drugs, gambling and other vices to develop. In addition, the new opportunities arising from project construction will attract new in-migrants to the project area with potential negative impacts on social and cultural aspects, including potential conflicts between the local and the immigrant populations and exposure of the locals to vices and attendant health impacts. This could cause health problems and spread of STDs including HIV.

173. Mitigation: The indication of food and drinking water deficit in areas where construction camps are to be established would require that the contractor would have to manage food and water requirement independent of the local resources. Keeping in view the local customs, traditions and considerations, a set of "rules" for the workers – both local and outside and in-migrants - will have to be identified through stakeholder consultation. These codes of conduct, would include awareness programs, be included in the CEMP and Contract and be enforced to help facilitate a "positive" environment in the project area and thus build a "community" of mutual trust and respect during project construction.

174. This EIA also presents a Grievance Resolution Mechanism (see Chapter 8) designed to resolve conflicts or grievances arising from the community dealing with construction.

Gender, Child Labor, and TIP

175. Impact: During project construction, daily wage labor may be deployed for excavation and transportation of construction materials and other construction-related works. The contractors/subcontractors may discriminate against women with unequal pay and/or conditions. In general, the physical nature of the work and gender dynamics will likely mean that employment opportunities will be more readily available to men rather than women. It must be borne in mind that many women in Myanmar are already engaged in arduous physical work such as road-building and farm work, and would benefit from access to paid work. There is a risk that children may be employed by the contractor/subcontractor at low wages. Further, the Project may help create conditions that may introduce or exacerbate Trafficking in Persons (TIP)[46].

176. Mitigation: The EMP for the project includes measures to prevent discrimination against women employed by contractor/sub-contractor and to prohibit child labor. The EMP also specifies that due priority should be given to project affected persons, vulnerable groups and poor people. The Contractor will be responsible for dealing with issues such as labor contracting and working conditions, trafficking in persons, HIV/AIDS, organizing and delivering trainings, appropriate communication and reporting. The Contractors shall cooperate with the anti-trafficking in persons division (ATIPD) maintained dedicated anti-trafficking taskforce (ATTF) police throughout the country.

Community Expectations

177. Impact: While the proposed projects are not designed for rural electrification, stakeholder consultations revealed rural electrification was a major expectation. In general, other benefits the

[46] Myanmar does not fully meet the minimum standards for the elimination of trafficking in persons (TTIP); however, it is making significant efforts to do so. Myanmar was upgraded to Tier 2 Watch List. These achievements included continued progress to eliminate the recruitment and use of child soldiers, an increased number of personnel dedicated to anti-trafficking law enforcement units, and the first trafficking prosecutions of government officials since the enactment of the 2005 Anti-Trafficking in Persons Law. https://www.state.gov/j/tip/rls/tiprpt/countries/2017/271156.htm

community would expect are local employment, local infrastructure development as road and health facility improvement and opportunities for supplementary income generation activities. Although not within the scope of the proposed projects, failure to address these expectations may create risks to the project especially considering the consent of affected communities on land taken for substations and tower pads and land use restrictions in community forests and private land beneath the transmission lines.

5.4.11 Occupational Health and Safety

178. Impact: Construction related accidents are common in Myanmar, primarily because of unsafe construction practices. In addition, occupational health and safety hazards specific to electric power transmission and distribution projects primarily include[47]:

- Live power lines
- Working at height
- Electric and magnetic fields
- Exposure to chemicals

179. The erection of towers and stringing of lines in steep slopes are difficult and strenuous work and smallest error in judgement/negligence of safety guidelines may cause accident and grievous harm. Work related injury and vehicle accidents are the likely impacts.

180. Mitigation: Strict observance of Occupational Health and Safety (OHS) guidelines elaborated in the EMP with attendant continuous supervision and monitoring of adherence to OHS guidelines would minimize accidents and injury.

Health and Sanitation

181. Impact: Most of the projects are located in areas where health and sanitation facilities are relatively poor. Health care facilities are not readily available. The likely increase in population of the area during construction may add further stress on local health facilities. Further, the lack of proper health and sanitary facilities in temporary construction camps could affect the health of the workers. The most vulnerable will be women and children in the localities.

182. Mitigation: The temporary camp provided for the project workers should have health and sanitary facilities. Drinking water sources shall be tested prior to mobilization. The contractor shall maintain at least first aid kits and vaccines against infectious and communicable diseases, which will decrease pressure on local health and sanitation facilities. Health check-up of workers will be a requirement.

5.4.12 Visual Aesthetic Value

183. Impact: Transmission lines and towers along the valleys and on the forested areas would reduce the aesthetic appreciation of the area where scenic beauty is an endowment of nature. This potential impact applies to all the Transmission Lines.

184. Mitigation: Wherever possible, the design would endeavor to run the lines below the ridges of the hills to avoid the lines protruding out of the landscape and enable merging with it.

5.4.13 Work Camp/Temporary Yard Operation and Location.

185. Impacts: The presence and daily operations at work camps may adversely affect the environment and communities. Most of the impacts have been assessed above.

186. Mitigation: Recommended mitigation measures include:

[47] Ibid.

- Identify the location of work camps in consultation with the local authorities, DPTSC, and NGOs/CBOs; where possible.
- Avoiding locating camps near settlements and/or water supply intakes.
- Avoiding the cutting of trees and minimizing the removal of vegetation for the camps.
- Providing water and sanitary facilities for employees.
- Managing solid waste and sewage according to national and local regulations. As a rule, solid waste must not be dumped, buried, or burned at or near the project site, but must be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits.
- Ensuring the Contractor organizes and maintains a waste handling, separation/storage, collection, and transportation system.
- Ensuring that all liquid and solid hazardous and non-hazardous waste are separated, collected, and disposed of according to national requirements and regulations.
- If private land is used for work camps or for other temporary purposes, Contractor to pay rent to the owner and restore the land to previous state.
- At conclusion of the project, removing all debris and waste, as well as all temporary structures, including office buildings, shelters, and toilets.
- Planting exposed areas with suitable vegetation.
- Ensuring the PMU/PIC inspects and reports that the camp has been vacated and restored to pre-project conditions.

5.5 Environmental Impacts Related to Operation

187. Adverse impacts related to Operation will include potential health and safety issues, continuing habitat fragmentation in certain areas due to vegetation management, and bird collisions. Impacts associated with operation and maintenance activities including community conflicts, technical inspections, and illegal access may also occur.

Occupation and Community Health and Safety

188. Impact: Health and safety issues both for workers and nearby communities discussed above under construction impacts could continue during operation.

189. Mitigation: Strict observance by MoEE of Occupational Health and Safety (OHS) guidelines elaborated in the EMP with attendant continuous supervision and monitoring of adherence to OHS guidelines would minimize accidents and injury.

190. During the project operation, MoEE will be responsible for:

- Providing occupational health and safety training to all workers at substations and on line maintenance.
- Providing adequate and sufficient personal protective equipment (PPE) to all workers.
- Carrying out training and awareness-raising for community on dangers of the transmission lines and substations.
- Maintaining adequate signage, fencing, and security to keep people and animals away from dangerous structures.
- Developing updating, and implementing an Emergency Response Procedures

Habitat fragmentation due to Right of Way Maintenance.

191. Impact: Maintaining the clearance zone under the conductors may exacerbate habitat fragmentation due to increased access to forest areas and wetlands by increased numbers of people. Land and water contamination can result from use of herbicides to keep the right-of-way clear.

192. Mitigation: Clearance maintenance should be done in cooperation with local residents and supervised by proper agencies, such as the Forest Department of MONREC. Herbicides should not be used.

193. Mitigation: Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas.

Bird collisions

194. Impact: Continued risk of bird collisions with towers and conductors.

195. Mitigation: Maintain measures to prevent or reduce bird collisions (e.g. line marking devices) in higher risk areas, ensure design complies with good practice collision risk avoidance.

Illegal Access

196. Impact**.** Increased human access as a result of access roads may lead to habitat degradation, hunting of bird and mammals, and collection of wild plants.

197. Mitigation. Work with Forest Department and local authorities to control increased access to sensitive forests / wetlands. Close any remaining temporary access roads except as needed for maintenance

Community Conflicts

198. Impact: As mentioned above under Construction Impacts, competition for resources and conflicts with affected communities may continue after construction is complete.

199. Mitigation: The mitigation measures introduced above should continue to be applied during operation. This implies that MoEE should adhere to the Conflict Resolution Mechanism presented in this EIA, and assign an officer to deal specifically with conflicts or grievances that may arise.

5.6 SOCIO-ECONOMIC IMPACTS

5.6.1 Benefits

200. The construction of substations and transmission lines will certainly have positive impacts in offering employment and service provision opportunities to qualified local people, which should also be directed to women and disadvantaged communities.

201. Local contracting capabilities can also be strengthened if some services can utilize their skills. Skills training as part of the benefit-sharing program and that subsequent employment of trained participants is strongly suggested as it will generate income among local population.

202. The education data on township level, however, shows that education attainment is very low. In Mon State between 40% and 60% of population in the townships where the transmission line projects are located have only up to primary school education. In Tanintharyi and Magway the population with only primary school education is even higher with 60 to 70%. Skills training for the most vulnerable will be challenging given the low levels of literacy in many of the townships of interest. Methods of communication regarding job and service opportunities will have to be advertised and encouraged in a way that allows the less educated local community members to participate.

203. The identified impacts have been assessed post mitigation and management, assuming that the measures set out in this assessment are applied and are effective. Without the application and monitoring of these measures a number of significant social impacts may occur as a result of the Project (through construction and operation) therefore consideration as to how the recommended measures will be applied is critical.

5.6.2 Community Health

204. The socio-economic assessment identified that the communities surrounding the Project-affected area are facing a number of health challenges including limited availability of healthcare facilities and services (lack of medical personnel), and high prevalence/ rates of some illnesses. There is potential for these challenges to be exacerbated by the TL construction activities.

205. Even though temporary only, project activities during construction such as land clearing, mobilization of heavy vehicles and equipment can generate dust and noise which will impact on the air quality and could result in increased number of respiratory illness among the communities. This will cause inconvenience, not only to the affected community but to the surrounding community as well. Other potential health problems due to the construction is the creation of disease vector breeding grounds i.e. mosquito.

206. In addition, the increased temporary population size resulting from the presence of non-local workers could lead to overcrowding. This will increase pressure on the existing limited healthcare facilities and services, competition on existing water resources, and increase in transmission of communicable diseases through the interaction between the local population and those moving into the area.

207. The overcrowding can also introduce new types or strains of diseases that may spread in local communities, including the potential of increased numbers of HIV/AIDS and other STDs. This potential impact is likely to occur in areas close to worker camps. Special attention needs to be given in areas with high poverty rates such as rural Mon and Tanintharyi where sex trade could be considered as an economic activity by the most vulnerable to mitigate livelihood stresses (e.g. single mothers, households experience extreme poverty).

208. **Mitigation.** Mitigation Measures, Management, and Monitoring:

- Public consultation regarding the potential negative impacts of the TL project need to be undertaken prior to construction, as well as dissemination of information and knowledge regarding the mitigation actions.
- Community services program in the form of health care assistance for the significant affected people and contributions to improve public health services for community within the TL project impact area should be delivered in collaboration with related government development programs in the region.
- A public health action plan as part of an TL project awareness campaign should be developed in collaboration with local health workers and NGO programs

5.6.3 Community Safety during Construction

209. Impacts associated with increased road traffic due to project construction activities could result in minor to serious injuries or even fatalities, particularly where the transmission line project passes through or near populated areas. In areas such as plantations or forest used by communities, compromised community safety could also result in damaged community relations with the project.

210. Increased numbers of in-migrants during the TL construction might result in local community neighborhood safety issues. This can partially be mitigated by establishing worker camps outside existing communities during construction for each construction section, as well as equipment depots and material storage areas.

211. **Impacts.** Mitigation Measures, Management, and Monitoring:

1. The contractors will introduce high health and safety standards following a Health and Safety Manual.
2. Health and safety training should be provided to all contractors and their employees.

3. A Construction Traffic Management Plan to manage construction-related traffic should be developed, including: (a) onsite construction traffic rules, speed limits and signaling, (b) designated access points onto/off the construction site, (c) offsite construction traffic routes and working hours, (d) accident management/emergency preparedness and response (e.g. cooperation with fire-department/ ambulances/ health centers and hospitals), and (f) cooperation with local government authorities.
4. The government will make commercially reasonably efforts to ensure that contractors comply with the plan through inclusion of conditions in contracts, monitoring and evaluation.

212. The Mitigation Measures, Management, and Monitoring should be discussed with the local government of the affected areas and communicated locally to affected people, especially the community grievance procedures.

5.6.4 Impact to Workplace Incident and Injury

213. Through transmission line construction there is potential for workplace injuries among contractor employees, particularly as construction involves mobilization of heavy equipment, land clearing and soil preparation, materials and structure materials and construction of temporary access roads. Based on Myanmar law and international best practice the Project workforce is entitled to appropriate working conditions amongst other labor rights. In order to provide adequate working conditions, the introduction of a number of control measures, including the definition of appropriate safety standards, will be necessary. Impacts to workplace incident and injury may result if the Project does not take steps to ensure the implementation of these requirements.

214. **Impacts.** Mitigation Measures, Management, and Monitoring:

- All contractors must subscribe to high health and safety standards.
- The government will supervise and monitor the construction process, according to health and safety standards.
- In addition, health and safety training will be provided to all employees as part of the Human Resources Induction Program. A worker grievance management mechanism should be socialized during the training as well.

5.7 Climate Environmental Impacts Related to Decommissioning

215. The design life of transmission lines is generally from 40 to 60 years. At or before that time the owners will need to take measures to upgrade (improve certain components to higher loads), refurbish (carry out extensive renovation to restore the design life of the system), or decommission the system (for example by replacing it with a parallel system)[48]. In the event of refurbishment or decommissioning it is expected that contractors will carry out the work and that this would result in certain construction-related impacts. Because the decommissioning would occur relatively far in the future it is difficult to forecast many environmental, social, or economic impacts since the baseline at that time will be unknown. This EIA recommends that at the time of decommissioning a detailed Decommissioning Plan, together with an updated EIA and EMP be developed and implemented.

5.8 Change

216. There are two perspectives to considering climate change for the transmission line component: 1) the effect of the transmission lines have on the production of greenhouse gases (GHG) that would contribute to climate warming, and 2) the effect of climate change on the transmission lines.

[48] Brennan, Gary "Refurbishment of Existing Overhead Transmission Lines" Integral Energy, Australia, CIGRE, Session B2-203, 2004

5.8.1 Greenhouse Gas (GHG) Emissions

217. Materials used in the construction of transmission lines (aluminum, steel and other metals, concrete, and other building materials) have embodied emissions as a result of the energy used to produce them.[49] In addition to the embodied emissions, transmission line construction can also contribute emissions from construction equipment, energy in land clearing, sulfur hexafluoride (SF_6, used in insulation and current interruption applications), and nitrous oxide (N_2O) corona effects created by very high-voltage transmission lines. SF_6, and N_2O are GHGs having 22,800 and 298 GWP (global warming potential)[50]. Given the size of the ADB program it is likely that calculation of embodied and direct GHG emissions will need to be computed in the final EIA to determine the full climate change impacts of the program.

218. In addition to the direct and embodied GHG emissions from construction of the TL lines, the projects may have impacts associated with the clearance of the ROW under the TL lines in forested areas. It has been estimated that the average annual CO_2e sequestration in forested areas amounts to about 13t CO_2e/ha.[51] The same source estimated average biomass residing in different types of forests as ranging from 145 to 342 t/ha. If a significant amount of this resource is burned it would release significant amounts of carbon into the atmosphere. Based on these parameters and the length and characteristics of the lines, the total annual sequestration from the project areas is estimated at over 17,000t as shown in Table 12.

Table 12 Estimated Annual Sequestration from Forest Cover to Be Removed

Annual CO2e sequestration						
Parameter	Ahlone-Dala-Thida Line	Ahlone-Thida (Strand) Line	Maw-lamyine–Ye–Dawei line	Access roads	New Substations	Totals
ROW Width (m)	46	46	46	7	-	
Total Design Length (km)	17	289	289	20	-	**615**
ROW Area (ha)	76	38	1,329	14	38	**1,457**
ROW area that is forested (ha) (estimate)	-	-	924	5	8	**929**
number of trees felled (per RP estimate)	-	-	277,110	1,575	13	**278,685**
Annual average CO2e sequestration (t)	-	-	12,008	68	99	**12,076**
Notes:	Areas based on Google Earth Photos and Ground Reconnaissance Survey: 2017					
	Average annual CO2e sequestration in forested areas is about 13t CO2e/ha.					

219. As of 2017, Myanmar's GHG emissions make up about 0.42% of global emissions[52]. In its Intended Nationally Determined Contribution (INDC), submitted to the UNFCCC in 2015, "Myanmar

[49] Madrigal, Marcelino and Randall Spalding-Fecher 2010 "Impacts of Transmission and Distribution Projects on Greenhouse Gas Emissions: Review of Methodologies and a Proposed Approach in the Context of World Bank Lending Operations" Energy and Mining Sector Board Discussion Paper No. 21, Word Bank

[50] IPCC 2007 "Fourth Assessment Report: Climate Change 2007" Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.

[51] Subedi, B.P., K.Gauli, N.R. Joshi, A. Pandey, S. Charmakar, A., A. Poudet, M.R.S. Murthy, H. Glani, and S.C. Khanal. 2015 "Forest Carbon Assessment in Chitwan-Annapurna Landscape." Study Report, WWF Nepal Hariyo Ban Program, Balutwatar, Kathmandu, Nepal.

[52] Myanmar contributes 201.5 $MtCO_2e$ per year compared to world emissions of 48,257 $MtCO_2e$ per year; USAID (March 2017)

plans to mitigate emissions in the forestry and energy sectors. It will implement mitigation actions contingent upon international capacity-building, technology development and transfer, financial resources, and the active participation of the national and international private sector. In the forestry sector, the INDC notes the 30-Year National Forestry Master Plan for RFs and PPFs and its protected area systems. In the energy sector, the INDC notes plans to (1) increase hydroelectric generation to 9.4 GW by 2030, (2) increase access to clean sources of electricity among rural communities and households, and use up to 30% renewables in the rural electricity mix, (3) improve energy efficiency in industrial processes and achieve a 20% electricity saving potential by 2030, and (4) distribute 260,000 efficient cook-stoves by 2031 to reduce fuel wood used for cooking."[53]

220. Up to 25% of global carbon emissions is due to deforestation.[54] Although deforestation occurs rampantly in the forests of Myanmar as in other parts of South and Southeast Asia, community forest programs have successfully managed reforestation in those areas they control. A recent report[55] about community forests in Nepal stated: "the community forests, mainly in the hills, are well managed with positive economic, social and environmental outcomes." The routing process that developed the proposed alignments included an effort to avoid going through forests since the right-of-way areas under the lines will require removal of the existing trees, thereby potentially reducing the carbon-capture capability of the community forests and also adding to the construction and operation cost of the lines.

5.8.2 Effects of Climate Change on the Transmission Line Program

221. Available studies of the effects of climate change in Myanmar on electric facilities are limited. A 2011 study of the Khimti 1 Hydropower Scheme[56] in Nepal identified several potential risks for the hydropower plant, some of which are either directly or indirectly applicable to the ADB transmission line program, such as:

- Risk of catastrophic flooding destroying or damaging the towers, particularly where they cross major rivers.
- Risk of completely interrupted energy from hydropower or thermal plants that were damaged or destroyed by events such as cyclones, floods, landslides, etc. This would leave the transmission lines without any product to transmit thereby reducing or eliminating their economic value.

- Risk of increased erosion and landslide potential due to increasing storm intensity affecting access roads, operational structures such as substations, bridges and towers.

5.8.3 Climate Risk Assessment and Management Report

222. This section provides a summary of the Climate Risk Assessment performed for the PNDP. The full Climate Risk Vulnerbility Assessment (CRVA) report is provided as a Supplementary Appendix – Appendix 7.

https://www.climatelinks.org/sites/default/files/asset/document/2017_USAID_GHG%20Emissions%20Factsheet_Burma.pdf

[53] Ibid.

[54] IPCC 2001 "Climate change 2001: the scientific basis. Contribution of Working Group I to the IPCC Third Assessment Report." Cambridge University Press, Cambridge.

[55] Paudel, N.S., Khatri, D.B., Khanal, D.R. and Karki, R. 2013. The context of REDD+ in Nepal: Drivers, agents and institutions. Occasional Paper 81. CIFOR, Bogor, Indonesia.

[56] Stenek, Connell, Firth, Colley 2011 "Climate Risk Case Study - Khimti 1 Hydropower Scheme, Himal Power Limited – NEPAL" International Finance Corporation

Climate Risk Assessment and Management Report	
I. Basic Project Information	
Project Title: TA-8342 MYA: Power Transmission and Distribution Improvement Project	
Project Budget:	
Location: Myanmar – distribution component in two regions (Ayeyarwardy and Bago) and three states (Mon, Kayin and Rakhine); transmission component in two locations: (i) Ahlone and Thida; (ii) Melamine–Ye–Dawei	
Sector: Energy	
Theme: Power transmission and distribution	
Brief Description: The Government of the Republic of the Union of Myanmar has requested the Asian Development Bank (ADB) to provide financial assistance for the Power Network Development Project (the Project). ADB approved a project preparatory technical assistance (PPTA), TA 9179-MYA, which will conduct due diligence and prepare relevant project documents in accordance with ADB's requirements for Project approval. Another important output of the Project is the implementation of a computerized assets management system to manage transmission assets under DPTSC and a computerized customer billing system for areas under the ESE. Based on Myanmar's latest power development plan(s), in particular the transmission and distribution development plans, the PPTA will: a. confirm the rationale and priority of the proposed transmission and distribution components of the Project; b. prepare technical design and cost estimates for the proposed transmission and distribution components of the Project, and propose appropriate contract packaging and procurement plans; c. conduct economic and financial due diligence; d. undertake social and poverty reduction impact assessments and capacity and governance assessments; e. carry out social and environment safeguard due diligence in accordance with ADB's Safeguard Policy Statement; f. prepare engineering design and draft bidding documents and assist in the bidding process of the Project components as required; g. prepare relevant documents for use in drafting the Report and Recommendation to the President.	
II. Summary of Climate Risk Screening and Assessment	
A. Sensitivity of project component(s) to climate/weather conditions and sea level	
Project components The Project consists of two components: the **distribution component** and the **transmission component**.	*Sensitivity to climate/weather conditions and sea level* Climate risk screening has identified some existing unstable distribution poles in **flood-prone** (i.e. low-lying) areas and/or where the soil is soft and high **rainfall intensity/frequency** causes erosion and instability. **Wild fire** in forest areas

The **distribution component**, under the responsibility of Electricity Supply Enterprise (ESE), includes design, supply, installation and commissioning of 66/33 kilovolt (kV), 66/11 kV and 33/11 kV substations and related distribution lines in two regions (Ayeyarwardy and Bago) and three states (Mon, Kayin and Rakhine). The **transmission component**, under the responsibility of the Myanmar Department of Power Transmission and System Control (DPTSC), includes design, supply, installation and commissioning of two 230 kV transmission lines and related substations, namely: a. 8.2 kilometer (km) 230 kV transmission line between Ahlone and Thida substations with a 230/66/11 kV (150 Mega Volt Ampere (MVA)) substation at Ahlone and a 230/66/11 kV (3 x 150 MVA) gas-insulated switchgear (GIS) substation at Thida; b. 320 km 230 kV Mawlamyaine–Ye–Dawei transmission line with a 230/66/11 kV (2 x 50 MVA) substation at Ye and a 230/66/11 kV (2 x 50 MVA) substation at Dawei.	that intersect with both transmission and distribution components of the project, and the impact of **hot temperatures** and **cyclones** on project infrastructure, have also been identified as current and future medium to high risks to the project. **Extreme precipitation and flooding** could affect transmission towers, distribution cables (if underground), substations (infrastructure, switching gear, etc.), and transformers due to inundation of above-ground components, and erosion that could expose underground components and disturb the structural integrity of facilities. **Wild fire** is common in some locations associated with distribution and/or transmission components of the project. Wild fire could damage distribution poles, overhead lines, and other infrastructure. Conversely, the transmission and distribution components of the project could increase the occurrences of wild fire (e.g. if sparks or other failure occurs in dry areas/seasons and acts as a trigger for wild fire in addition to natural triggers (e.g. lightning) and human triggers (e.g. discarded cigarettes, arson etc.). **Temperature increase** could affect transmission and distribution cables, substations (infrastructure, switching gear, etc.), and transformers by reducing the electricity carrying capacity of lines and increasing losses within substations and transformers. De-rating of transformers could occur at –1% load per 1°C rise in temperature. Decreased conductivity of overhead lines and underground cables could occur as resistance increases at about 0.4% per 1°C degree rise in temperature which leads to a decrease of 0.5-1% line load capacity. Sag of overhead lines of up to 4.5 cm could also occur per 1°C rise in temperature at conductor surface for 35°C ambient temperature and span of 400 meters. **Extreme climate events** (flood, typhoons/cyclones, drought, wild fire) could damage facilities as well as control systems through loss, or reduced quality, of information/communication technology (ICT) services.

B. Climate Risk Screening

Risk topic	*Description of the risk*
1. Increase in heavy rain 2. Increase in rain frequency 3. Flooding	• **Heavy rain** is categorized as an existing high risk for all project components and locations. Under climate change the intensity of rainfall in Myanmar is likely to increase and this will exacerbate existing risks associated with heavy rain.

4. Cyclones 5. Temperature increase 6. Wild fire	• **Frequent rain**, and associated saturated soils or inundated low-lying areas) is categorized as an existing high risk for all project components and locations. Under climate change the frequency of rainfall in Myanmar is likely to increase and this will exacerbate existing risks associated with frequent rain. • **Flooding** is categorized as very high risk for Mawlamyaine–Ye–Dawei and Ahlone–Thida transmission components and high for all distribution components except Kayin and Rakhine states. As with rainfall-related risks the risks associated with flooding are also likely to increase under the future climate change scenarios explored in the Climate Risk and Vulnerability Assessment (CRVA). • **Cyclones** are categorized as very high risk for all project components under both existing and future conditions. • **Temperature increases** are almost certain for Myanmar in the future. As such, risks to the project associated with temperature are categorized as moderate to high (moderate because the impacts are already being managed to some degree but high because the existing risks are almost certain to increase and challenges/questions exist around whether or not there is adaptive capacity within Myanmar, and the specific project locations, to satisfactorily deal with the increased risks associated with increased temperatures. • Existing literature reports that parts of Myanmar have high existing vulnerability to **wild fire**. At the state level, the highest vulnerability to wild fire is observed for Shan, Kayah, Kayin, Mon, central Bago, southern Rakhine, southern Kachin, southwestern Sagaing, the borders of Chin, Magway and Sagaing, northern and central Tanintharyi. Many of these regions associated with high risk/vulnerability of wild fire overlap with distribution and/or transmission components of this project. As such the existing and future risk and vulnerability associated with wild fire is categorized as high.
Climate Risk Classification: **HIGH**	
Climate risk assessment	
A climate adaptation strategy that includes a combination of engineering (i.e. structural) and ecosystem-based (i.e. non-structural) adaptation activities is needed if the Project is to be successful in the long term. The adaptation measures need to account for existing and future climate-related hazards, risks and vulnerabilities. The CRVA assesses the current and future climate-related hazards, risks and vulnerabilities for the project. The CRVA also identifies and assesses possible adaptation measures that could be implemented to mitigate the identified climate-related risks and vulnerabilities. The CRVA follows a logical and clear narrative from hazards to risks to vulnerabilities to possible adaptation measures in order to demonstrate the climate risk management for the project. Even though the design for the project is already advanced, this CRVA can still be used to test the strengths and weaknesses of the proposed design and, where required, adjust the design or implement necessary adaptation measures accordingly. The CRVA methodology consists of the following six tasks: • Task 1: Develop a methodological framework and overall work plan for the CRVA. • Task 2: Prepare relevant data, maps and information required for the CRVA. • Task 3: Conduct a baseline assessment of existing climate-related hazards, risks and vulnerabilities for the Project. • Task 4: Conduct an assessment of future climate-related hazards, risks and vulnerabilities for the Project. • Task 5: Identify potential structural and non-structural adaptation options. • Task 6: Report the CRVA findings and recommendations.	

III. Climate Risk Management Response within the Project
The level of climate risk assessed for this project is **high**, in particular from heavy/frequent rain, flooding, cyclones, temperature increase and wild fire. The following climate change adaptation options are recommended for consideration during the detailed design phase of the project: <u>Increased precipitation (intensity and frequency) and flooding</u> • Build a resilient high-capacity transmission system. • Design improved flood protection measures for equipment mounted at ground level in substations, including drainage design that accounts for rainfall/flood projections in the area. • Forbid the construction of power lines near dikes and ban "permanent" trees next to existing dikes. • Protect masts, antennae, switch boxes, aerials, overhead wires, and cables from precipitation (water ingress); wind; unstable ground conditions (flooding, subsidence); and changes in humidity. <u>Wild fire</u> • Reinforce existing transmission and distribution structures and build underground distribution systems. • Require higher design standards for distribution poles. • Where possible the project components should avoid fire-prone areas. Where this is not possible wild fire preparation/prevention activities should be conducted regularly (e.g. fuel reduction programs in seasons where risk of wild fire is low; cutting gaps in vegetation to act as fire breaks (especially near transmission or distribution components of the project). <u>Extreme events (flood, typhoons/cyclones, drought, wild fire)</u> • Increase the system's ability to return to normal operations rapidly if outages do occur. • Change routes of overhead lines along roads away from trees, rigorously prune trees, use covered and/or insulated conductors, and use more underground cables, especially in fire/flood prone areas. • Allow increased rerouting during times of disruption. • Include lightning protection (earth wires, spark gaps) in the distribution network. • Design redundancy into the information and communication technology (ICT) systems. • Develop and use "smart transformers" and "smart grids". <u>Temperature Increase</u> • Specify more effective cooling for substations and transformers. • Specify certified ICT components that are resilient to higher temperatures and humidity.

5.9 Risk Assessment and Emergency Response Plans

223. **Natural Hazards**. Myanmar is subject to severe natural hazards including earthquakes, floods, typhoons, and wildfires. The Climate Risk Assessment concluded that the will be more extreme floods, typhoons, and wildfires in the future.

224. **Industrial Hazards.** Industrial hazards associated with transmission lines and substations include:

i. Landslide and slope failures at transmission towers;
ii. Fire;
iii. Explosions;
iv. Chemical spills, leakages, and other unintended release of chemicals;

v. Electrical failures, equipment malfunctioning; and
vi. Electrocution accidents.

225. **Emergency Response Plans.** To address these hazards, emergency response plans need to be developed. The Transmission Line Construction Contractors will need to have emergency response plans for:

i. Fire and explosions;
ii. Hazardous Chemical Spills
iii. Landslides and Slope failures during construction of towers;
iv. Extreme events (i.e. wild fire, typhoons, floods); and
v. Electrocution accidents.

226. At substations, emergency response plans are needed to address (i) fires and explosions, (ii) oil leaks from transformers, (iii) electrical failures and equipment malfunctioning; and (iv) electrocution accidents.

227. Emergency response plans are to include:

i. emergency resources (e.g., fire-fighting equipment; spill clean-up equipment; first aid supplies; medical clinics; emergency vehicles)
ii. communication systems;
iii. administration of the plan;
iv. emergency response procedures (e.g., emergency notification, evacuation, fire suppression, spill clean-up; medical support);
v. communication of the procedures;
vi. emergency preparedness training; and
vii. debriefing and post-traumatic stress procedure.

5.10 Global, Transboundary and Cumulative Impacts

228. There are no anticipated or identified global or transboundary impacts for the project. Cumulative impacts from further development of the electric transmission grid of Myanmar will in general be economically positive in terms of strengthening the system.

5.11 Environmental/Social Audits of Existing Substations

5.11.1 Summary

229. The Transmission Line Component of the Project includes modifications to existing substations that will be connected to the Project's transmission lines. These substations will undergo modifications to accept the new lines coming in from the Project. However, none of the substations will increase in size so no additional land acquisition is expected.

230. The ADB Safeguard Policy requires that an environmental audit be carried out of associated facilities that are not part of the Project but are necessary for the Project to function. A "typical environmental audit report includes the following major elements: (i) executive summary; (ii) facilities description, including both past and current activities; (iii) summary of national, local, and any other applicable environmental laws, regulations, and standards; (iv) audit and site investigation procedure; (v) findings and areas of concern; and (vi) corrective action plan that provides the appropriate corrective actions for each area of concern, including costs and schedule".[57] This section provides an audit of the existing substations (see Table 13).

231. The existing substations that will be affected by this Project are:

[57] ADB Safeguard Policy Statement (2009), Appendix 1, page 32

- Mawlamyine substation, Mon State (a terminus of the Mawlamyine-Ye-Dawei Line)
- Ahlone substation, Yangon (a terminus of the Ahlone-Thida Line)
- Thida substation, Yangon (a terminus of the Ahlone-Thida Line)[58]

232. The main areas of concern were inadequate health and safety measures including the provision and use of personal protective equipment, oil and other leaks around some older transformers, and lack of an adequate solid waste management plan to deal with older equipment.

5.11.2 Audit and Site Investigation Procedure

233. The audits of the existing substations were conducted through a desk study of the existing information about the facilities and field site visits which included interviews with the directors of the facilities. The questions/issues below were discussed and documented.

Issues Investigated During the Site Visits

1. When the facility commissioned and what was the age of the transformers? Question asked so as to judge the general condition of the facility, evidence of maintenance, and likelihood of the presence of older transformers containing PCBs or other hazardous chemicals.
2. Were any external donors involved in the financing of the facility? This was to determine if there were environmental assessment requirements from the donors. In general, the facilities were constructed prior to the Myanmar Environmental Impact Assessment regulations.
3. Provide a layout plan of the facility, with dimensions. This request was made to determine the area of the substations and check for environmental issues such as drainage.
4. Was resettlement or compensation required at the time of the initial development of the facility? Again, substations were built on Government-owned land.
5. How many staff work at the facility? To estimate amount of PPE required versus provided.
6. Is there a written Health & Safety plan? Is training on safety done regularly?
7. Do workers have adequate Personal Protective Equipment (PPE) such as helmets, gloves, boots, and eye and ear protection?
8. Have there been any accidents in the facility that involved workers or others from the community?
9. Describe waste management procedures.
10. Are there wild animals which enter or live in the facility? Birds?
11. Is there a grievance mechanism for complaints by the local community or workers?
12. Was an IEE or EIA completed at the time of the original facility development?
13. Are there any leaking transformers? What is their age?

234. In addition to the interviews, the team performed a visual inspection of the substations. Of interest were:

- Evidence of leaks from transformers or other equipment
- Adequate fencing and other means of keeping the public and unauthorized persons away from the substation.
- Evidence of emergency planning and equipment
- Evidence of poor waste management.

Table 13 Results of the Audit Interviews at the substations

#	Question	Mawlamyine	Ahlone
1	Year Commissioned	2010	2012
2	External Donors	None	None
3	Layout Plan Available?	Provided	Provided
4	Resettlement or Compensation?	No	No

[58] This indoor GIS substation was not available for inspection at the time of the audits. The ADB due diligence audit report regarding this substation is shown in Appendix 5.

#	Question	Mawlamyine	Ahlone
5	Staff at facility	30 (41 authorized) most living in residential quarters at substation	28 (40 authorized). most living in residential quarters at substation
6	Written Health & Safety Plan?	No. Keep incident report.	Not written. Have had some training on H&S from Ministry
7	Adequate PPE Available?	Only 5 sets	Only 3 sets
8	Accidents?	None reported	None reported
9	Waste Management Procedure	Not written	Not written. Waste includes oils
10	Wild animals or birds enter facility?	No wild animals. Large birds rare. Snakes more common.	Large birds rare. Snakes more common.
11	Grievance mechanism for workers or community?	None	None
12	IEE or EIA completed?	None	None
13	Leaking transformers?	No leaks. Manufactured in 2011	No leaks. Manufactured in 2011

5.11.3 Findings and Areas of Concern

235. The principal findings and areas of concern were:

- There were no written Health & Safety Plans, nor was there periodic practice carried out to prepare for emergencies.
- Personal Protective Equipment was insufficient. Not every worker was assigned PPE. In addition, personnel in the control room and other areas where electric shock might occur were generally barefoot or wore flip-flop sandals.
- There was no written solid waste management system. Older transformers and other equipment were either left at the site or sent to a DPTSC storage site in Yangon.

5.11.4 Corrective Action Plan

236. The following corrective actions are recommended:

1) Each existing substation that will be affected by the project should develop and implement a Health and Safety Plan, containing the following:
   - Site security, including securing of excavations, hazardous materials, etc.
   - Confined space safety procedures
   - Excavation and trenching safety measures
   - Establishment of efficient emergency/ contingency plans, adequate facilities and equipment and trained staff for handling emergencies.
   - First aid facilities, equipment and materials
   - Protective clothing and safety equipment
   - Safety training and awareness-raising program for Substation staff
   - On-site safety publicity/signs
   - HIV/-AIDS Awareness Program
   - H&S management monitoring and reporting

2) Develop and implement a solid waste management plan that specifically addresses the handling of wastes produced at the substation, including the handling and storage of decommissioned equipment such as transformers. The plan should be developed cognizant of the

particular types and volumes of wastes created at the substations during construction, operation, and decommissioning phases. In general, it should follow the principles illustrated in the figure below[59]:

237. These measures should be taken as soon as possible, but before the implementation of the Transmission Line Project. The cost of these plans should be borne by DPTSC ad part of their normal planning and training budget.

[59] https://tudelft.openresearch.net/page/13491/4-2-innovations-to-tackle-inorganic-waste-in-texel

6 ANALYSIS OF ALTERNATIVES

238. The alternatives considered are:

- No action – that, the Project will not be undertaken
- Two alternatives routes were considered for Ahlone – Thida; and
- Two alternative routes were considered for Mawlamyine-Y-Dawei.

239. There are also design alternatives which have been considered during the feasibility level engineering. These primarily deal with technical options such as the use of air or gas insulation in the substations, the types and height of towers, and other technical features.

240. The process followed in identifying alternatives included the following activities:

- Considering the main alternatives to be with respect to siting and routing of transmission lines and facilities
- Identifying environmental and social considerations
- Developing alternative(s) based on environmental and social considerations.
- Deciding which is the preferred alternative.

6.1 No Action Alternative

241. This alternative consists of not building any of the transmission lines or substations under this project. The "no action" alternatives for each of the project components will have the effect of eliminating the benefits (national, regional, and local) that are expected from the projects. This would include the economic and fiscal benefits to the country of strengthening the electrical grid and facilitating industrial development in various parts of the country.

242. Because the transmission lines are part of a master plan for electrification of the country it is expected that these lines, or other very similar ones will be constructed at some point in the future perhaps under other funding. Any negative impacts therefore would only be postponed to a later date, and perhaps exacerbated if the lines are built without the environmental and social protections of the ADB Safeguard Policy. Myanmar is growing and urban areas are expanding, so social and resettlement impacts can be expected to increase in severity in the future. Ecological impacts to forests and other protected areas would also be postponed, not avoided.

6.2 Ahlone-Thida Line

243. **Dala Alternative**. The Preferred Alternative is via Dala (shown in Figure 32 below). This alternative has been assessed in Section 5.

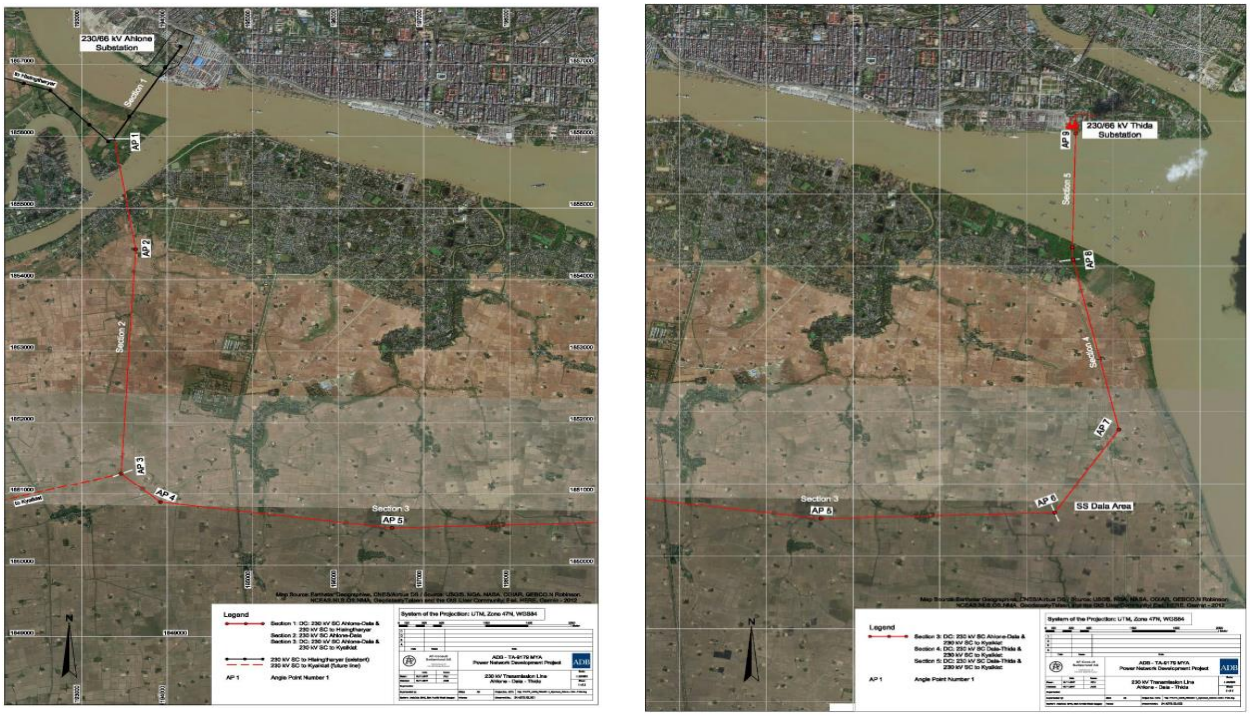


Figure 32 Ahlone-Thida (Dala Option).

244. **Strand Road Alternative**. The is alignment would follow Strand Road in Yangon from the Ahlone to the Thida substations and for the line to have a total length of about 8.2 km, as shown on Figure 33. This alignment was rejected because incur significant engineering and construction costs and adverse social impacts.

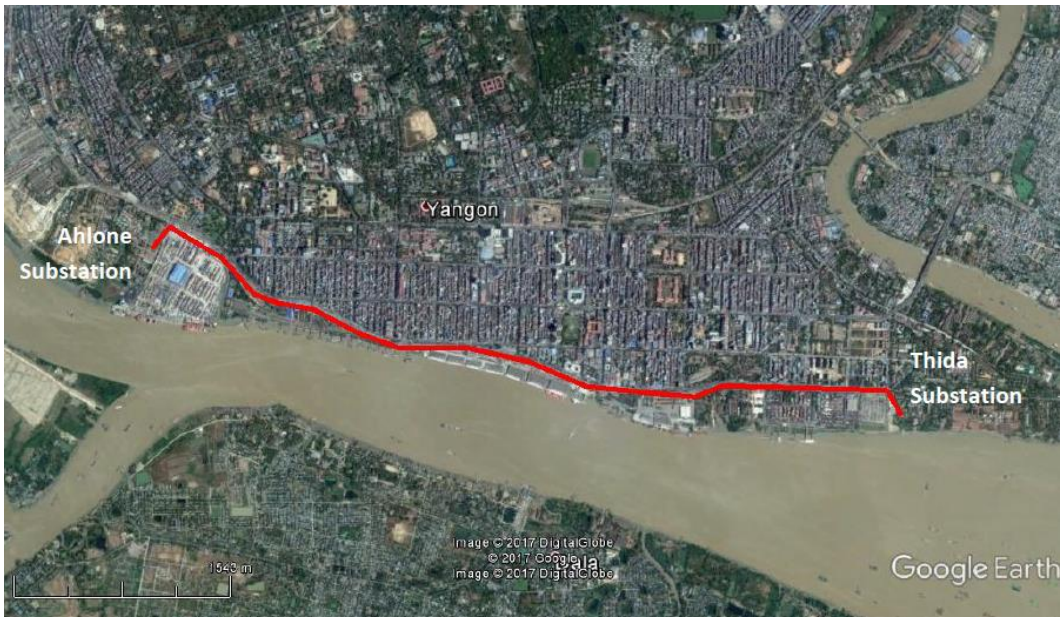


Figure 33 Ahlone-Thida Line (Strand Road Option)

245. **Impacts on community health and safety**. The alignment could pose danger to community from electrocution when the new 230 kV lines are being installed particularly if the prescribed safety measures and clearances from the lines are compromised during the construction period. Because the entire alignment is located in highly dense areas in Yangon, safety clearance from the

alignment should be investigated in the selection of the final tower location to avoid accidents. There may also be difficulty in constructing in congested areas.

246. **Impacts on night market**. A market (see Figure 34) is currently situated along the middle of Strand Road, which has just been recently resettled/displaced from another location. Construction of the new transmission line along the road will interrupt or even halt business for these traders for a significant time. These traders can be considered as vulnerable and will need special attention.

247. **Impacts on traffic**. Transmission towers are located along thoroughfares in Yangon. Traffic congestion will occur during the foundation works and pole installations, thus, requiring proper co-ordination with YCDC for traffic management.

248. **Impact on noise and air quality**. Short-term impacts of noise and dust caused from civil earthworks during construction of both alignments will occur from both brought about by the excavation of tower foundation, installation of towers, and movement of construction trucks and heavy equipment.

249. **Erosion and soil runoff**. Most of the new tower foundations will require excavation for the footings which will generate loose soil leading to potential erosion of adjacent areas including drainages.

250. **Existing roads, billboards, drainage and water supply lines.** The roads along the alignment of the transmission lines are surfaced with concrete or asphalt. The installation of tower foundations on these roads would damage the roads, thus, requiring complete road restoration after tower installation. The towers and transmission lines may impact on existing billboards along the road. Billboards provide a significant income for YCDC and removing of any of the existing billboards may not find approval. Drainage culverts and water supply lines are located along the sides of the roads. The existing sewage network which is in fragile stage (about 100 yrs. old) will require close coordination with YCDC to obtain the information and maps. All these features could be damaged or result in interrupted service due to the installation of the TL.

251. **Impact on land use.** The proposed 230 kV alignments while close to existing 66 kV lines, will affect land use in areas adjacent to the new towers. Construction of buildings more than 2-storeys would be restricted in areas along roadsides where vertical and horizontal safety clearance needs to be maintained. While shoulder areas of these roads are generally for commercial use, future plans of some property owners to expand and build higher structures may become restricted because of the presence of the transmission line**.**

252. **Visual** impact. The installation of the towers and transmission lines will have a visual impact on the landscape and impact on the perception of the community. While this impact is almost unavoidable, public consultation, disclosure of information and other stakeholder engagement activities will help to ease that impact. The potential need to use buried cable rather than pylons for the line would add significantly to the traffic and market disruption indicated in the previous bullets.

253. **Opportunity Cost.** In addition to these potential impacts the Ahlone-Thida alternative along Strand Road would not help in extending the grid south around Dala and would not facilitate a future substation (not part of the present project) at the southeast portion of the Preferred line to serve future development in the area.

Figure 34 Views along the Strand Road Alignment of Ahlone-Thida

Market Along Strand Road 	Market on Strand Road 
Utilities along Strand Road 	Container Way 

6.3 Mawlamyine-Ye-Dawei Line

254. The Preferred Alternative avoids key biodiversity areas (Figures 35, 36, and 37). This alternative has been assessed in Chapter 5.

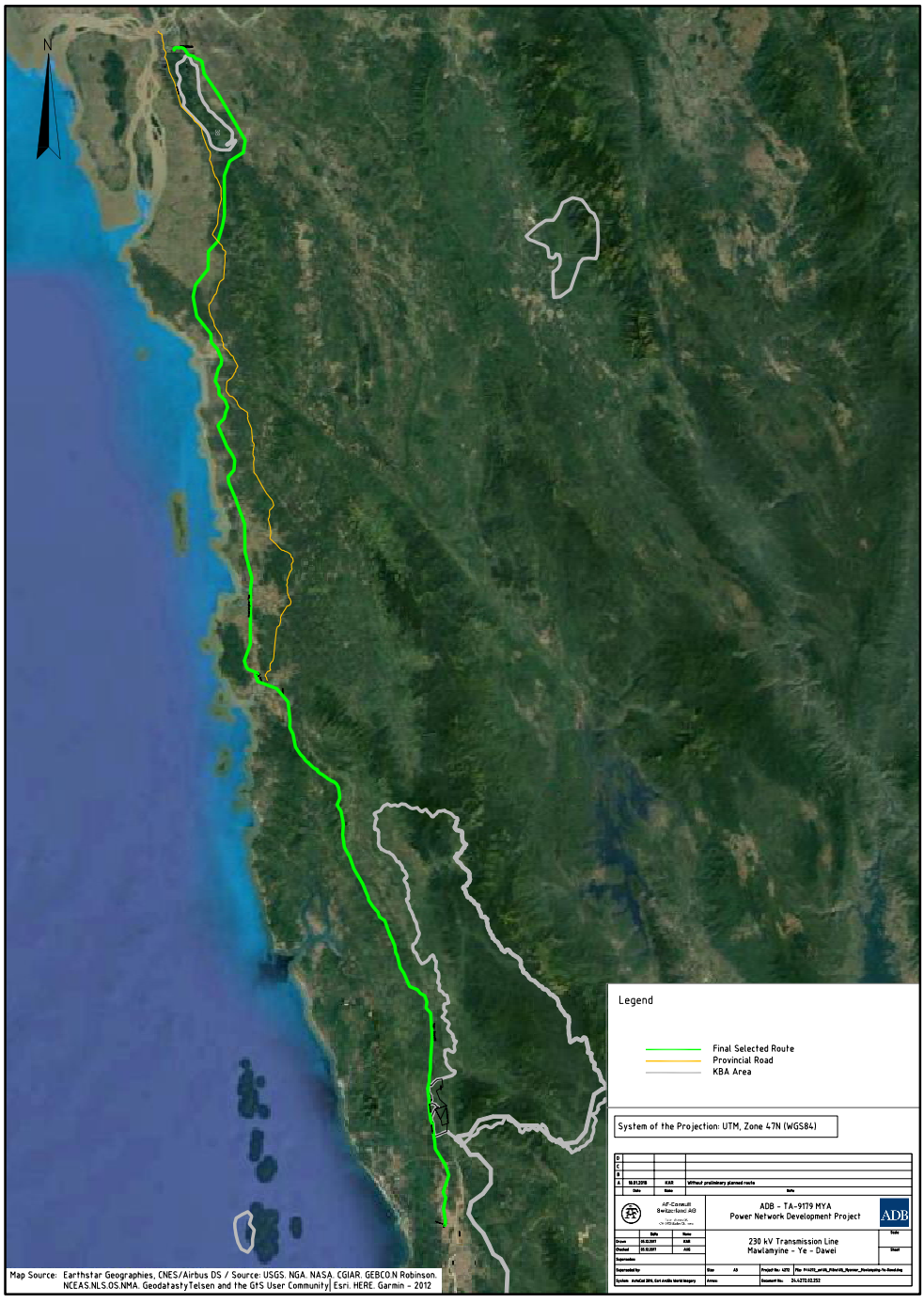


Figure 35 Preferred Alternative – Avoidance of Biodiversity Areas

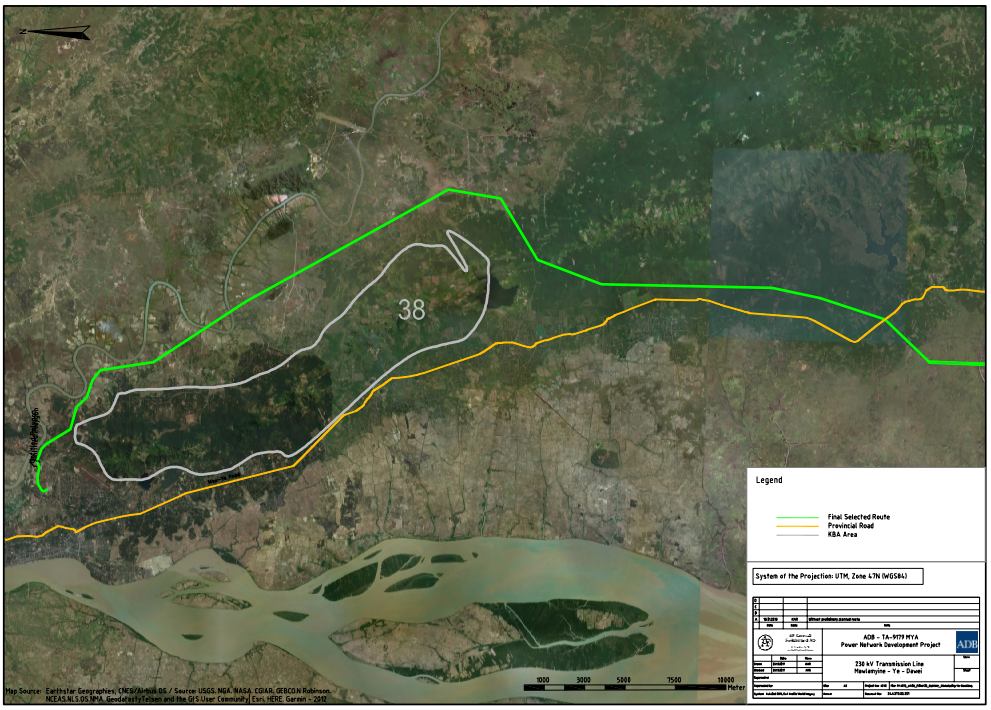


Figure 36 Alignment avoids the Mawlamyine Key Biodiversity Area.

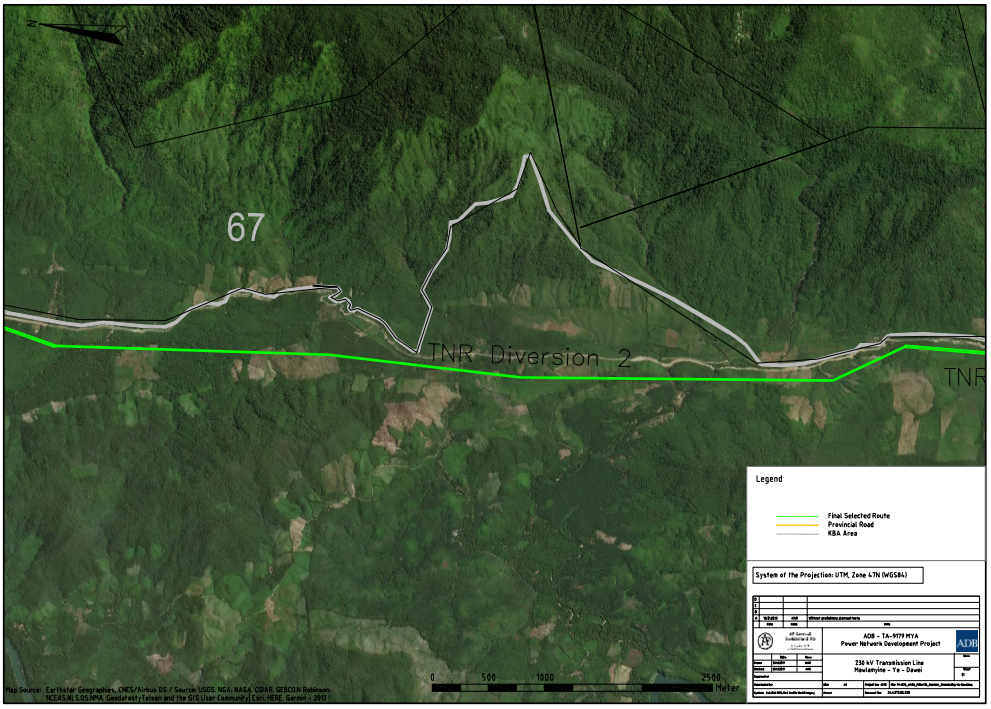


Figure 37. Alignment avoids the Taninthayi Nature Reserve.

255. **Encroachment on Key Biodiversity Areas.** An alternative alignment was rejected as it encroaches on the key biodiversity areas. This alternative alignment of south of Mawlamyine requires crossing the Mawlamyine Key Biodiversity Area from northeast to southwest (Figure 38). The alignment also encroaches on the Taninthayi Nature Reserve (Figure 39).

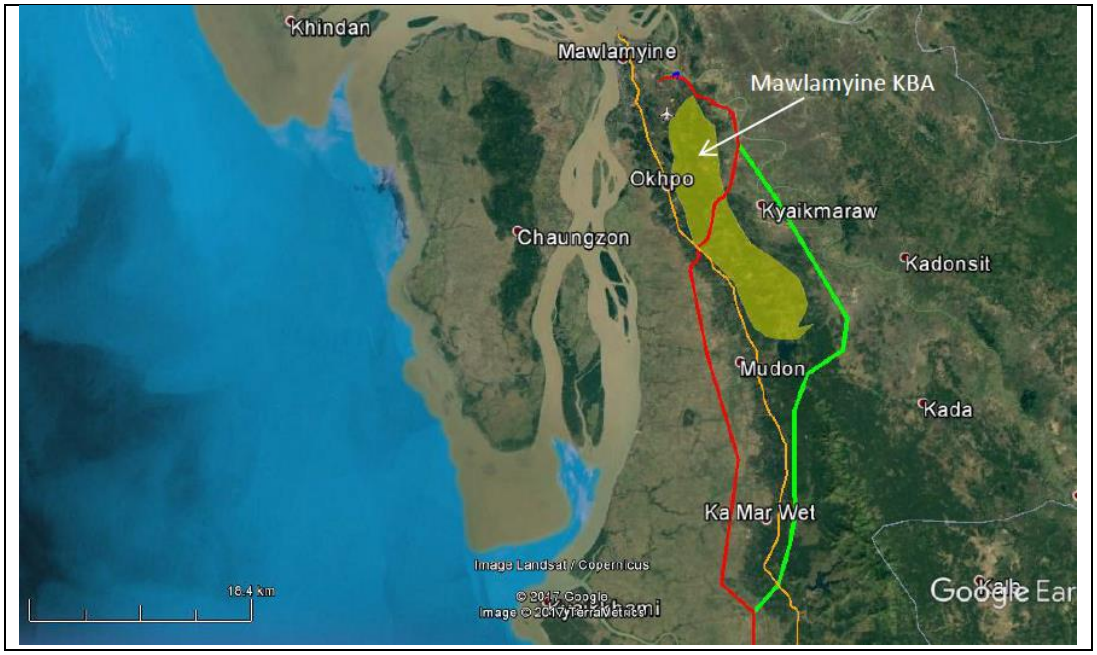


Figure 38 Alternative Alignment (Red Line) to Encroaches on Mawlamyine KBA

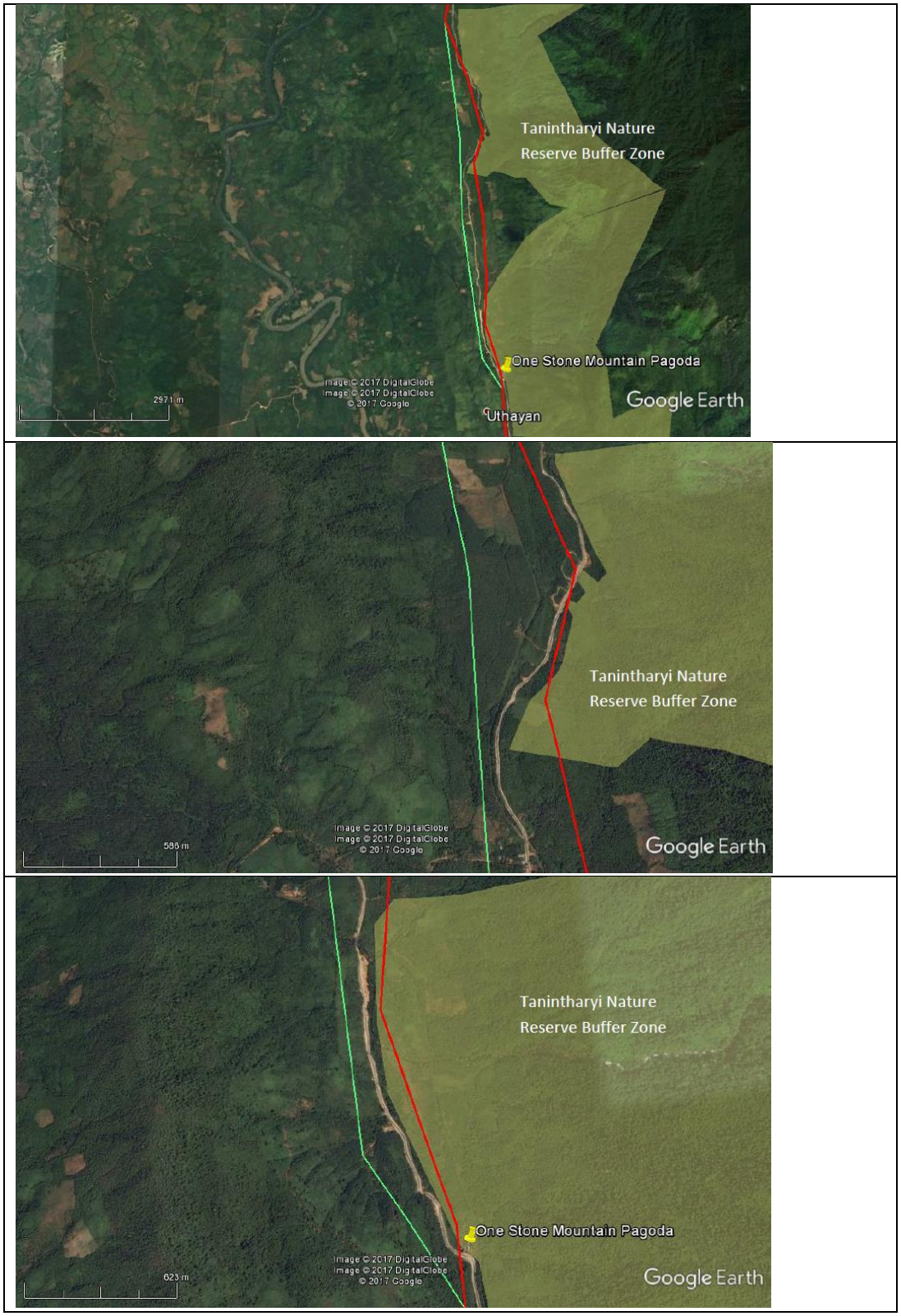


Figure 39 Alignment (Red Line) Encroaches on the Tanintharyi Nature Reserve

7 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 Background

256. Public and Agency Consultations were guided by the following requirements:

257. Article 61 of the Environmental Impact Assessment Procedure (2015) specifies that consultation shall consist of the following:

> "As part of the EIA investigations, the Project Proponent shall undertake the following consultation process:
>
> a) timely disclosure of all relevant information about the proposed Project and its likely Adverse Impacts to the public and civil society through local and national media, the website(s) of the Project or Project Proponent, at public places such as libraries and community halls, and on sign boards at the Project site visible to the public, and provide appropriate and timely explanations in press conferences and media interviews;
>
> b) arrange consultation meetings at national, regional, state, Nay Pyi Taw Union Territory and local levels, with PAPs, authorities, community-based organizations and civil society;
>
> c) consultations with concerned government organizations including the Ministry, the concerned sector ministry, regional government authorities and others; and
>
> d) field visits for the Ministry and concerned government organizations."

258. The ADB Safeguard Policy Statement (2009) specifies:

> "19. The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;1 (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report."

259. During construction and operation, communities in and around the Project area will be kept informed of construction activities that are likely to cause noise and dust nuisance, or disruption to irrigation flows or roads and pathways.

7.2 Consultation performed for this EIA

260. Consultation for the Transmission Line Component consisted of four parts:

1. Consultation with MoNREC, ECD, to introduce the project and obtain their decision as to the category of the Transmission and Distribution Components.

2. Consultation with MoNREC, Forest Department, to discuss the project and obtain information, including the process required for clearing the ROW of trees.

3. Two rounds of public meetings organized by DPTSC with a broad array of attendees at Townships affected by the transmission lines.

4. Household surveys to obtain data required for preparation of the Resettlement and Ethnic Group Development Plan. This information is reported in that document.

7.2.1 ECD and Forest Department Consultation

261. A meeting was held on September 11, 2017 with ECD of MoNREC to discuss the environmental categorization of the Project. Present at the meeting were representatives of the DPTSC, ADB, and the PPTA consultants. This meeting was the beginning of the consultation process, and the main purpose was to acquaint ECD with the Proposed Projects and to explain the environmental and social assessment approach that would be used to create the EIA to be submitted to ADB. At the meeting the Deputy Director General, U Sein Htoon Linn, announced that ECD had determined that the Transmission Line Component would require an IEE and EMP to meet the requirements of the Government. This was further clarified later as a requirement to submit a separate IEE for each of the transmission lines and their associated access roads and substations. It was agreed that the EIA would form the basis for the two IEEs.

7.2.2 Public Consultation

262. Public meetings were held at the locations indicated in Table 14. Details, including sign-up sheets and photos of the consultations are presented in Appendix 2.

Table 14 Locations of Public Consultation Meetings

Villages
1. Ahlone-Thida Line
Ahlone
Lathar
Botataung
Dala
2. Mawlamyine-Ye- Dawei Line
Talkku, Mudon Township, Mon State
Ahbaw, Ye Township, Mon State
Warkayuu Village, Thanphyuzayat Township, Tanintharyi
Yephyu, Kalaingaung Township, Tanintharyi Region

7.3 Summary Results of Consultation along the Proposed Transmission Lines

263. Two rounds of public consultation with over 700 attendees in townships and villages along the transmission lines (see Table 15) resulted in a clear indication that people are supporting the project and want it to proceed as fast as possible. Concerns about the timing of construction and possible impacts to the communities were raised, which indicates the need for a comprehensive and robust EMP to be implemented. The principal concerns included:

- timing of the construction to reduce impacts on cropping
- proper compensation to individuals and communities for damages during construction
- whether the Project will bring electricity to the localities
- whether there will be job opportunities for local people
- how soon will electricity come to the village or locality?
- local authorities emphasized that they want to be involved in the final survey and routing of the lines.

Table 15 Number of attendees at the public consultation meetings

Date	Location	Male	Female	Total
First Round Public Consultations				
30-Sep-17	Kaleinaung Township, Yephyu	45	6	51
28-Sep-17	Warkayuu Village, Thanphyuzayat Township	11	2	13
29-Sep-17	Ye Township, Mon State	67	15	82
28-Sep-17	Taw Kuu Village, Mudon Township	28	13	41
17-Oct-17	Ahlone Township	22	11	33
16-Oct-17	BotataungTownship	20	4	24
20-Oct-17	Dala Township	49	16	65
	Totals of first round	242	67	309
		78.2%	21.8%	
Second Round Public Consultations				
20-Dec-17	Lathar	12	19	31
20-Dec-17	Dala	64	23	87
13-Dec-17	Thanphyuzayat	26	13	39
13-Dec-17	Mudon	52	60	112
13-Dec-17	Ye	59	2	61
12-Dec-17	Kalainaung	65	6	71
	Totals of second round	278	123	401
		69.3%	30.7%	
	Totals of both rounds	**520**	**190**	**710**
		73.2%	**26.8%**	

8 GRIEVANCE REDRESS MECHANISM

8.1 Introduction

264. Unforeseen problems and issues may arise due to construction and operational impacts. Therefore, to resolve these issues, the DPTSC will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance. It should be emphasized that this grievance redress mechanism relates only to the Project's environmental performance. Grievances associated with resettlement and compensation are addressed through a separate process described in the Resettlement and Ethnic Group Development Plan.

8.2 Objectives of Grievance Redress Mechanism

265. A Grievance Redress Mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to diverse members of the community, including more vulnerable groups such as women and youth. Opportunities for confidentiality and privacy for complainants are to be honored where this is seen as important.

266. DPTSC will appoint a Public Complaints Officer (PCO) to the DPTSC PMU to deal with complaints from affected people throughout implementation of the Project. Prior to construction, the PCO will finalize the GRM in collaboration with local government. The local government bodies at the village and township level will act as focal points for contact with the PCO. DPTSC PMU and the village and township focal points will issue notices to inform the public within the project area of the GRM. The PCO's phone number, address, and email address will be disseminated to the people through displays at the respective offices of the government administrations and public places.

267. The PCO should have experience and/or training in dealing with complaints and mediation of disputes. The PCO will have facilities to maintain a complaints database and communicate with Contractors, the Project Implementation Consultant, the DPTSC PMU, village and township representatives, and with complainants.

8.3 GRM Process and Timeframes

268. The GRM process and proposed timeframes is summarized in Table 16.

269. **GRM Entry Points**. Formal complaints may be made directly to the PCO or through: (i) DPTSC offices, Contractors, the Project Implementation Consultant, Village Governments, and Township Governments.

270. **Stage 1: Informal Resolution.** If a concern arises, the affected person(s) may attempt to resolve the issue directly with the Contractor. The Contractor must inform the PCO of the complaint and its resolution. If the issue is successfully resolved, no further follow-up is required.

271. **Stage 2: Formal Complaint**. Affected people who are not able to resolve the issues in Stage 1 will submit an oral or written complaint directly to the PCO or through GRM entry points (DPTSC offices, Contractors, the Project Implementation Consultant, Village Governments, and Township Governments). For an oral complaint, the PCO must make a written record, including the date and time of the complaint. For each complaint, the PCO must investigate the complaint, assess

its eligibility, and identify an appropriate solution. A clear reply will be provided within five (5) working days to the complainant, Village Government and/or Township Government, DPTSC, PMU, and Contractor.

272. The PCO will instruct the Contractor to take corrective actions, as necessary, through the DPTSC PMU and the Project Implementation Consultant. The PCO will review the Contractor's response and undertake additional monitoring. During the complaint investigation, the PCO will work in close consultation with the Contractors, and the Project Implementation Consultant. Contractors during construction should implement the redress solution and convey the outcome to the PCO within seven (7) working days.

273. **Stage 3: Multi-stakeholder Meeting**. If no solution can be identified by the PCO or if the complainant is not satisfied with the suggested solution under Stage 2, the PCO will organize, within 21 days of filing of the complaint, a multi-stakeholder meeting under the auspices of the head of DPTSC, where all relevant stakeholders (i.e., the complainant, DPTSC PMU, Contractor, Project Implementation Consultant, Village Government and/or Township Government focal points) will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The Contractors should implement the agreed-upon redress solution and convey the outcome to the PCO within seven (7) working days;

274. **Stage 4: ADB Special Mission** If the multi-stakeholder hearing process is not successful, the PCO will inform ADB accordingly, and the ADB Project team will organize a special mission to address the problem and identify a solution; and

275. **Stage 5**: **Judicial Proceedings.** If the affected people are not satisfied with the reply in Stage 4, they can go through local judicial proceedings.

276. **Reporting**. The PCO will record all complaints, investigations, and subsequent actions and report monthly. A summary report on PCO operations and Complaint logs will be included in semi-annual environmental monitoring reports to ADB and MoNREC.

8.4 Responsibilities of PCO

277. The responsibilities of the PCO are:

i. The PCO will instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCO. Similarly, the PCO will coordinate with Village and Township focal points to "capture" complaints made directly to them;

ii. The PCO will log complaint and date of receipt onto the complaint database and inform the Project Implementation Consultant and the Contractor;

iii. The PCO, with the Project Implementation Consultant and the Contractor, will investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project activities, and identify appropriate corrective measures. If corrective measures are necessary the PCO, through the Project Implementation Consultant, will instruct the Contractor to take necessary action.

iv. The PCO will inform the Complainant of investigation results and the action taken;

v. If complaint is transferred from local government agencies, the PCO will submit interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies;

vi. The PCO will review the Contractors response on the identified mitigation measures, and the updated situation;

vii. The PCO will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not recur;

viii. The PCO will review the Contractors response on the identified mitigation measures, and the updated situation; and

ix. During the complaint investigation, the PCO will work together with the Contractors and the Project Implementation Consultant. If mitigation measures are identified in the in-

vestigation, the Contractors will promptly carry out the mitigation. The Project Implementation Consultant will ensure that the measures have been carried out by the Contractors.

278. The tracking and documenting of grievance resolutions within the PCO and/or DPTSC PMU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) systems with the capacity to analyze information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the DPTSC and ADB.

Table 16 Summary of Grievance Redress Process

Stage	Process	Time from complaint submission
1.Informal Resolution	• Only for minor complaints • Affected person tries to resolve the problem with the Contractor • Contractor must keep a record and report to PCO	1 – 3 days
2. Formal Complaint	• Affected person(s) contact PCO directly or through one of GRM entry points (i.e., local DPTSC offices, Contractors, the Project Implementation Consultant, Village Governments, and Township Governments) • PCO records and investigates complaint • If the complaint in not eligible (for example if has to do with a compensation disagreement), PCO so informs Complainant • If the complaint is eligible, PCO works with Contractor, Project Implementation Consultant, and PMU to find a solution • PCO notifies affected people and instructs Contactor	5 days
	• Contractor implements solution within 7 days of agreement on the solution	12 days
3. Multi-stakeholder meeting	• If the complaint cannot be resolved, a multi-stakeholder meeting is convened under the auspices of DPTSC • all relevant stakeholders (i.e., the complainant, DPTSC PMU, Contractor, Project Implementation Consultant, Village Government and/or Township Government focal points) will be invited • the meeting should result in a solution acceptable to all, and identify responsibilities and an action plan	21 days
	• Contractor implements the agreed solution within 7 days of the multi-stakeholder meeting	28 days
4. ADB Special Mission	• If complaint cannot be resolved, ADB is notified by PCO • ADB Project team will field a special mission to address the problem and attempt to identify a solution	60 days
5. Judicial Proceedings	• If the complaint cannot be resolved, the complainant has recourse to the local judicial process	indeterminate

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

279. ADB's Safeguard Policy Statement (2009) requires that an Environmental Management Plan (EMP) be prepared as part of an EIA report. This EMP aims to:

- Comply with ADB requirements and guidance.
- Comply with applicable environmental requirements of the Government of Myanmar, which requires an EMP to be part of an IEE or EIA.
- Achieve sustainable and environmentally and socially acceptable development interventions for transmission line development.
- Inform the Government of Myanmar involved agencies and the future contractors on environmental management strategies and social impact mitigation measures.

280. To achieve these objectives, four actions have been taken in formulating the EMP:

- Institutional mechanism prepared for EMP implementation, monitoring, and reporting.
- Measures were outlined for adoption in project planning and design to avoid or minimize adverse impacts on the environment and affected communities
- Specific mitigation measures were formulated to avoid or minimize the adverse impacts of the pre-construction, construction, operation, and eventual decommissioning phases of transmission line development
- A plan was prepared to monitor the implementation of the mitigation measures and their effectiveness in combating adverse impacts

9.2 Institutional Arrangements

281. The MoEE and its DPTSC do not have environmental and social management systems to guide project preparation, project construction, operation, and maintenance of lines. Overall responsibility for implementation of the environmental management plan falls to the Project Management Unit (PMU) for this project

282. There are nine agencies that are involved in the implementation, supervision, and monitoring of the environmental management plan: (i) Contractors, (ii) Project Implementation Consultant, (iii) MOEE, (iv) DPTSC PMU, (v) Ahlone-Thida PIU, (vi) Mawlamyine-Ye Dawei PIU, (vii) Ministry of Natural Resources and Environmental Conservation, (viii) ADB, and (ix) Environmetal Quality Monitoring Sub-contractors (see reporting relationships Figure 40).

283. **Construction Contractors**. Construction Contractors will be responsible for:

i. Preparation of a Contractor's Environmental Management Plan;
ii. implementation of the environmental management plan mitigation measures; and
iii. frequent monitoring and reporting of environmental management plan implementation.

284. **Project Implementation Consultant (PIC).** The PIC will be responsible for

i. supervision and monitoring of and reporting the contractor implementation of the EMP on behalf of DPTSC PMU and Transmission Line PIUs;
ii. supervision of Environmetal Quality Monitoring Sub-contractors (mentioned as Environmental Monitoring Contractors in Figure 40);
iii. assist DPTSC PMU and Transmission Line PIUs in preparing of the environmental safeguard monitoring reports; and
iv. assist DPTSC PMU in organization of training and capacity development.

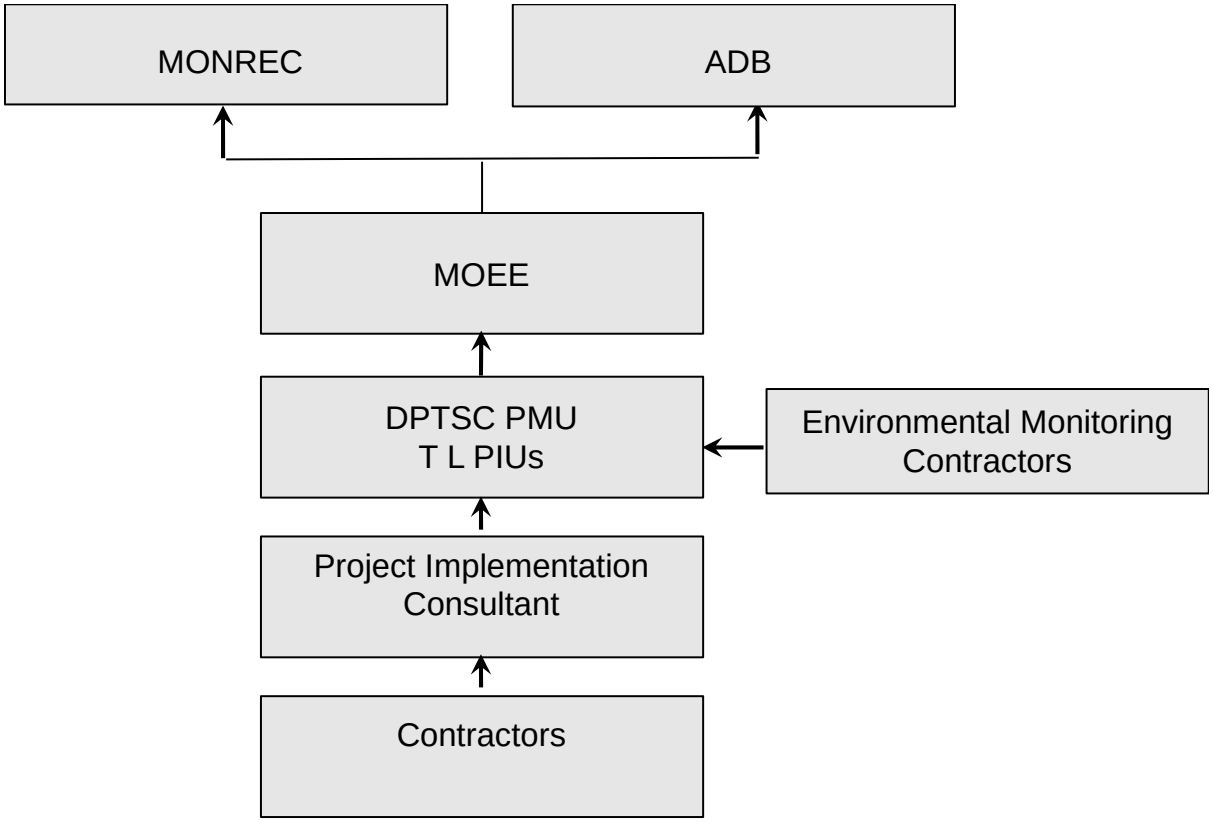


Figure 40. Arrangements for Implementation of the Environmental Management Plan

285. **DPTSC Transmission Line PIUs.** Ahlone-Thida PIU and Mawlamyine-Ye Dawei PIU will have responsibility for:

i. ensuring implementation of all mitigation measures;
ii. ensuring implementation of all monitoring programs;
iii. supervision and monitoring of the implementation of the environmental management plan (EMP);
iv. operation of the Grievance Redress Mechanism for the transmission line;
v. meeting all the conditions of the Environmental Compliance Certificate (as issued by MoNREC); and
vi. submitting semi-annual Monitoring Reports to the PMU.

286. **DPTSC PMU.** The DPTSC PMU will have overall responsibility for:

i. ensuring implementation of all mitigation measures;
ii. ensuring implementation of all monitoring programs;
iii. supervision and monitoring of the implementation of the environmental management plan (EMP);
iv. establishment and operation of the Grievance Redress Mechanism;
v. training and capacity development of environmental staff of PMU, PIUs, and Project Implementation Consultant;
vi. meeting all the conditions of the Environmental Compliance Certificate (as issued by MoNREC); and

vii. submitting semi-annual Monitoring Reports to DPTSC management, MOEE, MoNREC and to ADB.

287. **Ministry of Natural Resources and Environmental Conservation (MoNREC).** MoNREC is responsible for:

i. review of the periodic environmental safeguard monitoring reports submitted by DPTSC to ensure that adverse impacts and risks are mitigated as planned;

ii. as necessary, conduct monitoring and inspection of projects to determine compliance with all environmental and social requirements;

iii. as necessary, impose penalties and /or require Project Proponent to undertaken corrective action; and

iv. where Projects are not in compliance or not likely to comply with its environmental and social requirements, take appropriate enforcement actions including: (i) suspension of project operation; and (ii) employing third parties to correct non-compliance.

288. **ADB.** ADB is responsible for:

i. conducting periodic site visits for projects with adverse environmental impacts;

ii. conducting supervision missions for detailed review for projects with significant adverse environmental impacts; and

iii. reviewing the periodic environmental safeguard monitoring reports submitted to ensure that adverse impacts and risks are mitigated as planned.

289. **Environmetal Quality Monitoring Sub-Contractors.** Environmental Quality Monitoring Sub-contractors will be responsible for conducting air quality, water quality, noise, and biological environmental monitoring programs on behalf of the DPTSC PMU and the Transmission Line PIUs.

9.3 Contractors Environmental Management Plan

290. Before the construction starts each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with the EMP. The CEMP is to include all mitigation measures and monitoring requirements to be carried out by the Contractor. The CEMP will be submitted to the Project Implementation Consultant for review and approval. Approval will be required one month prior to the start of construction. Contract documents shall explicitly indicate the requirement for the CEMPs Construction cannot start until all CEMPs. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

291. The CEMP is to include mitigation measures and monitoring programs for:

- Construction camp management;
- Borrow pits, quarries, and waste disposal sites;
- Access road construction, use, and rehabilitation;
- Dust and noise management;
- Erosion control;
- Solid waste management;
- Hazardous waste management;
- Traffic management;
- Emergency response planning and management;
- Occupation Health and Safety; and
- Community Health and Safety; and
- Public Consultation.

9.4 Environmental Staffing Requirements

292. MoEE and DPTSC do not have environmental and social management systems to guide project preparation, project construction, operation, and maintenance of transmission lines. Overall responsibility for implementation of the environmental management plan falls to the Project Management Unit (PMU) for this project.

293. **DPTSC Project Management Unit (PMU).** DPTSC will assign an Environmental Safeguard Officer and a Social Safeguards Officer to the PMU (see Table 17).

294. **Transmission Line Project Implementation Units (PIUs).** the PMU will appoint Environmental Safeguards Officers to the (PIUs) for each transmission line.

295. **Project Implementation Consultants.** The Project Implementation Consultants will support the PMU and PIUs on environmental management of the Project. One international Environmental Supervision Consultant, and two (2) national Environmental Safeguard Specialists will be needed (see Table 17).

296. **Environmetal Quality Monitoring Sub-Contractors.** Environmental Monitoring Contractors will be responsible for conducting air quality, water quality, noise, and biological environmental monitoring programs on behalf of the DPTSC PMU.

Table 17. Indicative Staff Requirements for Environmental Management

Staff	Position	Level of Effort
DPTSC PMU	Environmental Safeguard Officer Social Safeguards Officers	Full time during the Project
Transmission Line PIUs	Environmental Safeguards Officers for each Transmission Line	Part time during construction
Project Implementation Consultant	International Environmental Supervision Consultant	12 person months
	National Environmental Safeguard Specialist for each Transmission Line	2 persons x 18 persons months Total 36 person months
Contractors	Environmental Safeguards Officer	Full time during construction
Outside Consultants to PMU or through the Construction Supervision Consultant	Capacity Development Environmental Management Training	Contract
	Environmental Quality Monitoring Subcontractors	Contract

9.4.1 Training and Capacity Development

297. DPTSC needs to provide capacity development and/or training programs to ensure staff in Contractors, Project Implementation Consultant, DPTSC PMU, and the Transmission Line PIUs (i) fully understand the environmental management plan; (ii) understand their responsibilities; and (iii) are capable to undertake their responsibilities. As DPTSC does not have environmental and social management staff, DPTSC needs to hire a qualified contractor through the PMU or the PIC to conduct necessary training and capacity development programs.

298. Training on the implementation of an EMP should address two thematic areas. The first area should be principles of environmental assessment and management focused on the potential impacts of project activities on the natural and social environments. The second area should be environmental safeguard requirements of the ADB and Government of Myanmar with specific reference to the EMP implementation.

9.5 Recommended Reporting Requirements.

299. Monitoring of the environmental management plan will have weekly reporting be the Contractor; and monthly reporting by the PIC. The PIC will draft semi-annual environmental monitoring reports. The PMU will finalize the environmental monitoring reports and DPTSC will submit the reports to ECD and ADB (Table 18).

Table 18 Reporting Requirements

Responsibility	Reporting Requirement	Reporting to
Contractor	Weekly inspection and monitoring reports	PIC
Project Implementation Consultants (PIC)	Monthly inspection and monitoring reports	DPTSC PMU
	Draft semi-annual environmental monitoring reports	DPTSC PMU
DPTSC PMU	Final semi-annual environmental monitoring reports	DPTSC
DPTSC	Submission of Final semi-annual environmental monitoring reports	ECD, ADB

9.6 Summary of Impacts

300. The project is expected to generate several beneficial impacts, especially at the national and regional levels, by providing reliable electricity with fewer service interruptions. Some local benefits may arise via employment on substation and access road construction and from enabling local support businesses (i.e., catering) near substation sites.

301. Potential adverse impacts on the environment and the public, which are mainly limited to the construction phase, have also been identified and are listed below.

9.6.1 Construction Phase

- Although every effort has been taken in routing the lines to avoid impacts to ***properties,*** it is expected that some land and building acquisition will be required. This issue is discussed in full in the RP.
- ***Air quality*** may deteriorate due to emissions and dust from hauling construction materials and equipment, and from building the unpaved access roads.
- ***Noise and vibration*** levels in and around the construction sites could increase as a result of operating construction machinery and during material loading and unloading. In some locations, it is likely that pile driving may be required to ensure stable foundations for towers or other components. Access roads may bring higher noise levels to communities that did not previously have a road nearby.
- The quality of ***surface water*** of the water bodies close to the project construction sites may deteriorate if erosion products and silt, construction materials (e.g., borrowed fill material, sand, construction waste, water used in construction activities), and domestic effluent from work camps are allowed to reach the receiving water bodies, especially during rains.
- ***Wetlands*** may be adversely affected by the installation of towers or new substations, placement of construction waste, exhaust emissions, and increased noise levels, which may affect sensitive flora and fauna inhabiting the wetlands
- ***Soil*** in excavated areas may erode and be carried away by runoff; there may be erosion in steep slopes in areas cleared under the transmission lines.

- Improper handling and disposal of ***solid of hazardous waste*** may contaminate surface and groundwater; attract vermin (e.g., rats, scavenging birds); and pose a health risk. Improper handling, storage, and disposal of (oils, fuels, lubricants, etc.) may also contaminate the surrounding environment if accidentally released or disposed of incorrectly.
- ***Forests.*** Some protected ***forests and mangroves*** may be impacted by the clear-cutting of vegetation in the TL ROW.
- ***Biodiversity-*** There may be impacts to ***rare and endangered species habitats and wildlife corridors.*** This will require special treatment especially along the Mawlamyine-Ye-Dawei line. Protected areas should be avoided if possible so as to reduce impacts
- Some ecosystem services, primarily damage to ***water recharge areas*** or affecting the ***availability of non-timber forest products*** may occur.
- ***Birds*** There may be impacts to important ***bird flyways***.
- ***Cultural and religious resources -*** Some ***cultural features*** such as religious sites, visual and aesthetic resources, and touristic resources may be affected in spite of efforts to avoid these features during the routing process.
- The location and operation of work camps and temporary yards may not only damage the immediate environment but also contaminate the surroundings with waste.
- Minor changes to ***land use*** may occur, for example, in a reduction of available agricultural and forest lands.
- The ***occupational health and safety*** of construction workers may be affected adversely due to hazardous working environments such as steep slopes, forests, and remote areas.
- Impacts on ***communities*** during the construction phase could also result from construction workers eventually developing conflicts with the local community, from the spread of vector borne and communicable diseases, including HIV/AIDS and STDs, trafficking of persons, including youth and women, and disruption of services and shifting of utilities.
- In urban areas there could be damage to underground ***utilities*** from improper siting or construction of the towers.
- **UXO** - The Mawlamyine-Ye-Dawei line is in an area where **UXO** has been reported. The safety of constructions workers and local people could be compromised unless precautionary measures are taken.
- ***Climate Change - Greenhouse gas emissions*** from construction equipment are anticipated. Further, the removal of significant amounts of biomass from under the transmission lines could release currently sequestered carbon into the atmosphere.

302. All the above potentially adverse impacts of the construction phase are localized spatially, are temporary and short in duration, and can be mitigated by employing best construction management practices and mitigation measures, which are detailed in the following sections. Proper plans and engineering designs that take into consideration environmental and social aspects will avoid or minimize most of the potential adverse environmental and social impacts of construction.

9.6.2 Operations Phase

303. **Birds** If the mitigation measures discussed in this EMP are not carried out properly there may be ongoing bird collision and electrocution during the Projects' operation.

304. **Occupational and Community Health and Safety.** The health and safety of workers and the community may be impacted due to danger of electrocution if access to dangerous areas or equipment is not effective.

305. **Right of Way Maintenance**. Unless critical terrestrial and aquatic habitats are avoided, Right of Way maintenance activities may have adverse impacts on plants, mammals, birds, and water quality.

306. **Illegal Access.** Unless access is restricted and controlled**.** Increased human access as a result of access roads may lead to habitat degradation, hunting of bird and mammals, and collection of wild plants

307. **Positive impacts.** Benefits from improved electricity reliability are expected at the national and regional levels.

9.7 Mitigation Measures

308. An allowance for environmental mitigation measures has been included in all cost estimates. Further, the incorporation of mitigation measures into the project designs has been part of the design process and is included in the design cost itself. The mitigation actions to be implemented during the construction phase will be part of the construction activities and their costs are included in the construction costs. This section contains a description of the general mitigation measures.

9.7.1 Design and Preconstruction

309. During the detailed design, mitigation planning will continue to ensure:

i. Finalization of the detailed alignment of Transmission Lines to ensure avoidance of protected areas, key biodiversity areas and important bird areas;
ii. Finalization of design of measures to reduce the risk of bird collisions;
iii. Finalization of tower placements and avoid sensitive receptors
iv. Specifications and prepared for materials with the lowest embedded GHG emissions;
v. Preparation of an EMF Risk Assessment; and
vi. Preparation of Emergency Response Plans.

310. During Preconstruction, mitigation activities will include:

i. UXO clearance of transmission lines;
ii. Finalizing land acquisition and resettlement surveys; and
iii. Preparation of Contractor's Environmental Plans

9.7.2 Construction

311. **Air Quality/Dust.** A set of mitigation measures have been designed to minimize the air-borne particulate matter including dust and hydrocarbon emission released to the atmosphere during and after construction, particularly along the right of way and at substations.

312. **Noise/Vibration.** Noise and vibration will be controlled near sensitive receptors noise minimization measures for vehicles and equipment, and restriction of construction work to the daytime.

313. **Water Resources.** Hydrological impacts will be minimized through ensure efficient and uninterrupted drainage of peak surface runoff; prevent flood damage to the project components and downstream locations; and reduce or eliminate the contamination of surface water courses with runoff from the substations, construction camps, or other project components. Impacts to water quality will be minimize by proper disposal of domestic waste water from camps; storage areas containment systems to avoid accidental discharges; and spill response and clean-up plans.

314. Impacts to irrigation systems will be minimize through avoid to reduce or eliminate disruptions to the irrigation systems. Irrigation uses will be notified about construction activities that may temporarily affect irrigation. Impacts to wetlands will be minimized by avoid disturbing wetlands by routing the transmission lines elsewhere. Where construction near or in wetlands is required, specify construction procedures to avoid contamination to the wetlands through the use of silt screens and other appropriate measures. Any damage to wetlands will be restored at the conclusion of the construction

315. **Land Degradation and Soil Erosion.** Land degradation and soil erosion by using already degraded areas for borrowing sites, quarries, and disposal sites. Erosion protection, especially on steep slopes and along river banks, with gabions, gravel, or vegetation will be implemented. Use of new borrow pits will be guided a borrow pit management plan to conserve topsoil, control erosion,

and rehabilitee sites after use. Landslide risks at transmission and at the substations will be mitigated through proper design. Construction activities using heavy equipment for grading, excavation, or slope cutting will be monitored to minimize the risk of slope failures.

316. **Solid Waste and Hazardous Waste Management**. Mitigation measures have been designed minimize contamination through improper disposal. Hydrocarbons and hazardous materials on impervious ground under cover and constructing the storage area as a spill tray to avoid spread of accidental spills. Access to areas containing hazardous substances will be restricted and controlled..

317. **Forests.** An Agreement with the Forest Department for compensation for trees removed or the requirements for replanting at alternate sites must be made. It is likely that trees will be need be replanted and at a rate of 2 planted for every tree felled.

318. The ROW area cleared of trees should be revegetated with plants that do not exceed 3 m in height without any impact on the transmission lines above. Careful selection of plants that do not exceed height limitation and suitable for each impacted area would have to carried out with the assistance of the Forest Department. Plants or shrubs that could facilitate sustainable harvesting of NTFPs but do not attract birds would be ideal for revegetation.

319. **Birds and Biodiversity**. To minimize the impacts on biodiversity, the siting of transmission rights-of-way, access roads, lines, towers, and substations has been designed to avoid critical bird and mammal habitats wherever possible. Additional mitigations include installing transmission lines above existing vegetation, when possible and safe, to avoid/minimize land clearing and avoiding construction activities during bird and wildlife breeding season and other sensitive seasons or times of day. Where critical habitat will be lost, rehabilitation efforts will be needed. With respect to aquatic habitats, construction power transmission towers and substations to avoid critical aquatic habitat (e.g., watercourses, wetlands, riparian areas), as well as fish spawning habitat) . During clearing, disruption to riparian vegetation, especially mangroves, is to be minimized.

320. **Physical Cultural Resources.** To protect cultural resources from accidental damage from construction, existing cultural property will be treated as sensitive receptors. They will be avoided where possible and subject to the control on air pollution and noise. Chance Find Protocols will be use if as historical/cultural monuments are encountered during construction. Work is to stop and the relevant authorities including the Ministry of Religious Affairs and Culture is to be informed. The Ministry would implement measures to avoid damage to monuments and valuable features which the contractor is bound to follow.

321. **Community Health and Safety.** A set of mitigation measures has been designed to protect community health and safety. These include.

i. Traffic control measures to ensure public safety, especially when working near schools;
ii. Safety measures such as fences, signs, controlled entrances;
iii. Provide for training to communities (especially children) on the dangers of transmission lines, towers, and substations, and provide reflectors or other methods as appropriate to increase the visibility of these facilities;
iv. include providing access of people to all community properties and facilities during the construction period;
v. Ensure minimal impacts on public health, including prevention of spread of HIV/AIDS, STDs, potential trafficking of persons and child labor;
vi. Informing the public on the timing and duration of any disruption to water, electricity, roads, postal, telecommunications, or other services;
vii. Avoiding damage to utilities by ensuring that vehicles and equipment are operated by trained personnel, that operations are adequately supervised, and that the construction of towers and other facilities does not cause damage to underground utilities; and

viii. Avoiding conflicts with local communities by providing resources for worker requirements at camp stores and regulating outside visits.

322. **Occupational Health and Safety**. The objective is to ensure occupational safety and health of workers in compliance with the requirements of IFC Performance Standard 2 and Contractor's Health and Safety Plans. The Plans are to include:

i. Providing workers with hardhat/helmets and other personal protective equipment (PPE), including eye and ear protection, work gloves, and protective boots or similar footwear;
ii. Instructing workers in health and safety procedures, and requiring the workers to use the provided safety equipment;
iii. Establishing all relevant safety measures as required by law and good engineering practices;
iv. Provide training and briefings for workers on safety precautions and their responsibility for their safety and the safety of others;
v. Ensuring that vehicle and equipment operators are properly licensed and trained;
vi. Arranging for first aid facilities, rapid availability of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities;
vii. Arranging for regular safety checks of vehicles and materials, and allocating responsibility for checking;
viii. Establishing procedures and providing instructions about emergency evacuations and providing a list of emergency contacts available 24 hours a day;
ix. Providing HIV/AIDS and STD awareness training, and encouraging voluntary and confidential HIV and STD testing where this is locally available;
x. Providing a grievance redress mechanism for workers.

323. **Work Camps.** To ensure that work camps does not adversely affect the surrounding environment and residents in the area, the mitigation measures include:

i. Identify the location of work camps in consultation with the local authorities, DPTSC, and NGOs/CSOs;
ii. Avoiding locating camps near settlements and/or water supply intakes;
iii. Avoiding the cutting of trees and minimizing the removal of vegetation for the camps;
iv. Managing solid waste and sewage according to national and local regulations. As a rule, solid waste must not be dumped, buried, or burned at or near the project site, but must be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits;
v. Ensuring the Contractor organizes and maintains a waste handling, separation/storage, collection, and transportation system;
vi. Ensuring that all liquid and solid hazardous and non-hazardous waste are separated, collected, and disposed of according to national requirements and regulations;
vii. If private land is used for work camps or for other temporary purposes, Contractor to pay rent to the owner and restore the land to previous state;
viii. At conclusion of the project, removing all debris and waste, as well as all temporary structures, including office buildings, shelters, and toilet; and
ix. Planting exposed areas with suitable vegetation.

9.7.3 Operational Phase

324. To achieve sustainability, beneficial impacts and the effectiveness of mitigation measures must be enhanced even after construction, as some adverse environmental and social impacts may

result from the operation of project facilities. To reap the full environmental benefits of the proposed activities and ensure environmental enhancement, the following mitigation measures should be implemented. These may require national-level involvement.

325. **Protection of Birds.** The objectives of the EMP in relation to protection of wildlife and birds are to:

- Minimize adverse impacts to birds using the transmission line corridors and structures during their migration or local flights.
- Minimize adverse impacts to wildlife in migration corridors and in impacted forested areas.

326. Recommended mitigation measures include:

- Install and maintain reflectors and other features at all major river crossings of the transmission line, in protected forested areas, and as required at substations to enhance the visibility of the lines and reduce collisions.
- For the longer term, plant tall growing trees where these will grow outside of the transmission line ROW to encourage birds to fly higher and avoid both the trees and the lines.
- The tower design should include platforms or other features that can potentially be used by raptors and other species to nest safely on the transmission line towers.

327. **Occupational Health and Safety.**

328. Impact: Construction related accidents are common in Myanmar, primarily because of unsafe construction practices. In addition, occupational health and safety hazards specific to electric power transmission and distribution projects primarily include[60]:

- Live power lines
- Working at height
- Electric and magnetic fields
- Exposure to chemicals

329. The erection of towers and stringing of lines in steep slopes are difficult and strenuous work and smallest error in judgement/negligence of safety guidelines may cause accident and grievous harm. Work related injury and vehicle accidents are the likely impacts.

330. Mitigation: Strict observance of Occupational Health and Safety (OHS) guidelines elaborated in the EMP with attendant continuous supervision and monitoring of adherence to OHS guidelines would minimize accidents and injury.

331. **ROW Maintenance.** The objectives of the EMP with regard to environmental impacts associated with ROW maintenance during the operations phase are to:

- Maintain a safe separation between the conductor lines and objects below them.
- Provide job opportunities for local residents in the maintenance of the vegetation along the ROW in forested (non-agricultural or residential) areas.

332. Recommended mitigation measures include[61]

- Develop and implement a vegetation management plan to be used in the transmission line ROW that provides job opportunities to local residents, especially women and vulnerable people.

[60] Ibid.

[61] Adapted from International Finance Corporation, *Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution*, April 2007.

- Avoid the use of pesticides or herbicides to the extent possible. If use of these substances is unavoidable, train personnel to apply pesticides and ensure that personnel have received the necessary certifications or equivalent training where such certifications are not required.

333. **Illegal Access.** Increased human access as a result of access roads may lead to habitat degradation, hunting of bird and mammals, and collection of wild plants.

334. Recommended mitigation measures are:

- Work with Forest Department and local authorities to control increased access to sensitive forests / wetlands
- Close any remaining temporary access roads except as needed for maintenance

9.7.4 Decommissioning Stage

335. The design life of transmission lines is generally from 40 to 60 years. At or before that time the owners will need to take measures to upgrade (improve certain components to higher loads), refurbish (carry out extensive renovation to restore the design life of the system), or decommission the system (for example by replacing it with a parallel system)[62]. In the event of refurbishment or decommissioning it is expected that contractors will carry out the work and that this would result in certain construction-related impacts. Because the decommissioning would occur relatively far in the future it is difficult to forecast many environmental, social, or economic impacts since the baseline at that time will be unknown. It is recommended that at the time of decommissioning a detailed Decommissioning Plan be developed and implemented.

9.7.5 Summary Mitigation Table

336. Table 19 summarizes the mitigation measures required for design, construction, and operation of the transmission lines, the access roads, and the substations

[62] Brennan, Gary "Refurbishment of Existing Overhead Transmission Lines" Integral Energy, Australia, CIGRE, Session B2-203, 2004

Table 19a. Mitigation Measures for Design and Pre-Construction

Issue	Location	Mitigation Measure	Time frame	Ahlone-Thida (Dala) (USD)	Maw-lamyine-Ye-Dawei (USD)	Imple-mented by:	Super-vised/ Approved by:
Design and Pre-Construction Phase							
Design Considerations							
Biodiversity Protection	Mawlamyine-ye	Finalization of the transmission alignment to ensures avoidance of protected areas, key biodiversity areas and important bird areas	design phase	$0	$0	Design En-gineer	DPTSC
Bird Collision Risk Reduction		Finalization of design of measures to reduce the risk of bird colli-sions	design phase	$0	$0	Design En-gineer	DPTSC
Community Health and Safety		Finalization of the design of tower placements and avoid sensitive re-ceptors (schools, hospitals, com-munity centers, temples, and pa-godas)	design phase	$0	$0	Design En-gineer	DPTSC
GHG Emission Reductions		Specifications for using construc-tion materials with the lowest em-bedded GHG emissions	design phase	$1,205	$2,295	Design En-gineer	DPTSC
Electric and Magnetic Fields (EMF)	Entire project	Preparation of an EMF Risk As-sessment Evaluate potential exposure to the public against the reference levels developed by the Interna-tional Commission on Non-Ioniz-ing Radiation Protection.	design phase	$1,200	$17,400	Design En-gineer	DPTSC
		Site new facilities so as to avoid or minimize exposure to the pub-lic. Avoid installing transmission lines or other high-voltage equip-ment above or adjacent to resi-	design phase	$0	$0	Design En-gineer	DPTSC

Table 19a. Mitigation Measures for Design and Pre-Construction

Issue	Location	Mitigation Measure	Time frame	Ahlone-Thida (Dala) (USD)	Maw-lamyine-Ye-Dawei (USD)	Imple-mented by:	Super-vised/ Approved by:
Design and Pre-Construction Phase							
		dential properties or other locations intended for highly frequent human occupancy (e.g., schools, offices).					
		If EMF levels are confirmed or expected to be above the recommended exposure limits, the application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers.	design phase	$0	$0	Design Engineer	DPTSC
Land Acquisitions and Resettlement	Entire project	Finalization of land acquisition and resettlement survey. Payment of compensation	Pre-construction	Costs in REGDP	Costs in REGDP	PMU/PIC	DPTSC
UXO	Entire project	Specify that no construction on the scheme until sites have been declared safe by UXO authorities. Specify that UXO safety training by Contractors required.	Pre-construction	$0	$2,062	Design Engineer	DPTSC
UXO	Entire project	No construction on the scheme until sites have been declared safe by UXO authorities. UXO safety training by Contractors required.	Pre-construction	$0	$664,500	UXO Contractor	PIC

Table 19a. Mitigation Measures for Design and Pre-Construction

Issue	Location	Mitigation Measure	Time frame	Ahlone-Thida (Dala) (USD)	Maw-lamyine-Ye-Dawei (USD)	Imple-mented by:	Super-vised/ Approved by:
Design and Pre-Construction Phase							
Emergency Re-sponse	Transmission Lines	Develop emergency response plan for Contruction Phase including: response plans for: (i) Fire and ex-plosions; (ii) Hazardous Chemical Spills: (iii) Landslides and Slope failures during construction of towers; (iv) Extreme events (i.e. wild fire, typhoons, floods); and (v) Electrocution accidents.	Pre-con-struction			Contractor PIC	DPTSC
Emergency Re-sponse	Substations	Develop emergency response plans for substations including: (i) fires and explosions, (ii) oil leaks from transformers, (iii) electrical failures and equipment malfunc-tioning; and (iv) electrocution ac-cidents.	Pre-con-struction			DPTSC PIC	DPTSC
Environmental elements in de-sign of new substations and redesign of ex-isting substation	New and ex-isting substa-tions	- Incorporate environmental ele-ments in the design of substa-tions to include: i. provision of oil pits in transformer area ii. design of adequately sized drainage canals which drains towards the	Design			DPTSC PIC	DPTSC

Table 19a. Mitigation Measures for Design and Pre-Construction

Issue	Location	Mitigation Measure	Time frame	Ahlone-Thida (Dala) (USD)	Maw-lamyine-Ye-Dawei (USD)	Imple-mented by:	Super-vised/ Approved by:
Design and Pre-Construction Phase							
		road canal and not at adjoining areas and paddy fields iii. provision of proper fence around the substations iv. consider alternatives to SF6 circuit breakers with insulators made of composite and rubber instead of ceramic insulators v. use of non-PCB transformers vi. provision of storage area/room for new materials and spares vii. provision of waste segregation areas for hazardous waste and damaged equipment/materials viii. provision of waste segregation bins for solid waste/garbage (biodegradable and non-biodegradable bins) ix. monitoring of EMF at substations					
Contractor's Environmental Management Plan (CEMP)		The CEMP is to include mitigation measures and monitoring programs for:	Pre-construction			Contractor	DPTSC PIC

Table 19a. Mitigation Measures for Design and Pre-Construction

Issue	Location	Mitigation Measure	Time frame	Ahlone-Thida (Dala) (USD)	Maw-lamyine-Ye-Dawei (USD)	Imple-mented by:	Super-vised/ Approved by:
Design and Pre-Construction Phase							
		• Construction camp manage-ment; • Borrow pits, quarries, and waste disposal sites; • Access road construction, use, and rehabilitation; • Dust and noise management; • Erosion control; • Solid waste management; • Hazardous waste management; • Traffic management; • Emergency response planning and management; • Occupation Health and Safety; and • Community Health and Safety; and • Public Consultation					

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
Inadequate environmental awareness of workers	At construc-tion sites	Conduct special briefings and/or on-site training for the contractors and workers on the environmental require-ments of the project.	Construc-tion phase	$0	$0	Contractor	PIC
Air Quality/Dust							
Air Qual-ity/Dust	Entire Project	Ensure all heavy equipment and machinery is in full com-pliance with national regula-tions	Construc-tion phase	$0	$0	Contractor	PIC
		Use Euro IV diesel fuels when those fuels are available	Construc-tion phase	$0	$0	Contractor	PIC
		Wet stockpiled soil and sand before loading, particularly in windy dry condition	Construc-tion phase	$0	$0	Contractor	PIC
		Enclose stockpiles of sand and aggregate greater than 20 m3 in volume in walls ex-tending above the pile and beyond its front face	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites and camps	Ensure acceptable all-weather surfaces for areas within the site where there is a regular movement of vehi-cles	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Employ fuel-efficient and well-maintained haulage trucks with proper exhaust baffles to minimize exhaust emissions	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	Entire pro-ject	Turn off the engines for all vehicles, while parked on the site	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Use efficient equipment, machinery and vehicles with regular checks to affect nec-essary corrections or repairs, and ensure compliance with safety and air pollution re-quirements	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites	Cover soil, sand, and other construction material in stor-age and in transit	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites	Use effective water sprays during the delivery and han-dling of all sand and aggre-gate and other similar mate-rial when dust is likely to be created	Construc-tion phase	$7,050	$108,300	Contractor	PIC
	At construc-tion sites	Provide barriers in locations where strong winds are likely to blow away dust and debris	Construc-tion phase	$4,700	$72,200	Contractor	PIC
	At construc-tion sites	Spray bare areas and roads used for haulage of material with water	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites	Wash tires and lower bodies of vehicles when moving out from the construction site	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Arrange for regular safety checks of vehicles and mate-rial, and allocate responsibil-ity for checking	Construc-tion phase	$860	$1,640	Contractor	PIC
	At construc-tion sites	Select sites for material ex-traction away from residential	Construc-tion phase	$2,350	$36,100	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		areas to reduce the impacts of dust					
Noise and Vibration							
Noise/ Vibra-tion	Entire pro-ject	Fit all powered mechanical equipment and machinery with noise abating gear, such as mufflers for effective sound reduction, in full com-pliance with the applicable regulations	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	As possible, operate heavy equipment during daylight hours	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Terminate works at the es-tablished time (e.g., work during daylight hours) and avoid increasing noise during peak hours	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Isolate construction equip-ment that generates exces-sive noise/vibration	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Use well-maintained haulage trucks with speed controls	Construc-tion phase	$0	$0	Contractor	PIC
	Near sensi-tive areas	Take reasonable measures, such as installing acoustic screens to minimize noise near noise-sensitive areas such as schools and places of worship	Construc-tion phase	$5,938	$11,062	Contractor	PIC
	Entire pro-ject	Ensure the contractor takes responsibility for rectifying damages caused by vibration generated from or by the use	Construc-tion phase	$860	$1,640	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		of any equipment, machinery, and haulage vehicles					
Water Resources							
Stormwater Management and Hydrological Impacts [Main project sites and construction camps]	Main project sites and camps	Implement stormwater management plan at main project sites	Construction phase	$12,652	$35,348	Contractor	PIC
Stormwater Management and Hydrological Impacts [Project ROW]	Along TL	Implement stormwater management plan from design.	Construction phase	$1,054	$1,946	Contractor	PIC
Stormwater Management and Hydrological Impacts [Main project sites]	Project construction camps	Design cost-effective drains to collect and appropriately treat runoff water prior to discharge to local water courses.	construction phase	$0	$4,800	Design Engineer	DPTSC
Stormwater Management and Hydrological Impacts [Project ROW]	Project construction camps	As much as possible, utilize already used areas for earth borrowing, quarries, and disposal sites. Stormwater management plan for impacted areas.	design phase	$0	$0	Design Engineer	DPTSC
Wetlands	Where TL crosses/nears wetlands	In the design, avoid disturbing wetlands by routing the transmission lines elsewhere or devising construction methods that preclude impacts to wetlands. For areas	design phase	$2,350	$16,450	Design Engineer	DPTSC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Implemented by:**	**Supervised/ Approved by:**
Construction Phase							
		where avoidance is not possible, develop wetland mitigation plan.					
	Where TL crosses/nears wetlands	Where construction near or in wetlands is required, specify construction procedures to avoid contamination to the wetlands through the use of silt screens and other appropriate measures including water quality protection.	design phase	$0	$0	Design Engineer	DPTSC
	Where TL crosses/nears wetlands	If portions of wetlands are needed temporarily for construction staging or other uses, provide specifications that wetlands will be restored (or replaced) at the conclusion of the construction.	design phase	$0	$0	Design Engineer	DPTSC
Water Quality	Entire project	Implement proper construction management, including training operators and other workers to avoid pollution of water bodies by the operation of construction machinery and equipment	Construction phase	$0	$0	Contractor	PIC
	At construction camps	Store lubricants, fuels, and other hydrocarbons in self-contained secured enclosures. Per site	Construction phase	$0	$0	Contractor	PIC
	At construction sites	Dispose of water and waste products arising from the site via a suitably designed temporary drainage system in a manner that will not cause	Construction phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		pollution problems or other nuisance					
	At construc-tion sites	Properly dispose of solid waste from construction ac-tivities and labor camps.	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites	Locate temporary construc-tion facilities including struc-tures and material stockpiles at least 50 m away from wa-ter bodies and wetland areas.	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites	Avoid disposing of wash wa-ter, solid waste (such as dis-carded packing, waste from concrete agitator cleaning op-erations, and excavated ma-terial in water bodies and wetlands adjacent) to or in the vicinity of the sites.	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Maintain vehicles and equip-ment in good operable condi-tion and ensure no leakage of oil or fuel	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Perform regular checks on all equipment, plant, and ma-chinery	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Service vehicles, machinery, and equipment at properly managed and equipped work-shops where waste oil is col-lected and disposed of at ap-proved locations	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites and camps	Providing sanitation arrange-ments at work sites and tem-	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		porary accommodation facili-ties to avoid releasing wastewater and sewage to drains or water bodies.					
Wetland Miti-gation	At wetland locations	Implement wetland mitigation plan	Construc-tion phase	$2,000	$14,000	Contractor	PIC
Land Degradation and Soil Erosion							
Soil Erosion	Entire pro-ject	As much as possible, utilize already used areas for earth borrowing, quarries, and dis-posal sites	design phase	$0	$0	Design Engineer	DPTSC
	Entire pro-ject	Design erosion control plan with protection with gabions, gravel, or vegetation cover according to Myanmar stand-ards on steep slopes and along river banks	design phase	$16,800	$252,700	Design Engineer	DPTSC
Impact of Borrow Pits, Quarries and Waste Dis-posal	Entire pro-ject	Obtain a permit from local au-thorities for opening and/or use of borrow areas and quar-ries Construction materials will be sourced from approved sources, that are documented, where necessary, by (i) agreement of Landowner – e.g., lease contract; (ii) village approval; (iii) Environmental approval from the Environ-mental Conservation Depart-	design phase	$4,800	$72,200	Design Engineer	DPTSC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Implemented by:**	**Supervised/ Approved by:**
Construction Phase							
		ment; and/or (iv) mining permit from the Department of Mines or township or district General Administration Department.					
	Entire project	Obtain a permit from local authorities for construction and disposal operations	design phase	$750	$5,350	Design Engineer	DPTSC
Landslides	Entire project	Detailed design will be according to the relevant landslide prevention standards of the Republic of Myanmar.	design phase	$2,800	$50,400	Design Engineer	DPTSC
Soil Erosion	Entire project	As much as possible, utilize already used areas for earth borrowing, quarries, and disposal sites	design phase	$0	$0	Design Engineer	DPTSC
Soil Erosion and soil contamination	Entire project	In the short-term, protect all areas susceptible to erosion, flood damage, and silt transport/sedimentation with either temporary or permanent drainage works	Construction phase	$0	$0	Contractor	PIC
	at stream crossings	Stormwater and erosion management plan implemented per river crossing,	Construction phase	$0	$0	Contractor	PIC
	at towers	Average cost for sediment silt fencing	Construction phase	$7,200	$108,300	Contractor	PIC
	at towers	Stormwater contouring and channels	Construction phase	$6,000	$90,500	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	At construc-tion sites	Take measures to prevent pooling of surface water and scouring of slopes	Construc-tion phase	$0	$0	Contractor	PIC
	at wetlands and streams	Use silt traps where earth-works are carried out adja-cent to water bodies including wetlands	Construc-tion phase	$750	$13,950	Contractor	PIC
	at towers	Develop measures to strengthen the steep slopes with vegetation, grass and plants, or gabions. Work with local communities to imple-ment these measures.	Construc-tion phase	$442	$7,700	Contractor	PIC
	at towers	Avoid the use of arable land for earth borrowing. If una-voidable, the topsoil (ca 30 cm) shall be removed, stored, and refilled after the opera-tion is completed.	Construc-tion phase	$1,175	$18,050	Contractor	PIC
	Entire pro-ject	Restore to quasi-original conditions of landscape after completion of works and after use of quarries; restore vege-tation cover in accordance with the design constraints of transmission lines.	Construc-tion phase	$2,868	$5,292	Contractor	PIC
Landslides	at towers	Design the towers using ap-plicable landslide prevention design standards. Design ele-ment	Construc-tion phase	$0	$0	Contractor	PIC
Solid and Hazardous Waste							

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
Handling and Storage of Hazardous Materials	At construc-tion sites and camps	Store hydrocarbons and hazardous materials on im-pervious ground under cover and construct the storage area as a spill tray to avoid spread of accidental spills.	Construc-tion phase	$1,721	$3,279	Contractor	PIC
	At construc-tion sites and camps	Provide safe ventilation for storage of volatile chemicals	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion sites and camps	Restrict and control access to areas containing hazardous substances	Construc-tion phase	$1,721	$3,279	Contractor	PIC
	Entire pro-ject	Use refrigerants and fire ex-tinguishing agents in accord-ance with the "Montreal Pro-tocol"	Construc-tion phase	$0	$0	Contractor	PIC
Forests							
Forest Re-planting	Along TL	Replant trees per Forest De-partment requirements at a rate of 2 planted for every tree felled.	Construc-tion phase	$77	$251,654	Contractor	PIC
	Along TL	Maintain the replanted trees for a period of ten years.	Construc-tion phase	$0	$0	Contractor	PIC
Birds							
Bird Protec-tion	Maw-lamyine–Ye–Dawei Transmis-sion line	Habitat Loss, Habitat Frag-mentation, Hunting of Birds (as well as Mammals etc.) due to Increased Access to Forest Areas / Wetlands by increased numbers of people					

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas; Work with Forest Department and local authorities to control increased access to sensitive forests / wetlands					
	Access Roads	Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas. Close temporary access roads					
	Along all TL	Install and maintain reflectors and other features at all major river crossings of the transmission line to enhance the visibility of the lines and reduce collisions.	Construction phase	$21,000	$390,600	Contractor	PIC
	Along all TL	For the longer term, plant tall growing trees where these will grow outside of the TL ROW to encourage birds to fly higher and avoid both the trees and the lines.	Construction phase	$0	$0	Contractor	PIC
	at towers	The tower design should include platforms or other features that can be used by raptors and vultures to nest safely on the TL towers.	Construction phase	$0	$0	Contractor	PIC
	at towers	The tower design should include suspended insulators (instead of upright insulators)	Construction phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		and power lines below the cross arm					
	Along TL	Stringing of the power lines should be planned to obstruct only a minimum of air space in vertical direction by single level arrangement of conductor cables and "burying" the neutral cable; Attaching black and white markers on to cables in particular to the neutral cable, at river valleys (bird flyways);	Construc-tion phase	$0	$0	Contractor	PIC
	All trans-mission line Row	Include Design Measures to Prevent / Reduce Bird Collisions (e.g. line marking devices) in higher risk areas, ensure design complies with good practice guidelines. Re-align Line if Within / Adjacent to Protected Areas (e.g. IBAs / KBAs / Forest Reserves), along known migratory routes, and where birds regularly fly between roosting, feeding and nesting areas; Schedule construction outside nesting season as far as practicable (many species nest year round);					

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		Ensure contractor's specifications are reviewed by an Ornithologist / Ecologist to ensure that birds are considered.					
	Access Roads	Schedule access road construction outside nesting season as far as practicable (many species nest year round); Ensure contractor's specifications are reviewed by an Ornithologist / Ecologist to ensure that birds are considered					
	New Sub-stations	Schedule substation construction outside nesting season as far as practicable (many species nest year round); Ensure contractor's specifications are reviewed by an Ornithologist / Ecologist to ensure that birds are considered					
Biodiversity							
ROW Environmental Impacts	Along TL	Site transmission and distribution rights-of-way, access roads, lines, towers, and substations to avoid critical habitat through use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible;	design phase	$3,137	$5,788	Design Engineer	

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	Along TL	Install transmission lines above existing vegetation, when possible and safe, to avoid land clearing	design phase	$600	$600	Design Engineer	
	Entire pro-ject	Avoid construction activities during the breeding season and other sensitive seasons or times of day.	design phase	$2,022	$3,853	Design Engineer	
	Along TL	Revegetation plan for dis-turbed areas with native plant species. Revegetation plan that implements an inte-grated vegetation manage-ment approach. The selective removal of tall-growing tree species and the encourage-ment of low-growing grasses and shrubs is the common approach to vegetation man-agement in transmission line rights-of-way.	design phase	$2,688	$7,512	Design Engineer	
	Along TL	Remove invasive plant spe-cies during routine vegetation maintenance.	design phase	$675	$675	Design Engineer	
Aquatic Habi-tat	Where pro-ject crosses/nea rs wet-lands/strea ms	Avoid critical aquatic habitat (e.g., watercourses, wet-lands, riparian areas), as well as fish spawning habitat, and critical fish over-wintering habitat;	design phase	$0	$0	Design Engineer	DPTSC
	Where pro-ject crosses streams	Maintain fish access when ac-cess road crossings of water-courses are unavoidable by utilizing clear span bridges,	design phase	$638	$11,112	Design Engineer	DPTSC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		open-bottom culverts, or other approved methods;					
	Where pro-ject crosses streams	Minimize clearing and disrup-tion to riparian vegetation.	design phase	$0	$0	Design Engineer	DPTSC
Physical Cultural Resources							
Damage to Historic/Cul-tural Monu-ments and Features	Entire pro-ject	Implement Chance Find Plan. Assume 3 lost construction days due to chance find that is not significant. Assume one significant find/incident per project involving Ministry of Culture, site review and miti-gation design. Assume 10-days of lost construction. Cease work as soon as histor-ical and cultural monuments are encountered during con-struction activities [Probably need to assume a number of incidents for projects]	Construc-tion phase	$5,163	$9,837	Contractor	PIC
	Entire pro-ject	In accordance with Chance Find Plan, provide relevant in-formation to the Ministry of Culture. The Ministry will de-termine the value of the his-toric/archaeological monu-ments and provide guidance on if and how to proceed with the construction. This may in-clude excavating or otherwise documenting the monuments	Construc-tion phase	$10,543	$24,457	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		before proceeding, or in cases of very valuable features, developing a design to avoid the features at that site.					
Community Health and Safety							
Public Safety	Entire project Implementing the transmission line facilities using latest safety measures such as fences, signs, controlled entrances, etc.	design phase	$0	$0	Design Engineer	DPTSC	
	At affected communities	Provide for training for communities (especially children) on the dangers of transmission lines, towers, and substations, and provide reflectors or other methods as appropriate to increase the visibility of these facilities.	design phase	$22,273	$160,364	Design Engineer	DPTSC
Accessibility	Along TL	Plan to provide access to all properties during the construction period	design phase	$0	$0	Design Engineer	

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	Entire pro-ject	Develop and implement a Mobility and Access Facilita-tion Plan (MAFP).	design phase	$6,023	$11,477	Design Engineer	
	Along TL	Access plan for disabled per-sons will be provided in the designs for new paved roads in villages or populated areas	design phase	$0	$0	Design Engineer	
Traffic Man-agement and Construction Safety	Entire pro-ject	Formulating and implement-ing a construction-related traffic management plan. The plan should, at a minimum in-clude sections on:	Construc-tion phase	$8,595	$16,605	Contractor	PIC
	Entire pro-ject	Install traffic warning signs, and enforce traffic regulations during transportation of ma-terials, equipment, and ma-chinery	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Conduct awareness pro-grams on safety and proper traffic behavior in densely populated areas near the con-struction sites	Construc-tion phase	$5,132	$9,608	Contractor	PIC
	Entire pro-ject	Assign traffic control person-nel/flaggers	Construc-tion phase	$114,934	$164,291	Contractor	PIC
	Entire pro-ject	Provide alternative access to pedestrians	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Arrange necessary measures for passer-by safety and all means of transportation safety (e.g., establishing pro-tection zones, bypassing	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		these areas during transpor-tation of materials)					
	Entire pro-ject	Select quarry and borrow sites that are served by roads of adequate capacity for heavy trucks; where minor roads cannot be avoided in-clude provisions for repair and restoration	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Control the loading and op-erating speeds of haulage ve-hicles	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Repair damages to roads caused by haulage of con-struction materials, spoil and equipment, and machinery	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Obtain approval from local authorities if local road are used for transportation	Construc-tion phase	$53	$647	Contractor	PIC
Occupational Health and Safety							
Worker safety	Entire pro-ject	Contractors to develop de-tailed Environmental, Safety and Health (ESH) plans to be approved by the Engineer. These plans should, at a mini-mum include sections on:	Construc-tion phase	$5,163	$9,837	Contractor	PIC
	Entire pro-ject	Provide adequate warning signs	Construc-tion phase	$2,350	$36,100	Contractor	PIC
	Entire pro-ject	Provide workers with per-sonal protective equipment (PPE) (helmet, glasses, vest and boots at a minimum)	Construc-tion phase	$11,244	$17,256	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	Entire pro-ject	Instruct contractor workers in health and safety matters, and require the workers to use the provided safety equipment	Construc-tion phase	$11,659	$20,341	Contractor	PIC
	Entire pro-ject	Establish all relevant safety measures as required by law and good engineering prac-tices	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Provide training and brief-ings for workers on safety precautions and their respon-sibility for their safety and the safety of others	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Ensure that vehicle and equipment operators are properly licensed and trained	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Arrange for the provision of first aid facilities, rapid availa-bility of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Allocate responsibilities to ensure that these arrange-ments are in place	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Arrange for regular safety checks of vehicles and mate-rial, and allocate responsibil-ity for checking	Construc-tion phase	$860	$1,640	Contractor	PIC
	At construc-tion sites	Ensure that material extrac-tion operations are supervised	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		and carried out by trained and experienced staff					
	Entire pro-ject	Establish procedures and provide instructions about emergency evacuations, and provide a list of emergency contacts available for 24 hrs.	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Provide HIV/AIDS and STI awareness training and en-courage voluntary and confi-dential HIV and STI testing	Construc-tion phase	$12,829	$27,371	Contractor	PIC
Visual Aesthetic Values							
Visual	Transmis-sion Line ROWs	Wherever possible, the design would endeavor to run the lines below the ridges of the hills to avoid the lines pro-truding out of the landscape and enable merging with it.	Construc-tion phase			Contractor	PIC
Work Camps							
Work Camp/ Temporary Yard Opera-tion and Loca-tion	Entire pro-ject	As part of Site Establish-ment Plan, identify the loca-tion of work camps in consul-tation with the local authori-ties, OMCN, and NGOs; where possible, avoiding the location of camps near settlements or near water supply intakes	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion camps	Avoid the cutting of trees and minimizing the removal of vegetation for the camps	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
	At construc-tion sites and camps	Provide water and sanitary facilities for employees	Construc-tion phase	$1,775	$5,225	Contractor	PIC
	Entire pro-ject	Manage solid waste and sewage according to the na-tional and local regulations. As a rule, solid waste must not be dumped, buried, or burned at or near the project site, but shall be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits.	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Ensure the Contractor or-ganizes and maintains a waste separation, collection, and transportation system	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Ensure that all liquid and solid hazardous and non-haz-ardous wastes are separated, collected, and disposed of ac-cording to national require-ments and regulations	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	At the conclusion of the pro-ject, remove all debris and waste, as well as all tempo-rary structures, including of-fice buildings, shelters, and toilets	Construc-tion phase	$860	$1,640	Contractor	PIC
	Entire pro-ject	Plant exposed areas with suitable vegetation	Construc-tion phase	$0	$0	Contractor	PIC
	At construc-tion camps	Ensure the PMU/PIC inspects and reports that the camp	Construc-tion phase	$0	$0	Contractor	PIC

Table 19b. Mitigation Measures for Construction Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Construction Phase							
		has been vacated and re-stored to pre-project condi-tions					

Table 19c. Mitigation Measures for Operations Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Operations							
ROW Maintenance	Along TL	Develop and implement a vegetation management plan to be used in the TL ROW that provides job opportunities to local residents, especially women and vulnerable people.	Operation phase	$3,856	$67,112	MoEE	MoEE/ MoNREC
	Along TL	Avoid the use of pesticides or herbicides to the extent possible. If these substances are unavoidable, train personnel to apply pesticides and ensure that personnel have received the necessary certifications, or equivalent training where such certifications are not required.	Operation phase	$40,200	$40,200	MoEE	MoEE/ MoNREC
Substation staff quarters	At substations	Water supply, wastewater treatment and solid waste management from staff quarters.	Operation phase	$0	$0	MoEE	MoEE/ MoNREC
Soil Erosion	at towers	Proper inspection and maintenance of the tower pads roads and other infrastructure will be done to prevent soil erosion during the operation stage.	Operation phase	$0	$0	MoEE	MoEE/ MoNREC
Community Health and Safety	Entire project	MOEE to carry out training and awareness raising for community on dangers of the transmission lines. Adequate signage and fencing to keep people and animals away from the towers.	Operation phase	$16,750	$123,950	MoEE	MoEE/ MoNREC

Table 19c. Mitigation Measures for Operations Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
Bird Protec-tion	Transmis-sion Lines	Maintain Measures to Prevent / Reduce Bird Collisions (e.g. line marking devices) in higher risk areas, ensure de-sign complies with good prac-tice collision risk avoidance					
	Maw-lamyine- Ye – Dawei Transmis-sion Line	Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas; Work with Forest Department and local authorities to con-trol increased access to sensi-tive forests / wetlands					
	Access Roads	Replace any forest areas lost or fragmented with replanting of forest adjacent to existing forest areas. Close any remaining tempo-rary access roads except as needed for maintenance					
UXO	Entire pro-ject	Ongoing UXO safety training by DPTSC required.	Operation phase	$0	$10,000	MoEE	MoEE/ MoNREC
Climate Change	Entire pro-ject	None	Operation phase	$0	$0	MoEE	MoEE/ MoNREC
Social Mitigation							
Social Mitiga-tion Measures during con-struction	Entire pro-ject	Maximize opportunity to re-duce poverty and increase economic benefits to local population without regard to creed or ethnic origin	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Maximize opportunity to en-hance skills, capabilities and empowerment of local popu-lations, including women	Construc-tion phase	$0	$0	Contractor	PIC

Table 19c. Mitigation Measures for Operations Stage							
Issue	**Location**	**Mitigation Measure**	**Time frame**	**Ahlone-Thida (Dala) (USD)**	**Maw-lamyine-Ye-Dawei (USD)**	**Imple-mented by:**	**Super-vised/ Ap-proved by:**
	Entire pro-ject	Ensure activities avoid or minimize impacts on local communities	Construc-tion phase	$11,750	$180,500	Contractor	PIC
	Entire pro-ject	Maximize awareness of HIV/AIDS, TIP, Child/Forced Labor Conditions	Construc-tion phase	$13,400	$99,160	Contractor	PIC
	Entire pro-ject	Ensure continuing compli-ance with relevant provision of all applicable Plans during construction	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Ensure compliance with pro-vision of RAP(s)	Construc-tion phase	$0	$0	Contractor	PIC
	Entire pro-ject	Ensure safe handling and dis-posal of construction waste materials	Construc-tion phase	$0	$0	Contractor	PIC
Social Mitiga-tion Measures post construc-tion	Entire pro-ject	Maximize opportunities for employment and services among local populations	Operation phase	$2,500	$18,500	MoEE	MoEE/ MoNREC
	Entire pro-ject	Ensure continuing compli-ance with relevant provision of all applicable Plans until Closeout	Operation phase	$0	$0	MoEE	MoEE/ MoNREC
	Entire pro-ject	Ensure safe and efficient post-Compact/post-Closeout management of project facili-ties	Operation phase	$0	$0	MoEE	MoEE/ MoNREC

9.8 Environmental Monitoring

337. Environmental monitoring includes (i) baseline environmental monitoring; (ii) environmental quality monitoring, (iii) compliance monitoring, to ensure that mitigation specified in the EMP is carried out to an adequate standard, (iv) community feedback to obtain views and information on relevant environmental and social issues. The Environmental Monitoring Plan is summarized in Table 21.

9.8.1 Baseline Environmental Monitoring

338. During the preparation of this EIA Report, it was not possible to collect baseline information on air quality, water quality, and noise because the locations of potentially significant sources of pollution such as haul roads through communities, new access roads, and construction camps were not known. In addition, the locations of sensitive receptors - including residential, education, religious and healthcare sites have not been established. During preconstruction, two monitoring activities need to take place:

i. A survey of sensitive receptors near the transmission line ROWs and the substations; and
ii. Environmental quality monitoring of air quality, water quality, and noise (see Table20).

Table 20. Indicative Environmental Quality Baseline Monitoring Program

Component	Locations	Monitoring method	Monitoring frequency and timing	Monitoring Responsibility
Preconstruction Baseline Monitoring –				
Surface Water Quality	At major water bodies	**Method:** Establish project specific baseline water quality. **Parameters:** Temperature, Suspended particles, BOD, COD, pH, Hydrocarbon	Once Before site preparation	PMU PIC Environmental Monitoring Contractor
Air Quality	At key sensitive receptors - including residential, education, religious and healthcare sites	**Method:** Establish project specific baseline for air quality at key receptors **Parameters:** Suspended particles (dust), NOx, SOx, CO	Once Before site preparation	PMU PIC Environmental Monitoring Contractor
Noise	At key sensitive receptors - including residential, education, religious and healthcare sites along project road.	**Method:** Establish project specific baseline for noise at key receptors **Parameters:** Db(A) at receptors outside and inside. Sampling periods for noise will be undertaken consistent with compared to Myanmar Noise Standards and *World Health Organization (1999) Guidelines on Community Noise.*	Once Before site preparation	PMU PIC Environmental Monitoring Contractor

Table 21 Environmental Monitoring Plan

Table 21a. Environmental Monitoring during Preconstruction							
		Monitoring Events		Cost		Method	Stage
Parameters to be monitored	Monitoring location	A-T	M-Y-D	A-T	M-Y-D		
Pre-Construction Phase							
Survey of Sensitive Receptors	Entire Project	1	1	Tbd	Tbd	Survey of substation and transmission lines	Preconstruction
Environmental Quality Baseline Monitoring (air quality, water quality, noise)	Entire Project	1	1	Tbd	Tbd	Environmental quality monitoring sub-contractor	Preconstruction
Traffic safety	Design office	2	3	$129	$246	Design and traffic parameters	During the design
Accessibility	Design office	2	3	$129	$246	Design and traffic parameters	During the design
Material borrow and disposal areas	Design office	2	3	$129	$246	Permits from responsible authorities	During the design

Table 21b. Environmental Monitoring during Construction							
		Monitoring Events		Cost		Method	Stage
Parameters to be monitored	Monitoring location	A-T	M-Y-D	A-T	M-Y-D		
Construction Phase							
Soil erosion	New cut and fill areas, slopes, and quarries	66	120	$29,680	$54,020	Inspections at site and soil mechanical information	Monthly, or when deemed necessary during and after construction work
Soil contamination	Around areas of plant and machinery operation;	66	120	$11,542	$21,008	Inspection of sites and analysis of soil samples	Monthly, or when deemed necessary during and after construction work

Table 21b. Environmental Monitoring during Construction							
		Monitoring Events		Cost		Method	Stage
Parameters to be monitored	Monitoring location	A-T	M-Y-D	A-T	M-Y-D		
Soil contamination	Oil, chemical and hazardous materials storage areas	66	120	$11,542	$21,008	Inspection of sites and analysis of soil samples	Monthly, or when deemed necessary during and after construction work
Air Quality	Near Sensitive Receptors	Tbd	Tbd	Tbd	Tbd	Environmental Quality Monitoring Sub-contractor	Tbd
Water pollution (pH, color, electrical conductivity, turbidity, suspended solids, oil and grease, total dissolved solids)	In selected water bodies, mainly upstream and downstream of substations	44	80	$50,565	$92,035	Environmental Quality Monitoring Sub-contractor	During construction semi-annually
Noise - Leq (Leq describes sound levels that vary over time as a single decibel value which takes into account the total sound energy over the period of time of interest, usually one hour)	Sensitive Receptors	2	3	$774	$1,476	Environmental Quality Monitoring Sub-contractor	Before construction for baseline;
Noise - Leq	Sensitive Receptors	66	120	$29,680	$54,020	Environmental Quality Monitoring Sub-contractor	Monthly or when deemed necessary during earth, blasting, and pile driving work; on public complaints
Conservation of eco resources, including forests and trees on road sides	Work sites	22	40	$7,695	$14,005	Inspection	When clearing land and restoring used areas
Use of hazardous materials should be monitored to prevent accidents and reduce remedial costs for clean up	Work sites	66	120	$23,084	$42,016	Accident reports	When accident occurs, and periodically to check storage and handling

Table 21b. Environmental Monitoring during Construction							
		Monitoring Events		Cost		Method	Stage
Parameters to be monitored	Monitoring location	A-T	M-Y-D	A-T	M-Y-D		
Vehicle and pedestrian safety	At and around work sites in populated areas, and along roads used to move materials to project sites	66	120	$11,542	$21,008	Inspection on visibility and appropriateness	Once per month
Worker safety (protective equipment)	At work sites	17	33	$3,012	$5,738	Inspection	Unannounced inspections during work
Overall workers' camp site conditions	At the camp site during construction activities	6	10	$1,020	$1,780	Inspection	Annually or according to the existing regulations
Number of trainings on TIP by Contractor for their workforce	At the camp site where training takes place	6	10	$2,040	$3,560	Training report and training attendance sheet signed by participants	Annually or according to the existing regulations
Number of participants in the road safety trainings for women and children	At the camp site where training takes place	6	10	$1,603	$2,797	Training report and training attendance sheet signed by participants	Annually or according to the existing regulations
Before, during, and after Construction							
Social Impacts:	Construction sites in residential and business areas	9	13	$4,518	$7,032	Public consultation surveys with PAPs to monitor each of the parameters mentioned	Pre-construction phase and continue until completion of construction and 3 months after construction

Table 21c. Environmental Monitoring during Operation							
		Monitoring Events		Cost		Method	Stage
Parameters to be monitored	Monitoring location	A-T	M-Y-D	A-T	M-Y-D		
Bird Protection	At major bird migration corridors where lines cross major water courses	33	50	$11,542	$17,508	Obtain evidence of bird fatalities from local people	Every two months
ROW maintenance	Along forested areas of the transmission lines	6	8	$2,040	$2,860	Visual inspection of ROW, and discussions with local authorities and CFs	Annually
Inspect tower pads and other infrastructure for erosion	At all towers, bridges, roads	235	3610	$15,275	$234,650	Visual inspection of all towers and other infrastructure. Assume 5 towers inspected per work day	Annually

9.9 EMP Implementation Costs

339. EMP implementation costs include costs associated directly with the physical mitigation of project environmental and social impacts and the costs associated with the administration and management of the environmental and social programs associated with project implementation.

340. **Total Cost**. The total cost of implementing the EMP is shown in Table 22. These are estimates based on the best information available at this time. These estimates will be reviewed and revised during the development of the final design.

Table 22 Total Estimated Costs for Environmental Management of the Project

Item	Cost
Mitigation Measures	
Contractor – built into construction contracts	$2,863,832
Tree Removal Compensation	$251,731
UXO Clearance	$664,500
Subtotal	**$3,780,063**
Monitoring	
Supervision and Monitoring – Environment (Project Implementation Consultant cost)	$473,800
Suggested Budget for Environmental Quality Monitoring	$175,000
Institutional Strengthening, Training and Capacity Building	$100,000
Subtotal	**$748,800**
Total Cost of EMP Implementation	**$4,528,863**

341. **Environmental Supervision**. Environmental supervision costs include oversight supervision, institutional strengthening, training and capacity building, technical assistance to DPTSC's environmental unit and undefined impacts such as special provisions for chance find processing. These costs are detailed in Table 23.

Table 23 Budget for Environmental Supervision by Project Implementation Consultant.

Item	Units	No. of Units	Unit Cost	Cost
1. Consultants:				
a. Remuneration and PerDiem	person-months			
International Consultants		10	24,000	**240,000**
National Consultants		20	9,000	**180,000**
b. International Air Travel	trips	7	5,000	**35,000**
c. Domestic Air Travel	trips	20	400	**8,000**
2. Training and Capacity Development	Lump sum	1	100,000	**100,000**
3. Environmental Monitoring Studies and Surveys	Lump sum	5	35,000	**175,000**
4. Car Rental	months	18	600	**10,800**
TOTAL				**748,800**

342. **Cost Estimates for Each Transmission Line**. The total cost estimated project environmental mitigation and monitoring costs (inclusive of access roads and substations) for each transmission line are provided in Table 24.

Table 24. Environmental Mitigation and Monitoring Costs by Transmission Line

Project:	Environmental Mitigation Cost (USD)	Environmental Monitoring Cost (USD) (over full construction time)	Total Environmental Costs (USD)
Ahlone-Thida Line (Dala)	$429,197	$199,921	$629,118
Mawlamyine–Ye–Dawei line	$3,350,866	$548,879	$3,899,745
Total	***$3,780,063***	***$748,800***	***$4,528,863***

10 CONCLUSION AND RECOMMENDATIONS

343. The Project will provide much-needed stability to Myanmar's electric infrastructure, thereby helping the country's development. Careful assessment of potential environmental and social impacts reveals that the projects can be built and operated in a manner that will not result in significant environmental and social impacts, assuming the application, monitoring and enforcement of the Environmental Management Plan included in this EIA.

344. Two rounds of public consultation meetings with over 700 attendees (27% women) in townships and villages along the transmission lines resulted in a clear indication that people are supporting the project and want it to proceed as fast as possible. Concerns about the timing of construction and possible impacts to the communities were raised, which indicates the need for a comprehensive and robust EMP to be implemented. Consultation also took place with concerned agencies and local government officials, especially ECD and Forest Department of MoNREC.

345. Key elements of the environmental management of the Project are:

- Contractor's are to prepare a Contractor's Environmental Management Plan based on the EMP;
- Design and construction should avoid crossing or impacting forests, to the extent possible consistent with technical requirements of the transmission lines. This is especially important on the Mawlamyine-Ye-Dawei line, where rerouting of the proposed line to avoid crossing the Mawlamyine KBA and encroaching on the Tanintharyi Nature Reserve buffer zone are recommended and are considered part of the preferred alternative.
- Bird diverters should be incorporated every 25 meters on conductors at river crossings and where the transmission lines closely parallels a major river;
- Replanting of trees that are felled in the ROW should be done in accordance with Forest Department requirements which may require payment of a fee. It is recommended that 2 trees be planted for every tree that is removed, or as directed by the Forest Department;
- For the Mawlamyine-Ye-Dawei line it is recommended that DPTSC obtain clearance from UXO authorities (or NGOs) to ensure that the construction and operation of the line will not result in mine casualties;
- Health and safety problems exist at substations and for the Project as a whole. These need to be addressed through development of written health and safety and Emergency Response Plans to be developed by the Contractors;
- The Public Consultation Process should continue throughout the design, construction, operation, and decommissioning phases of the project. Affected people and other stakeholders should be given an opportunity to continue to provide inputs to DPTSC during project implementation.

346. **Conclusion**. Assuming that mitigation measures and monitoring requirements in the Environmental Management Plan are effectively implemented, the project is not expected to have a significant adverse environmental impact.