ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

FOR

200 MW COMBINED CYCLE POWER PLANT (Kanbauk)

Myanmar UPA Company Limited.

Revised Version-01

August 2024

MYANMAR UPA

Myanmar UPA Company Limited
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Date : 31-7-2024

Commitment to follow Environmental Conservation Law, Rules, Standards and Mitigation and Management Measures Stated in the Environmental Impact Assessment (EIA) Report

With regard to the above matter,

We, Myanmar UPA Company Limited, strongly commits that this EIA for our project has been carried out on works associated with 200 MW Combined Cycle Power Plant located in Kanbauk Village, Yebyu Township, Dawei District, Tanintharyi Region, Myanmar. By abiding with current rules and regulations, our organization firmly pledges to perform all operations in an environmentally sustainable manner by following Environmental Conservation Law 2012, Environmental Conservation Rules 2014, and relevant environmental standards through successful implementation of mitigation measures, Environment Management Plan (EMP), and Environmental Monitoring Plan (EMoP) stated in this EIA Report.

31/7/24

Managing Director (For)

(Daw Khine Wint Mon, Director & Country Manager)

Myanmar UPA Company Limited

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Commitment to follow and compliance with Environmental Conservation Law, Rules, Environmental Impact Assessment Procedure, National Environmental (Quality) Emission Guidelines and Other Relevant Environmental Standards To Prepare EIA Report

With Regard to the above matter,

E Guard Environmental Services has prepared the Environmental Impact Assessment (EIA) Report for 200 MW Combined Cycle Power Plant which is located in Kanbauk Village, Yebyu Township, Dawei District, Tanintharyi Region, Myanmar. Our company strongly commits that this EIA report has been prepared by following Environmental Conservation Law (2012), Environmental Conservation Rules (2014), Environmental Impact Assessment Procedure (2015), National Environmental Quality (Emission) Guidelines (2015) and other relevant environmental standards.

Aye Thiha
Managing Director
E guard Environmental Services

E Guard Environmental Services

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Third Party

E Guard Environmental Services Co.,Ltd

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List of Abbreviations

Full Name	Acronym
Myanmar UPA Company limited	MUPA
Combined Cycle Power Plant	CCPP
Initial Environmental Examination	IEE
Environmental and Social Impact Assessment	ESIA
Environmental Management Plan	EMP
Environmental Monitoring Plan	EMOP
Myanmar Investment Commission	MIC
E Guard Environmental Services Co., Ltd.	E Guard
Environmental Resources Management	ERM
Sustainable Environment Myanmar	SEM
Environmental Conservation Department	ECD
Ministry of Natural Resources and Environmental Conservation	MONREC
Myanma Oil and Gas Enterprise	MOGE
Electric Power Generation Enterprise	EPGE
Ministry of Electric Power	MOEP
Ministry of Electricity and Energy	MOEE
Government of Myanmar	GOM
Independent Power Producer	IPP
Memorandum of Agreement	MOA
Power Purchase Agreement	PPA
Operation and Maintenance	O & M
Long-Term Service Agreement	LTSA
International Union for Conservation of Nature	IUCN
Area of Influence	AOI

Full Name	Acronym
United Kingdom Department for Environment, Food and Rural Affairs	DEFRA
Gross Domestic Product	GDP
Asian Development Bank	ADB
World Bank Group	WBG
United Nations Framework Convention on Climate Change	UNFCC
United States Environmental Protection Agency's Criterion Continuous Concentration	USEPA CCC
Regional Screening Levels	RSL
Total Dissolved Solids	TDS
Scheduled Commercial Operation Date	SCOD
Engineering & Procurement Contractor	EPC
Particulate Matter under 10 micrometers diameter	PM_{10}
Particulate Matter under 2.5 micrometers diameter	$PM_{2.5}$
Nitrogen dioxide	NO_2
Sulphur dioxide	SO_2
Carbon dioxide	CO_2
Carbon monoxide	CO
Percentage	%
Gallons	gals
Kilogram	kg
microgram per meter cubed	$\mu g/m^3$
Degree Celsius	°C
Volatile organic compounds	VOCs
Green House Gas	GHG
Noise Sensitive Receivers	NSRs
Weather Research and forecasting Model	WRF

Full Name	Acronym
National Environmental Quality (Emission) Guideline	NEQG
Total Suspended Particulate	TSP
milligram per liter	mg/l
Parts per million	ppm
Decibels	dB
High Pressure	HP
Low Pressure	LP
Nephelometric Turbidity Units	NTU
True Color Unit	TCU
Build-Operate-Transfer	BOT
Health and Safety Executive	HSE
World Health Organization	WHO
Non-government Organization	NGO
International Finance Corporation	IFC
Standard Operation Procedure	SOP
Key Biodiversity Areas	KBAs
Corporate Social Responsibility	CSR
Environmental, Health and Safety Guidelines	EHSG
Continuous Emission Monitoring Systems	CEMS
Gas Turbine	GT
Diesel Generator	DG
Steam Turbine and Generator	STG
Heat Recovery Steam Generator	HRSG
Emergency Diesel Generator	EDG
Million standard cubic feet per day	mmscfd

အကျဉ်းချုပ်အစီရင်ခံစာ

၁.၁။ နိဒါန်း

ဤပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (ESIA) အစီရင်ခံစာသည် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ၊ တနင်္သာရီတိုင်းဒေသကြီး၊ ရေဖြူမြို့နယ်၊ ကံပေါက်ကျေးရွာတွင် တည်ရှိမည့် အဆိုပြု ၂၀၀ မဂ္ဂါဝပ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ(စီမံကိန်း)နှင့် စီမံကိန်း အဆောက်အအုံများနှင့် ဆက်စပ်နေသည့် ဖြစ်နိုင်ခြေရှိသည့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်ခြင်းကို တင်ပြထားပါသည်။

ဤအစီရင်ခံစာသည် Myanmar UPA Company Limited (စီမံကိန်းဖော်ဆောင်သူ (သို့) 'MUPA') အတွက် E Guard Environmental Services Co., Ltd. မှ ပြန်လည်ပြင်ဆင်၍ ရေးသားခဲ့ပြီး ရည်ရွယ်ချက်များ၊ နည်းလမ်းများနှင့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုဆန်းစစ်ခြင်း ရလဒ်များကို တင်ပြထားပါသည်။ ယခုအစီရင်ခံစာအား E Guard Environmental Services Co., Ltd. မှ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ ၂၀၂၄ ခုနှစ်၊ မတ်လ၊ (၆) ရက်စွဲပါ၊ စာအမှတ်၊ EIA-၂/၉ (TP-အတည်ပြု) (၁၀၈၉/၂၀၂၄) တတိယအဖွဲ့အစည်းနှင့် ပါဝင်ဆောင်ရွက်မည့် ပညာရှင်ပုဂ္ဂိုလ်များစာရင်း ခွင့်ပြုချက် (Annex-B) နှင့်အညီ ပြန်လည်ပြင်ဆင်ခဲ့ပါသည်။ ယခင်ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအား Environmental Resources Management ('ERM') နှင့် Sustainable Environmental Myanmar ('SEM') မှ ရေးသားပြီး ဇွန်၊ ၂၀၁၇ တွင် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ တင်ပြခဲ့ပါသည်။

၁.၂။ စီမံကိန်းနောက်ခံဖော်ပြချက်နှင့် သုံးသပ်ချက်များ

၂၀၁၄ခုနှစ်၊ ဩဂုတ်လတွင် ရေးထိုးသော သဘောတူညီမှုစာချွန်လွှာနှင့် ၂၀၁၆ခုနှစ်၊ မတ်လတွင် ချုပ်ဆိုသော လျှပ်စစ်ဓာတ်အားဝယ်ယူရေး စာချုပ်များအရ အဆိုပြုသူသည် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ၏ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန (လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန၏ Predecessor) မှ လွတ်လပ်သော လျှပ်စစ်ဓာတ်အားထုတ်လုပ်သူ (IPP) အဖြစ် ကံပေါက်မြို့နယ်တွင် စီမံကိန်း အကောင်အထည်ဖော်ဆောင်ရွက်ရန် အတည်ပြုပြီးဖြစ်ပါသည်။ စီမံကိန်းတွင် အောက်ဖော်ပြပါ စီမံကိန်းအဆောက်အအုံများ ပေါင်းစပ်ပါဝင်ဖွဲ့စည်းမည်ဖြစ်ပါသည်။

- ၂၀၀ မဂ္ဂါဝပ်လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ
- ရေသန့်စင်စနစ်ပါဝင်သည့် ရေတင်ဌာန
- ရေသွယ်ပိုက်လိုင်းနှင့်
- MOGE သဘာဝဓာတ်ငွေ့ လက်ခံထိန်းဖြန့်စခန်းရှိ ဖိအားထိန်းချုပ်ရေး စခန်းနှင့် ဖိအားထိန်းချုပ်ရေး စခန်းမှ ဓာတ်အားပေးစက်ရုံသို့ သွယ်တန်းထားသည့် ဓာတ်ငွေ့ထောက်ပံ့ရေး ပိုက်လိုင်း

ကမ်းလွန်ဓာတ်ငွေ့သိုက်မှ MOGE ဓာတ်ငွေ့လက်ခံရေးဌာနသို့ သွယ်တန်းထားသည့် MOGE ၏ ဓာတ်ငွေ့ပိုက်လိုင်းနှင့် စီမံကိန်းနယ်မြေမှ မဟာဓာတ်အားလိုင်းသို့ သွယ်တန်းသွားသည့်

လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန၏ ဓာတ်အားခွဲရုံသို့ သွယ်တန်းထားသည့် အဆိုပြုဓာတ်အားလိုင်းသည် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း နယ်ပယ်နှင့် သက်ဆိုင်ခြင်းမရှိပါ။

စီမံကိန်း၏နည်းပညာသည် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုနည်းပါးသည့် ထိရောက်သော လုပ်ငန်းလည်ပတ်မှုနှင့် အမြင့်မားဆုံးသော ယုံကြည်စိတ်ချရမှုအတွက် ဒီဇိုင်းရေးထားသော ပေါင်းစပ်ဓာတ်အားထုတ်လုပ်ရေး၏ ထိရောက်သောပုံစံမျိုးဖြစ်ပါသည်။

စီမံကိန်းသည် ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်းမှ ပံ့ပိုးသည့် သဘာဝဓာတ်ငွေ့ (သို့မဟုတ်) LNG ကဲ့သို့ အခြားအရင်း အမြစ်တစ်ခုအား ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်းမှ ပံ့ပိုးမည့် သဘာဝဓာတ်ငွေ့ ပမာဏရရှိမှု အပေါ်မူတည်၍ လောင်စာအဖြစ် အသုံးပြုလည်ပတ်မည်ဖြစ်ပြီး MUPA အနေဖြင့် Development Plan အား ပြည်လည်ပြင်ဆင်သွားမည်ဖြစ်ပါသည်။

လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်ရေးလုပ်ငန်း (EPGE) နှင့် သဘောတူညီထားသည့် အနှစ် (၃၀) လျှပ်စစ်ဓာတ်အားဝယ်ယူရေး သဘောတူညီချက်အရ ထုတ်လုပ်ရရှိသော လျှပ်စစ်ဓာတ်အား ပမာဏအား ရောင်းချမည် ဖြစ်ပါသည်။ စုစုပေါင်း စီမံကိန်းကုန်ကျစရိတ်မှာ ခန့်မှန်းခြေ ဒေါ်လာသန်း ၃၀၀ ဖြစ်ပါသည်။

၁.၃။ စီမံကိန်းလိုအပ်ချက်

ကြီးထွားလာသော GDP နှင့်အတူ မြန်မာနိုင်ငံ၏လျှပ်စစ်ဓာတ်အား လိုအပ်ချက်သည် ယခုနှစ်ပိုင်းတွင် အလွန်တရာ တိုးမြင့်လာပါသည်။ ၂၀၁၂ခုနှစ် အောက်တိုဘာလတွင် ADB သည် မြန်မာနိုင်ငံ၏ စွမ်းအင်ကဏ္ဍနှင့် သက်ဆိုင်သည့် အစီရင်ခံစာတစ်စောင်အား ထုတ်ပြန်ခဲ့ပါသည်။ ထိုအစီရင်ခံစာတွင် အနာဂတ်လျှပ်စစ်ဓာတ်အားလိုအပ်ချက်မှာ ၂၀၁၂-၂၀၁၃တွင် ၁၂၄၅၉ kWh သန်း နှစ်ဆဖြစ်လာမည်ဟု ခန့်မှန်းထားပြီး ၂၀၁၈-၂၀၁၉တွင် ၂၅၆၈၃ kWh သန်းဖြစ်လာလိမ့်မည်ဟု ခန့်မှန်းထားပါသည်။

၂၀၁၃ခုနှစ် ဇူလိုင်လမှစတင်၍ မြန်မာနိုင်ငံ၏ လျှပ်စစ်ဓာတ်အားသည် ရေအားလျှပ်စစ်၊ သဘာဝ ဓာတ်ငွေ့နှင့် ကျောက်မီးသွေးမှ အဓိကထုတ်လုပ်ရရှိ၍ စုစုပေါင်း လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေး၏ ၇၀ရာခိုင်နှုန်း၊ ၂၂ရာခိုင်နှုန်းနှင့် ၃ရာခိုင်နှုန်း အသီးသီးရှိပါသည်။ စုစုပေါင်းသိုလှောင်ထားသည့် ပမာဏ ၃၇၃၅ မဂ္ဂါဝပ်မှ ၈၃၅ မဂ္ဂါဝပ်ခန့်သည် သဘာဝဓာတ်ငွေ့လောင်ကျွမ်း၍ စွမ်းအင်ထုတ်လုပ် ခြင်းမှ ရရှိပါသည်။ ခြောက်သွေ့ရာသီတွင် ရေပြတ်လပ်မှုကြောင့် ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးသည် စွမ်းအား အပြည့်အဝ လည်ပတ်နိုင်ခြင်း မရှိသေးပါ။ ထို့ကြောင့် လျှပ်စစ်ဓာတ်အားထောက်ပံ့ရေးသည် ထိုအချိန်အတွင်း ပုံမှန်မရှိပေ။

စီမံကိန်းသည် တိုင်းပြည်၏ ရေအားလျှပ်စစ်ပေါ်မှီခိုနေရမှုကို လျှော့ချရန် သဘာဝဓာတ်ငွေ့သုံး စွမ်းအင်ထုတ်လုပ်ခြင်းအား စုစုပေါင်း ထုတ်လွှတ်မှုအရောအနှောတွင် ၅၀ ရာခိုင်နှုန်းကျော် တိုးမြင့်မည့် လာမည့်နှစ်များတွင် သဘာဝဓာတ်ငွေ့လောင်ကျွမ်း၍ စွမ်းအင်ထုတ်လုပ်ခြင်း၏ ၁၇၄၀

မဂ္ဂါဝပ်ကို ထည့်ပေါင်းခြင်းဖြင့် မြန်မာနိုင်ငံ၏ကြိုးပမ်းအားထုတ်မှုနှင့်အတူတူ ရင်ဘောင်တန်း ဆောင်ရွက်မည်ဖြစ်ပါသည်။

၁.၄။ စီမံကိန်း

စီမံကိန်းဖော်ဆောင်သူသည် ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်၊ တနင်္သာရီတိုင်းဒေသကြီး၊ ရေဖြူမြို့နယ်တွင် ၂၀၀ မဂ္ဂါဝပ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံအား အကောင်အထည်ဖော် ဆောင်ရွက်ရန် စီစဉ်လျက်ရှိပါသည်။

၁.၄.၁။ စီမံကိန်းတည်နေရာ

စီမံကိန်းတည်နေရာသည် ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်၊ တနင်္သာရီတိုင်းဒေသကြီး၊ ထားဝယ်ခရိုင်၊ ရေဖြူမြို့နယ်၊ ကံပေါက်ကျေးရွာအုပ်စုတွင် တည်ရှိပါသည်။

ပုံ ၁.၁ စီမံကိန်းတည်နေရာ

လျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် စုစုပေါင်း ၉.၄၇ ဟက်တာ အကျယ်အဝန်းရှိသည့် စက်ရုံမြေနေရာတွင် တည်ရှိပါသည်။ ထိုမြေနေရာသည် ယခင်က လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်ရေးလုပ်ငန်း (EPGE) ပိုင်နေရာဖြစ်ပါသည်။ သို့သော် ၎င်းမြေနေရာအား စီမံကိန်းအတွက်

အသုံးပြုရန်လျာထားပြီး စီမံကိန်းအဆိုပြုသူနှင့် EPGE တို့သည် မြေငှားရမ်းသည့် သဘောတူညီချက်ချုပ်ဆိုရန် ဆောင်ရွက်လျက်ရှိပါသည်။

အောက်ဖော်ပြပါ ကျေးရွာ ၁၀ ရွာသည် စီမံကိန်းနှင့် အနီးတဝိုက်တွင် တည်ရှိပါသည်။ (စီမံကိန်းနေရာနယ်နိမိတ်မှ အချင်း ၅ ကီလိုမီတာ)

- မိချောင်းအိုင်ကျေးရွာ
- လှည်းကုန်းကျေးရွာ
- ကံပေါက်ကျေးရွာ
- အုန်းပင်ကွင်းကျေးရွာ
- ဟိန်းဇဲကျေးရွာ
- ရှင်ပုံကျေးရွာ
- ဖက်တောင်ကျေးရွာ
- ပြင်ကြီးကျေးရွာ
- ဂန့်ဂေါတောင်ကျေးရွာနှင့်
- ရေငံကျေးရွာ တို့ဖြစ်ကြပါသည်။

ဟိန်းဇဲမြစ်ရှိရေသန့်စင်မှုစနစ်ပါဝင်သည့် ရေတင်ဌာနအဆောက်အအုံ တည်ဆောက်မည့်နေရာသည် စီမံကိန်းနယ်မြေ၏ အနောက်မြောက်ဘက် (၃) ကီလိုမီတာခန့် တွင်တည်ရှိပါသည်။

၁.၄.၂။ စီမံကိန်းအဆောက်အအုံများ

စီမံကိန်း အဆောက်အအုံများနှင့် ဆက်စပ် အဆောက်အအုံများမှာ အောက်ဖော်ပြပါအတိုင်းဖြစ်ပါသည်။ ဧရိယာစုစုပေါင်း၏ ၉.၄၇ ဟက်တာခန့်ကို စီမံကိန်း အဆောက်အအုံများ တည်ဆောက်ရန်အတွက် လျာထားပါသည်။

- ၂၀၀ မဂ္ဂါဝပ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် အောက်ဖော်ပြပါ အစိတ်အပိုင်းများနှင့်ပေါင်းစပ်ဖွဲ့စည်းထားပါသည်။
    - ဓာတ်ငွေ့တာဘိုင် ၃ စုံ
    - စွန့်ပစ်အပူသုံး လျှပ်စစ်ဓာတ်အားပေးစက် (HRSG) ၃ စုံ
    - ရေနွေးငွေ့သုံး ဓာတ်အားပေးတာဘိုင် ၁ လုံးနှင့် ၎င်းနှင့် ဆက်စပ်လျက်ရှိသည့် အကူကိရိယာများ
    - ၂၃၀ ကေဗွီဓာတ်အားခွဲရုံနယ်မြေ (၆၆ ကေဗွီဓာတ်အားခွဲရုံနယ်မြေ အနီးတဝိုက်တွင် တည်ရှိသည်။)
    - အလုပ်ရုံ/သိုလှောင်ရုံနှင့် အုပ်ချုပ်ရေးအဆောက်အအုံ
    - အအေးခံတာဝါ နှင့် ရေအအေးခံစနစ်
    - ရေသိုလှောင်ကန် နှင့်
    - ဝန်စည်အတင်အချ ဧရိယာ
- ဟိန်းဇဲမြစ်တွင်းမှ ရေများကိုရယူပြီး ယင်းမြစ်နဖူးတွင် တည်ရှိမည့် လုပ်ငန်းသုံးရေရယူစုပ်တင်သည့်စခန်းမှတဆင့် အဆိုပြုစီမံကိန်းသို့ သွယ်တန်းထားသော ရေသယ်ယူသည့်ပိုက်လိုင်းသည် ၃.၃ ကီလိုမီတာခန့်ရှည်လျား၍ ၃၀ စင်တီမီတာခန့် အချင်းရှိပါသည်။

- MOGE သဘာဝဓာတ်ငွေ့ လက်ခံထိန်းဖြန့်စခန်းရှိ ဖိအားထိန်းချုပ်ရေး စခန်းနှင့် ဖိအားထိန်းချုပ်ရေး စခန်းမှ ဓာတ်အားပေးစက်ရုံသို့ သွယ်တန်းထားသည့် ဓာတ်ငွေ့ထောက်ပံ့ရေး ပိုက်လိုင်းကို စီမံကိန်း အဆိုပြုသူမှ ပိုင်ဆိုင်ပါသည်။ ဓာတ်ငွေ့ထောက်ပံ့ရေးပိုက်လိုင်းသည် ၂.၆ ကီလိုမီတာခန့်ရှည်လျား၍ အချင်း ၂၅ စင်တီမီတာခန့်ရှိပါသည်။

၂၀၀ မဂ္ဂါဝပ်လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ

လျှပ်စစ်ဓာတ်အားပေးစက်ရုံအား စဉ်ဆက်မပြတ်လည်ပတ်နိုင်စေရန် ပေါင်းစပ်သည့်နည်းဖြင့် ဒီဇိုင်းရေးဆွဲထားပါသည်။ ပုံမှန် ပေါင်းစပ်လည်ပတ်နေစဉ် ထွက်ရှိလာသည့် အပူသည် အလွန်ပူပြင်းသည့် ရေနွေးငွေ့ထုတ်လုပ်ပြီး လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ပေးရန် ရေနွေးငွေ့ တာဘိုင်အား မောင်းနှင်မည့်စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ဓာတ်အား ထုတ်လုပ်သည့် စက်ထဲသို့ ဝင်ရောက်စေမည်ဖြစ်ပါသည်။ စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ဓာတ်အား ထုတ်လုပ်သည့် စက်မှထွက်ရှိလာသောဓာတ်ငွေ့သည် စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ဓာတ်အား ထုတ်လုပ်သည့် စက်၏အဓိက မီးခိုးခေါင်းတိုင်မှ လေထုထဲသို့ ထုတ်လွှတ်မည်ဖြစ်ပါသည်။ လျှပ်စစ်ဓာတ်အားပေး စက်ရုံသည် အချိန်တော်တော်များများအတွက် စွမ်းအားပြည့် လည်ပတ်နိုင်လိမ့်မည်ဟု မျှော်မှန်း ထားပါသည်။

စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ ဓာတ်အားပေးစက်သည် ဓာတ်ငွေ့တာဘိုင်၏ စွန့်ပစ်ဓာတ်ငွေ့များမှ ပို့ဆောင်ပေးသည့် စွမ်းအင်ကို အများဆုံးဖြစ်အောင်ပြုလုပ်ရာတွင် အသုံးပြုသည့် စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ လျှပ်စစ်ထုတ်လုပ်ခြင်း (ဖိအားမြင့်နှင့် ဖိအားနိမ့်) နှင့်အတူ ဖိအားနှစ်မျိုးအတွက် ဒီဇိုင်း ပြုလုပ်ထားပါသည်။ စွန့်ပစ်အပူသုံး ရေနွေးငွေ့ ဓာတ်အားထုတ်ထုပ်သည့် စက်မှထုတ်လုပ်သော ဖိအားမြင့်ရေနွေးငွေ့အား ဖိအားမြင့်ရေနွေးငွေ့ တာဘိုင်သို့ ပို့ဆောင်ပြီးထွက်ရှိလာသည့် အပူနှင့် ဖိအားနိမ့်ရေနွေးငွေ့အား ဖိအားနိမ့်ရေနွေးငွေ့ တာဘိုင်သို့ ပို့ဆောင်ပါသည်။

ပေါင်းစပ်လည်ပတ်နေစဉ် အသားတင် လျှပ်စစ်ဓာတ်အားထုပ်လုပ်မှုသည် ၂၀၀ မဂ္ဂါဝပ် ဖြစ်ပါသည်။ ဓာတ်အားပေးစက်ရုံသည် သဘာဝဓာတ်ငွေ့ (သို့မဟုတ်) LNG အား ၎င်း၏ လောင်စာအဖြစ် အသုံးပြုပါသည်။

ရေအအေးခံစနစ်

စီမံကိန်းအတွက် Mechanical Draft Cooling Tower စနစ်ကို ရွေးချယ်ထားပါသည်။ အဓိက ရေအအေးခံသည့် စနစ်သည် ရေအေးကို ရေနွေးငွေ့တာဘိုင် ငွေ့ရည်ဖွဲ့ကိရိယာသို့ အအေးခံ တာဝါဘေစင်တွင် တပ်ဆင်ထားသည့် ရေအေးပန့်များဖြင့် ထည့်ပေးပါလိမ့်မည်။ ငွေ့ရည်ဖွဲ့ ကိရိယာမှ ရေပူများသည် အကန့်များစွာပါဝင်သော စက်မှုစွမ်းအင်သုံး လေမှုတ်အအေးခံတာဝါသို့ ပြန်လည်ရောက်ရှိပြီး ၎င်း၌အအေးခံခြင်း ပြုလုပ်ပြီးနောက် အအေးခံတာဝါ ဘေစင်၌ စုဆောင်း ပြီးမှ ငွေ့ရည်ဖွဲ့ကိရိယာ အေးစေရန်အတွက် ပြန်လည်ပို့လွှတ်ခြင်းခံရသည့် စနစ်ဖြစ်ပါသည်။

ရေစနစ်

ရေယူမည့်စနစ်တွင် ရေတင်ဌာန၊ ရေသန့်စင်သည့်စက်၊ ရေသွယ်ပိုက်လိုင်းနှင့် ရေသိုလှောင်ကန်တို့ပါဝင်ပါသည်။ ရေတင်ဌာနနှင့် ရေသန့်စင်စက်များကို ပြင်ကြီးကျေးရွာတွင် တပ်ဆင်တည်ဆောက်မည်ဖြစ်ပါသည်။

ဟိန်းဇဲမြစ်မှ မြစ်ရေကို ရေတင်ဌာနကိုအသုံးပြု၍ ၈၆၀ m^3/hour ရေစီးနှုန်း ဖြင့်ယူဆောင်မည်ဖြစ်ပါသည်။ ရရှိလာသောရေကို ဟိန်းဇဲမြစ်ကမ်းတွင် တပ်ဆင်ထားသည့် Reverse Osmosis စနစ်သုံး ရေသန့်စင်စက်ကို အသုံးပြု၍ သန့်စင်ပါမည်။

သန့်စင်ပြီးသောရေကို စီမံကိန်းနေရာသို့ အချင်း၃၀ စင်တီမီတာ ရှိပြီး အရှည် ၃.၃ ကီလိုမီတာရှည်သည့် ရေပိုက်လိုင်းမှတဆင့် ပို့ဆောင်မည်ဖြစ်ပြီး စီမံကိန်းနေရာတွင် တည်ရှိသည့် ရေသိုလှောင်ကန်တွင် သိုလှောင်ထားမည် ဖြစ်ပါသည်။ အဆိုပြု ရေပိုက်လိုင်းသည် ရေသန့်စက်မှ စီမံကိန်းနေရာရှိ ရေသိုလှောင်ကန်အထိ သွယ်တန်းထားမည် ဖြစ်ပါသည်။ ရေပိုက်လိုင်းကို တည်ရှိဆဲ ကားလမ်းတစ်လျှောက် တပ်ဆင်မည် ဖြစ်ပါသည်။

ရေသိုလှောင်ကန်၏ သိုလှောင်နိုင်စွမ်းမှာ ၃၀၀၀၀ ကုဗမီတာခန့်ဖြစ်ပြီး အရေးပေါ်မီးငြိမ်းသတ်စနစ်အပါအဝင် စက်ရုံ၏သုံးရက်တာ ရေသုံးစွဲမှုအတွက် ပြည့်စုံ လုံလောက်စေမည် ဖြစ်ပါသည်။

ထုတ်လွှတ်မှုထိန်းချုပ်ခြင်း

စီမံကိန်းသည် အောက်ဖော်ပြပါ ကိရိယာများဖြင့် တပ်ဆင်အသုံးပြုမည်ဖြစ်ပါသည်။

- အနိမ့်ဆုံး NO_x ခြောက်သွေ့လောင်ကျွမ်းစက်အား NO_x ထုတ်လွှတ်မှုအနိမ့်ဆုံးဖြစ်စေရန် တပ်ဆင်မည် ဖြစ်ပါသည်။
- စဉ်ဆက်မပြတ် ထုတ်လွှတ်မှု စောင့်ကြပ်စနစ်တွင် NO_x ပါဝင်မှုအား ၅၀ မဂ္ဂါဝပ်အထက် သဘာဝဓာတ်ငွေ့သုံး တာဘိုင်များအတွက် IFC EHSG နှင့် NEQEG တို့တွင် သတ်မှတ်ပြဌာန်းထားသော နည်းလမ်းများအတိုင်း စောင့်ကြပ်ကြည့်ရှုရန် တပ်ဆင်မည်ဖြစ်ပါသည်။

၁.၄.၃။ ဆက်စပ်အဆောက်အအုံများ

လက်ရှိတွင် MOGE သဘာဝဓာတ်ငွေ့ လက်ခံထိန်းဖြန့်ရေးစခန်းသည် စီမံကိန်းနေရာမှ အနောက်မြောက်ဘက် ၁.၇ ကီလိုမီတာအကွာတွင် တည်ရှိ၍ ဇောတိက နှင့် ရတနာမှ သဘာဝဓာတ်ငွေ့ကို ရယူနေပါသည်။ စီမံကိန်း ဖိအားထိန်းချုပ်စခန်းသည် MOGE သဘာဝဓာတ်ငွေ့လက်ခံထိန်းဖြန့်ရေးစခန်း နယ်မြေအတွင်းတည်ရှိပါသည်။ သဘာဝဓာတ်ငွေ့ကို ၂.၆ ကီလိုမီတာခန့်ရှည်လျား၍ အချင်း ၂၅ စင်တီမီတာခန့် ရှိသည့် မြေအောက်တွင် မြှုပ်နှံထားသည့် ဓာတ်ငွေ့ထောက်ပံ့ရေး ပိုက်လိုင်းဖြင့် ပို့ဆောင်မည် ဖြစ်ပါသည်။

၁.၄.၄။ စီမံကိန်း လည်ပတ်ပုံ ခြုံငုံသုံးသပ်ချက်

ဤအစီရင်ခံစာ၏ ရည်ရွယ်ချက်အတွက် စီမံကိန်းအား တည်ဆောက်ရေးအဆင့်၊ လည်ပတ်ရေးအဆင့်နှင့် လုပ်ငန်းဖျက်သိမ်းရေးအဆင့်ဟူ၍ အဆင့်သုံးဆင့် ပိုင်းခြားထားပါသည်။

<u>တည်ဆောက်ရေးအဆင့်</u>

တည်ဆောက်ရေးအား ဇူလိုင် ၂၀၂၇ ခုနှစ် နှစ်လည်ပိုင်းတွင် စတင်ရန် လျာထားပြီး လပေါင်း၃၀ အတွင်းပြီးစီးရန်နှင့် စီးပွားဖြစ်လည်ပတ်ရန် ရည်ရွယ်ထားသည့် မတ်လ၊ ၂၀၂၉ ခုနှစ် နှစ်ကုန်ပိုင်းတွင် ပြီးစီးရန် မျှော်မှန်းထားပါသည်။

စီမံကိန်း၏ဆောက်လုပ်ရေးလုပ်ငန်းများတွင် စုစည်းခြင်း၊ လုပ်ငန်းခွင်ရှင်းလင်းခြင်း၊ စီမံကိန်းအစိတ်အပိုင်းအားလုံး၏ ကုန်းတွင်းပိုင်းတည်ဆောက်ရေးနှင့် လုပ်ငန်းဖွဲ့စည်းရေးတို့ ပါဝင်ပါသည်။ စက်ကြီးများဖြစ်သည့် မြေညှိစက်၊ မြေတူးစက်၊ မြေသယ်ကား၊ မြေသိပ်သည်းစက် စသည့်တို့ကို စီမံကိန်းလုပ်ငန်းနေရာတွင် အသုံးပြုသွားမည်ဖြစ်ပါသည်။

EPC ကန်ထရိုက်တာများအား ဆောက်လုပ်ရေး၊ အလုပ်သမားအင်အား ဖြည့်တင်းရေးနှင့် တည်ဆောက်ရေး လုပ်ငန်းများအား ဆောင်ရွက်ရန် အလုပ်ခန့်မည် ဖြစ်ပါသည်။ EPC ကန်ထရိုက်တာများသည် လျှော့ချရေးနည်းလမ်းများ အကောင်အထည်ဖော်ဆောင်ရေး၊ စီမံရေးနည်းလမ်းများနှင့် စီမံကိန်းဖော်ဆောင်သူ၏ စောင့်ကြပ်လေ့လာရေး အစီအစဉ်အောက်တွင် ရှိသည့် ယခုအစီရင်ခံစာတွင် သတ်မှတ်ထားသော စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်များအတွက် တာဝန်ရှိပါသည်။

<u>လည်ပတ်ရေးအဆင့်</u>

လည်ပတ်ရေးအဆင့်အား မတ်လ၊ ၂၀၃၀ ခုနှစ် တွင် စတင်ရန် မျှော်မှန်းထားပါသည်။ စီမံကိန်းအား စီမံကိန်းဖော်ဆောင်သူမှ ပိုင်ဆိုင်လည်ပတ်မည် ဖြစ်ပါသည်။ စီမံကိန်း လည်ပတ်ရေးနှင့် ထိန်းသိမ်းရေးအား ထုတ်လုပ်သူနှင့် ပြည်ပကျွမ်းကျင်ပညာရှင်တို့အတူ ခေတ်ငွေ့တာဘိုင်အတွက် ရေရှည်ဝန်ဆောင်မှု စာချုပ်ဖြင့် စီမံကိန်းဖော်ဆောင်သူမှ လုပ်ကိုင်ဆောင်ရွက်မည် ဖြစ်ပါသည်။ ရေရှည် ဝန်ဆောင်မှုစာချုပ်တွင် အပို အစိတ်အပိုင်းများထောက်ပံ့ခြင်း၊ စောင့်ကြပ်လေ့လာခြင်း၊ ဆောင်ရွက်ခြင်းနှင့် စစ်ဆေးခြင်း၊ အကြီးစားနှင့် အသေးစား ပြင်ဆင်ခြင်းအတွက် အထူးလုပ်သား ခန့်အပ်ခြင်းတို့ အကျုံးဝင်ပါသည်။

အလားတူ စက်ရုံများတွင် သက်ဆိုင်ရာ လည်ပတ်ရေးအတွေ့အကြုံရှိသည့်အပြင် နည်းပညာများတွင် လုံလောက်သည့် ဗဟုသုတ ရှိသည့် စီမံကိန်းလည်ပတ်ရေးနှင့် ထိန်းသိမ်းရေးအလုပ်သမားများအား လုပ်ငန်းမဖွဲ့စည်းခင်တွင် ခန့်ထားအသုံးပြု၍ EPC ကန်ထရိုက်တာဆီမှ စီမံကိန်းအား ထိန်းချုပ်မည်ဖြစ်ပါသည်။

<u>လုပ်ငန်းဖျက်သိမ်းခြင်းအဆင့်</u>

ဤစီမံကိန်းသည် တည်ဆောက်လည်ပတ် လွှဲပြောင်း (BOT) စနစ်ဖြင့် အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ လုပ်ငန်းလည်ပတ်ရေး သက်တမ်းကုန်ဆုံးချိန်တွင် စီမံကိန်းအား လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန (MOEP) သို့ လွှဲပြောင်းသွားမည် ဖြစ်ပါသည်။ သို့သော် ယခုအစီရင်ခံစာ ပြည့်စုံစေရန် ရည်ရွယ်၍ လုပ်ငန်းဖျက်သိမ်းခြင်းအဆင့်အား ယေဘုယျလက်တွေ့အစဉ်အလာ များပေါ် အခြေခံ၍သာ ထည့်သွင်းထားခြင်းဖြစ်ပါသည်။

လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၏ သက်တမ်းမှာ အနှစ်သုံးဆယ် ဖြစ်ပါသည်။ စီမံကိန်း အဆောက်အအုံ များအား ဖျက်သိမ်းရေးအား ထည့်သွင်းစဉ်းစားကာ ဒီဇိုင်း ရေးဆွဲထားပါသည်။ ယေဘုယျအားဖြင့် အဆောက်အအုံနှင့် စက်ယန္တရားများ တစ်ခုချင်းသီးခြားတည်ရှိနိုင်ရန်နှင့် တပ်ဆင်သည့် လုပ်ငန်းစဉ် ပြောင်းပြန်ဖြစ်စေ (သို့) အဆင်ပြေသည့် နည်းလမ်းတစ်ခုဖြင့် ဖြစ်စေ အဆင့်ဆင့်ဖျက်သိမ်းနိုင်ရန် ဒီဇိုင်းထုတ်ရေးဆွဲရပါမည်။ ထို့ကြောင့် လုပ်ငန်းဖျက် သိမ်းရေးအဆင့်လုပ်ငန်းများသည် မြေတူးခြင်းကဲ့သို့ အခြေခံအလုပ်၊ စက်ပစ္စည်းတပ်ဆင်ရေး၊ အဆောက်အအုံ တည်ဆောက်ရေး အဆင့်နှင့် ဆက်စပ်သည့် လုပ်ငန်းစဉ်များ ကဲ့သို့ အလားတူပါသည်။

၁.၅။ အခြားရွေးချယ်စရာနည်းလမ်းများ

အဓိက ဒီဇိုင်းစံချိန်စံညွှန်းနှင့် စီမံကိန်းအမျိုးအစားအား အပြိုင်တင်ဒါလုပ်ငန်းစဉ်ဖြင့် ဖော်ဆောင်ရန် လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနမှ ဆုံးဖြတ်ပါသည်။ ထို့ကြောင့် ၎င်းတို့သည် ယခုအစီရင်ခံစာ၏ လုပ်ကိုင်ခွင့်ထက် ကျော်လွန်ပါသည်။

သို့သော် အခြားရွေးချယ်စရာနည်းလမ်းများ ခွဲခြမ်းစိတ်ဖြာခြင်းအား အောက်ဖော်ပြပါအချက်များ အတွက် ဆောင်ရွက်ခဲ့ပါသည်။

- လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးရွေးချယ်စရာများ
- စီမံကိန်းတပ်ဆင်ရေး ရွေးချယ်စရာများနှင့်
- နည်းပညာဆိုင်ရာရွေးချယ်စရာများတို့ဖြစ်ပါသည်။

စီမံကိန်းနှင့် ပတ်သက်၍ အခြားဆောင်ရွက်နိုင်သောနည်းလမ်းများဆိုင်ရာ အသေးစိတ် ဖော်ပြချက်များကို အခန်း (၄)၊ အပိုဒ်ခွဲ (၄.၅) တွင် ဖော်ပြထားပါသည်။

၁.၆။ အုပ်ချုပ်ရေးဆိုင်ရာမူဘောင်

စီမံကိန်းသည် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ၏ ဥပဒေေရးရာနှင့် အုပ်ချုပ်ရေးဆိုင်ရာ လိုအပ်ချက်များကို လိုက်နာဆောင်ရွက်မည် ဖြစ်ပါသည်။ စီမံကိန်းသည် ပြည်ထောင်စု သမ္မတမြန်မာနိုင်ငံမှပါဝင် လက်မှတ် ရေးထိုးထားသော နိုင်ငံတကာ သဘောတူစာချုပ် များကို လိုက်နာဆောင်ရွက် မည်ဖြစ်သည့်အပြင် အပြည်ပြည်ဆိုင်ရာ ငွေကြေးရန်ပုံငွေအဖွဲ့ စံချိန်စံညွှန်း (IFC PS) (2012) နှင့် အခြားသက်ဆိုင်ရာ လမ်းညွှန်ချက်များကိုလည်း လိုက်နာမည်ဖြစ်ပါသည်။

၁.၆.၁။ မြန်မာနိုင်ငံပြဋ္ဌာန်းဥပဒေများအား သုံးသပ်ခြင်း

နောက်ဆုံးဥပဒေပြုခဲ့သည့် ဖွဲ့စည်းပုံအခြေခံဥပဒေသည် မြန်မာနိုင်ငံ၏ အုပ်ချုပ်ရေးဥပဒေနှင့် ပြဋ္ဌာန်းချက်များနှင့် ပတ်သတ်သည့် သတင်းအချက်အလက်များကို ဖော်ပြပေးပါသည်။ ဖွဲ့စည်းပုံဥပဒေသည် အခြားသော အမျိုးသားဥပဒေ (သို့) အပြည်ပြည်ဆိုင်ရာ သဘောတူညီချက်များထက် ပို၍အရေးကြီးပါသည်။

၂၀၁၈ခုနှစ် မေလတွင် နောက်ဆုံးပြဋ္ဌာန်းခဲ့သည့် ဖွဲ့စည်းပုံအခြေခံဥပဒေသည် မြန်မာနိုင်ငံ၏ အုပ်ချုပ်ရေးဆိုင်ရာဥပဒေ၊ ပြဋ္ဌာန်းချက်များနှင့် ပတ်သတ်သည့် သတင်းအချက်အလက်များကို ဖော်ပြပေးပါသည်။ ဖွဲ့စည်းပုံအခြေခံဥပဒေသည် အခြားသော ပြည်တွင်းဥပဒေ (သို့) အပြည်ပြည်ဆိုင်ရာ သဘောတူညီချက်များထက် ပို၍အရေးပါ ပါသည်။

မြန်မာနိုင်ငံအား အဓိက အုပ်ချုပ်ရေးဆိုင်ရာဌာနခွဲ (၂၁) ခု ခွဲခြားထားပါသည်။

- ပြည်နယ် (၇) ခု
- တိုင်းဒေသကြီး (၇) ခု (အဆိုပါ တိုင်းဒေသကြီးများကို ယခင် ၂၀၁၀ပြည့်နှစ် ဩဂုတ်လ မတိုင်မီက "ခရိုင်များ" အဖြစ် ရည်ညွှန်းထားပါသည်။)
- ကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရဇုန် (၅) ခု
- ကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရ တိုင်းဒေသကြီး (၁) ခုနှင့်
- ပြည်ထောင်စုတစ်ခု

ပြည်နယ်နှင့် တိုင်းဒေသကြီးကို ခရိုင်များအနေဖြင့် ခွဲခြားထားပါသည်။ ခရိုင်တွင် မြို့၊ ရပ်ကွက်နှင့် ကျေးရွာအုပ်စုများဖြင့် ပေါင်းစပ်ဖွဲ့စည်းထားသည့် မြို့နယ်များပါဝင်ပါသည်။ ကျေးရွာအုပ်စုဆိုသည့် အနီးအနားကျေးရွာများအုပ်စုဖြစ်ပါသည်။ ပြည်နယ်များ၊ တိုင်းဒေသကြီးများနှင့် ကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရ ဒေသများ၏ အုပ်ချုပ်ရေးပုံစံကို အခြေခံဥပဒေမှ သတ်မှတ်ပေးပါသည်။

၁.၆.၂။ မြန်မာနိုင်ငံ၏ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လိုအပ်ချက်များ

မြန်မာနိုင်ငံသည် ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအတွက် နည်းဥပဒေလိုအပ်ချက်များကို ၂၀၁၅ခုနှစ် ဒီဇင်ဘာလ ၂၉ရက်နေ့တွင် ထုတ်ပြန်ခဲ့ပါသည်။ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လိုအပ်ချက်များနှင့် သက်ဆိုင်သည့် ဥပဒေများမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- ပတ်ဝန်းကျင်ဆိုင်ရာမူဝါဒ (၁၉၉၄) ၊ Myanmar Agenda 21 (၁၉၉၇) နှင့် အမျိုးသားရေရှည်ဖွံ့ဖြိုးသောမဟာဗျူဟာ (၂၀၁၉)
- ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂)
- ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ (၂၀၁၃)

- နိုင်ငံခြားရင်းနှီးမြှပ်နှံမှုဥပဒေ (၂၀၁၂) ၊ နိုင်ငံခြားရင်းနှီးမြှပ်နှံမှုနည်းဥပဒေ (၂၀၁၃) နှင့် ရင်းနှီးမြှပ်နှံမှုအသိပေးထုတ်ပြန်ချက် (၂၀၁၃)
- ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်း (၂၀၁၅) နှင့်
- အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာ ထုတ်လွှတ်မှုစံချိန်စံညွှန်း လမ်းညွှန်ချက် (၂၀၁၅)

၁.၆.၃။ အပြည်ပြည်ဆိုင်ရာစံချိန်စံညွှန်းများနှင့် လမ်းညွှန်ချက်များ

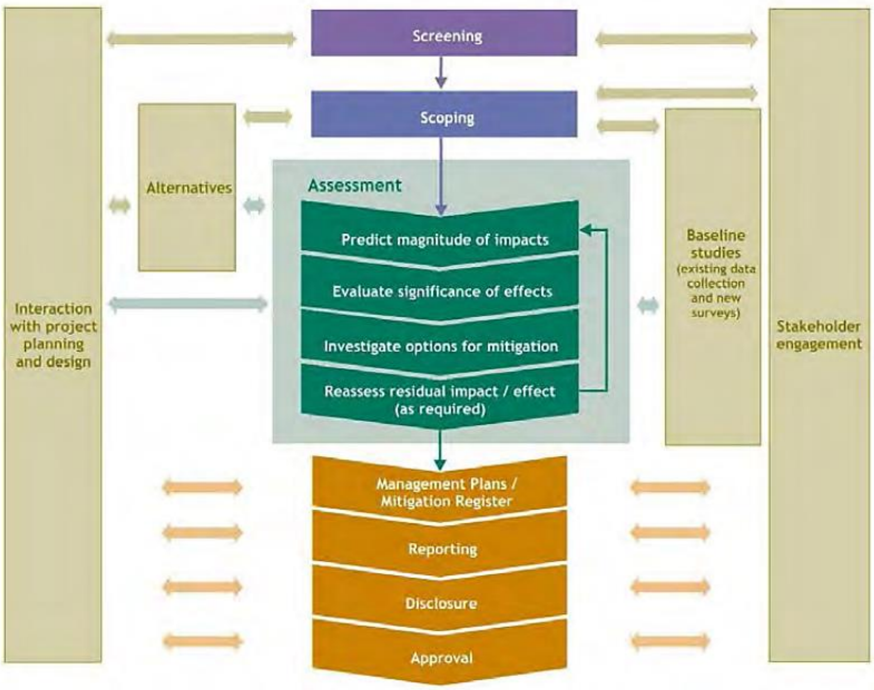
စီမံကိန်းသည် အမျိုးသားဥပဒေများအပြင် ကမ္ဘာ့ဘဏ်အုပ်စု၏လုံခြုံရေးနည်းနာများနှင့် အပြည်ပြည်ဆိုင်ရာငွေကြေးရန်ပုံငွေအဖွဲ့၏ စံချိန်စံညွှန်းများ (IFC PS) အပါအဝင် အပြည်ပြည်ဆိုင်ရာ စံချိန်စံညွှန်းများအား လိုက်နာဆောင်ရွက်မည် ဖြစ်ပါသည်။ ထို စံချိန်စံညွှန်းများသည် အမျိုးသား ဥပဒေအား ပိုမိုပြည့်စုံစေရန်နှင့် အားကောင်းလာစေရန် အပြင်စီမံကိန်းများသည် ဘေးအန္တရာယ်များ နှင့် ထိခိုက်မှုများကို အသေးငယ်ဆုံးလျော့ချရန် သတ်မှတ်ထားသော အကောင်းမွန်ဆုံးသော အလေ့အထများအတိုင်း လိုက်နာဆောင်ရွက်ကြောင်း သေချာစေရန်နှင့်ချမှတ်ထားပါသည်။ အပြည်ပြည်ဆိုင်ရာ ဆောင်ရွက်မှုစံချိန်စံညွှန်းများနှင့် လမ်းညွှန်မှုများသည် ဘေးအန္တရာယ်များနှင့် ထိခိုက်မှုများကို သတ်မှတ်ရန် လမ်းညွှန်ပေးပါသည်။ ၎င်းတို့ကို ဘေးအန္တရာယ်များနှင့် ထိခိုက်မှုများ ကို ရှောင်ကြဉ်ရန်၊ လျော့ချရန်နှင့် စီမံကိန်းအဆင့်လုပ်ငန်းများနှင့် သက်ဆိုင်သည့် ဆောင်ရွက်ရမည့် လုပ်ငန်းများအား ထုတ်ဖော်ပြောကြားရာတွင် သက်ဆိုင်သူများနှင့် တွေ့ဆုံညှိနှိုင်းပွဲများအပါအဝင် စဉ်ဆက်မပြတ် ဆောင်ရွက်သော စီးပွားရေးတစ်ရပ်အနေဖြင့် တွေ့ဆုံညှိနှိုင်းပွဲများအပါအဝင် စဉ်ဆက်မပြတ် ဆောင်ရွက်သော စီးပွားရေးတစ်ရပ်အနေဖြင့် ဘေးအန္တရာယ်များနှင့် ထိခိုက်မှုများကို စီမံခန့်ခွဲရာတွင် အကူအညီ ဖြစ်စေရန် ဒီဇိုင်းရေးဆွဲထားပါသည်။

စီမံကိန်းအတွက်အသုံးပြုမည့် နိုင်ငံတကာစံချိန်စံညွှန်းနှင့် လမ်းညွှန်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

- The IFC's Performance Standards (IFC's PSs) (2012);
- IFC/World Bank Group (WBG) EHS Guidelines and WBG EHS Guidelines for Thermal Power (2007 and 2008);
- IFC's Stakeholder engagement handbook and other relevant Good Practice Notes;
- IFC's Handbook for Preparing a Resettlement Action Plan (if applicable)
- Kyoto Protocol to the UNFCC on Climate Change (1997);
- United Nations Convention on Biological Diversity (1992);
- Basel Convention (1989);
- Ramsar Convention on Wetland (1971); and
- International Union for Conservation of Nature and Natural Resources, Red List of Threatened Species (1964).

၁.၇။ ထိခိုက်မှုဆန်းစစ်ခြင်းနည်းလမ်း

ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းနည်းလမ်းသည် ပုံ (၁.၂) တွင် ဖော်ပြထား သည့် ချဉ်းကပ်ခြင်းနည်းကို ယေဘုယျအားဖြင့် လိုက်နာဆောင်ရွက်ပါမည်။ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းသည် ဖြစ်နိုင်ခြေရှိသည့် ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝဗေဒဆိုင်ရာ၊ လူမှုစီးပွားဆိုင်ရာ နှင့်ယဉ်ကျေးမှုဆိုင်ရာ ပတ်ဝန်းကျင်အကျိုး သက်ရောက်မှုများအား အကဲဖြတ်ရန်၊ ဖြစ်နိုင်ခြေရှိသည့် အနုတ်သဘောဆောင်သော အကျိုးသက်ရောက်မှုများ အတွက် ရှောင်ရှားရန်၊ လျော့ချရန်၊ ချေပရန် နှင့် လျော်ကြေးပေးဆောင်ရန် စီမံကိန်းမှ ဆောင်ရွက်ရမည့် ကနဦးနည်းလမ်းများအား သတ်မှတ်ရန်၊ လုပ်ဆောင်နိုင်သည့် နေရာ များတွင် ဖြစ်နိုင်ခြေရှိသည့် ကောင်းမွန်သော အကျိုးသက်ရောက်မှုများကို တိုးမြှင့်ရန် နည်းလမ်းများအား သတ်မှတ်ရန် စနစ်ကျသည့် အောက်ဖော်ပြပါ လုပ်ငန်းစဉ် အတိုင်း လုပ်ဆောင်လျက်ရှိပါသည်။



ပုံ ၁.၂ ယေဘုယျ ထိခိုက်မှုဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်အဆင့်များမှာ အောက်ဖော်ပြပါ အတိုင်း ဖြစ်ပါသည်။

စိစစ်ခြင်း

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစောပိုင်းအဆင့်တွင် ကနဦးသတင်းအချက်အလက်များသည် စီမံကိန်းအတွက် မည်သည့်ဥပဒေနှင့် အခြားလိုအပ်ချက်များ အသုံးပြုမည်ကို ဆုံးဖြတ်ရန် အကူအညီဖြစ်စေပါသည်။ ထိုအဆင့်သည် စီမံကိန်းအကြောင်းအရာ နှင့် စီမံကိန်းနှင့်ဆက်စပ်လျက်ရှိသည့် အဆောက်အအုံများ အပြည့်အစုံဖော်ပြခြင်းကို အသုံးပြု၍ ဆောင်ရွက်ခဲ့ပါသည်။

နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်း

နယ်ပယ်တိုင်းတာ သတ်မှတ်ခြင်းလေ့လာနေစဉ် စီမံကိန်း၊ ပတ်ဝန်းကျင်နှင့် လူသားအရင်း အမြစ် (သို့) စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများကြား ဖြစ်နိုင်ခြေရှိသည့် ဆက်စပ်မှုများ အား သတ်မှတ်ပေး၍ ၄င်းတို့၏ စိုးရိမ်ရသည့် သက်ရောက်မှုများ ဖြစ်ပွားနိုင်ခြေအလိုက် ဦးစားပေးသတ်မှတ်ခဲ့ပါသည်။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်း အစီရင်ခံစာအား ၂၀၁၆ခုနှစ်၊ ဒီဇင်ဘာလတွင် ERM မှ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ တင်သွင်းခဲ့ပါသည်။

စီမံကိန်းအကြောင်းအရာဖော်ပြချက်

စီမံကိန်းအကြောင်းအရာဖော်ပြချက်အား စီမံကိန်းသွင်ပြင်လက္ခဏာများနှင့် လုပ်ငန်းများ၏ နယ်ပယ်ကို ပတ်ဝန်းကျင်အား အကျိုးသက်ရောက်နိုင်ခြေရှိသည့် ကိစ္စရပ်များကို အကိုးအကားပြုလုပ်ထားသည့် ရည်ညွှန်းချက်နှင့်အတူ စီမံကိန်းအကြောင်းအရာဖော်ပြချက်ကို သတ်မှတ်ရန် ပြင်ဆင်ထားပြီး ဖြစ်ပါသည်။

အခြေခံအချက်အလက်များ

ဆန်းစစ်နိုင်သည့် စီမံကိန်း၏ အကျိုးသက်ရောက်မှုများကို ဖော်ပြထားသည့် အကြောင်းအရာတစ်ခုကိုဖော်ပြရန် စီမံကိန်းတည်ရှိမှုတွင် သက်ရောက်ရန် မျှော်လင့်ထားသည့် ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝဗေဒဆိုင်ရာ၊ လူမှုစီးပွားဆိုင်ရာနှင့် ယဉ်ကျေးမှုဆိုင်ရာ အခြေအနေများ ဖော်ပြချက်ကို တင်ပြထားပါသည်။ အခြေခံအချက်အလက်များတွင် စီမံကိန်းကြောင့် ထိခိုက်သူများ အားလုံးနှင့် အဆိုပြုစီမံကိန်းကြောင့် သိသာထင်ရှားစွာ အကျိုးသက်ရောက်ခံရနိုင်ခြေ ရှိသည်ဟု သတ်မှတ်ထားသည့် အရင်းအမြစ်များအားလုံး၏ သတင်းအချက်အလက်များ ပါဝင်ပါသည်။

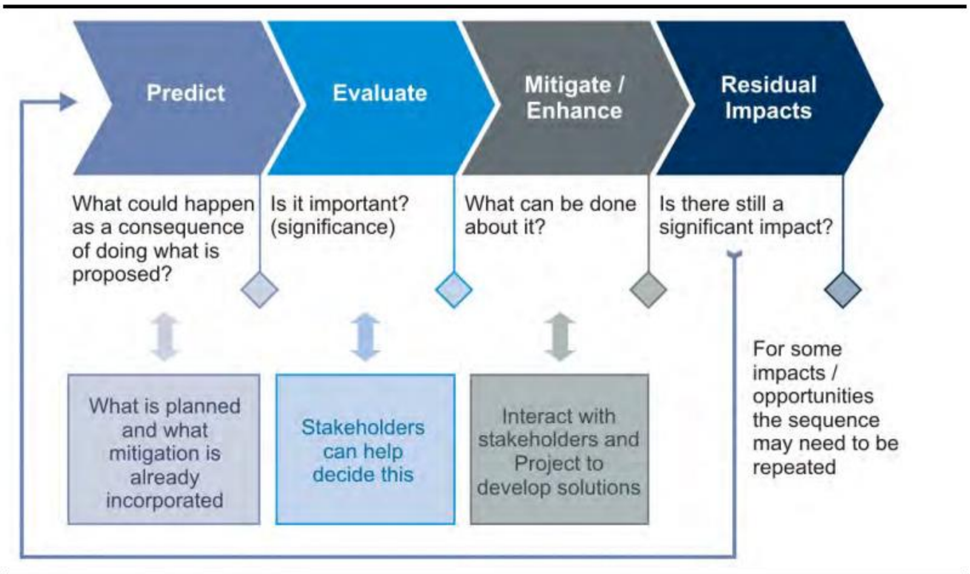
သက်ဆိုင်သူများနှင့် ဆွေးနွေးတိုင်ပင် ညှိနှိုင်းခြင်း

ထိရောက်မှုရှိသည့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်သည် အရေးကြီးသည့်အဆင့်များ တစ်လျှောက်လုံးတွင် သက်ဆိုင်ရာ သက်ဆိုင်သူများနှင့် ဆွေးနွေး တိုင်ပင် ညှိနှိုင်းခြင်းပြုလုပ်ရန် လိုအပ်ပါသည်။ ၄င်းသည် စီမံကိန်းအပေါ် သက်ဆိုင်သူများ၏ သဘောထားအမြင်များကို နားလည်နိုင်ရန် အထောက်အကူပြုသည့်အပြင် အကျိုးသက်ရောက်မှုများကို အကဲဖြတ်ခြင်းနှင့် ခန့်မှန်းခြင်းများ ဆောင်ရွက်ရာတွင် ထည့်သွင်းစဉ်းစားသင့်သည့် ကိစ္စရပ်များကို သတ်မှတ်နိုင်ရန် အထောက်အကူပြုပါသည်။

<u>အကျိုးသက်ရောက်မှုများဆန်းစစ်ခြင်း၊</u>

အကျိုးသက်ရောက်မှုများကို သတ်မှတ်ခြင်းနှင့် ဆန်းစစ်ခြင်းများကို နယ်ပယ်တိုင်းတာ သတ်မှတ်ခြင်း လုပ်ငန်းနှင့်အတူ စတင်၍ ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်၏ ကျန်ရှိသောအပိုင်းများ တစ်လျှောက် ဆက်လက်လုပ်ဆောင်ပါသည်။ အဓိက ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အဆင့်များကို ပုံ ၁.၃ တွင် အကျဉ်းချုပ် ဖော်ပြထားပါသည်။

- **သက်ရောက်မှုများခန့်မှန်းခြင်း** : စီမံကိန်းနှင့် ၎င်းနှင့်ဆက်စပ်နေသည့် လုပ်ငန်းများ၏ အကျိုးဆက်တစ်ခုအဖြစ် သက်ရောက်ခံရသူများနှင့် သက်ရောက်ခံ အရင်းအမြစ်များအပေါ် ဖြစ်ပေါ်နိုင်ခြေရှိသည့် အရာများကို ဆုံးဖြတ်ရန်
- **သက်ရောက်မှုများအကဲဖြတ်ခြင်း** : သက်ရောက်မှုများ၏အရေးပါမှုနှင့် ဖြစ်ပွားနိုင်ခြေကို ထည့်သွင်းစဉ်းစားခြင်းအားဖြင့် ခန့်မှန်းထားသည့် သက်ရောက်မှု များ၏ အရေးပါမှုနှင့် သက်ရောက်ခံ အရင်းအမြစ်များ၊ သက်ရောက်ခံလူများ၏ ထိခိုက်လွယ်မှု၊ တန်ဖိုး နှင့်/သို့ အရေးပါမှု ကို အကဲဖြတ်ရန်
- **လျော့ချရေးနှင့် မြင့်တင်ရေး** : အနှုတ်သဘောဆောင်သည့် သက်ရောက်မှုများ နှင့် ကောင်းသော သက်ရောက်မှုများကို မြှင့်တင်ရန် သင့်တော်ကောင်းမွန်သည့် နည်းလမ်းများအား သတ်မှတ်ရန်
- **ကြွင်းကျန်သက်ရောက်မှုများ အကဲဖြတ်ခြင်း** : လျော့ချရေးနှင့်မြှင့်တင်ရေး နည်းလမ်းများ ၏ ထိရောက်သော အကောင်အထည်ဖော်ဆောင်ရေးကို လက်ခံယူဆ၍ အရေးပါသည့် သက်ရောက်မှုများကို အကဲဖြတ်ရန်



ပုံ ၁.၃ ထိခိုက်မှုဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်

<u>လျှော့ချသည့်နည်းလမ်းများနှင့် တိုးမြှင့်ရေးနည်းလမ်းများ သတ်မှတ်ခြင်း</u>

ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုတစ်ခု၏ အရေးပါမှုကို သတ်မှတ်ပြီးသည်နှင့် တပြိုင်နက် နောက်တစ်ဆင့်အနေဖြင့် လျှော့ချသည့်နည်းလမ်းများနှင့်တိုးမြှင့်ရေးနည်းလမ်းများ သတ်မှတ်ခြင်းကို အကဲဖြတ်ရန်လိုအပ်ပါသည်။ ယခု ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ် ခြင်း၏ ရည်ရွယ်ချက်များအတွက် E Guard သည် အောက်ဖော်ပြပါ လျှော့ချသည့် နည်းလမ်းများ အရေးပါပုံအဆင့်ကို လက်ခံကျင့်သုံးလျက်ရှိပါသည်။

- ရှောင်ရှားခြင်း
- သက်ရောက်မှုများအား လျှော့ချခြင်း
- သက်ရောက်မှုများအား လျော့နည်းအောင်ပြုလုပ်ခြင်း
- သင့်တော်စွာ ပေးလျော်ခြင်း၊ အခြားသောနည်းလမ်းများဖြင့် ပေးလျော်ခြင်း

<u>စီမံခြင်း၊ စောင့်ကြည့်လေ့လာခြင်းနှင့် စစ်ဆေးခြင်း</u>

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်တွင် နောက်ဆုံးအဆင့်မှာ အခြေခံစီမံခန့်ခွဲမှု ၏ သတ်မှတ်ချက်နှင့် က) ထိခိုက်မှုများ (သို့) ၄င်းတို့နှင့် ဆက်စပ်ပတ်သက်နေသောစီမံကိန်း အစိတ်အပိုင်းများသည် အသုံးပြုထားသော စံချိန်စံညွှန်းများအား ဆက်လက်လိုက်နာခြင်းရှိမရှိနှင့် ခ) လျှော့ချရေးနည်းလမ်းများသည် ထိခိုက်မှုများကို ထိရောက်စွာကိုင်တွယ်ဖြေရှင်းခြင်းရှိမရှိနှင့် လျော်ကြေးနည်းလမ်းများနှင့် ပေးလျော်မှုများသည် သက်ရောက်မှုများအား မျှော်မှန်းထားသည့် အတိုင်းအတာရောက်အောင် လျှော့ချနိုင်ခြင်းရှိမရှိ သတ်မှတ်ရန်လိုအပ်သော စောင့်ကြည့်လေ့လာရေး နည်းလမ်းများစသည့် သတ်မှတ်ရန်လိုအပ်သော စောင့်ကြည့်လေ့လာရေးနည်းလမ်းများ တို့ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာ တစ်စိတ်တစ်ပိုင်းအနေဖြင့် အကောင်အထည်ဖော်ဆောင်ပြီးဖြစ်ပါသည်။ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်သည် ယေဘုယျအားဖြင့် လိုအပ်ချက်များ၊ စီမံခန့်ခွဲမှုနှင့် လျှော့ချရေးနည်းလမ်းများနှင့် အခြားသောကတိကဝတ်များအား မည်သို့အကောင်အထည်ဖော်ဆောင်မည်၊ စီမံခန့်ခွဲမည်နှင့် စောင့်ကြည့်မည်ကိုပြဌာန်းမည့် စီမံကိန်းအသေးစိတ်အစီအစဉ်ကို ရည်ညွှန်းပါသည်။ ၄င်းသည် စီမံကိန်းကတိကဝတ်ကို ဖော်ဆောင်ရန်အတွက် တာဝန်ယူဆောင်ရွက်မည့် အဖွဲ့အစည်းများ၊ စောင့်ကြည့်လေ့လာရေး လိုအပ်ချက်များနှင့် သက်ဆိုင်ရာစံချိန်စံညွှန်းများ (သို့) အဆင့်များ၊ စောင့်ကြည့်လေ့လာရေးအချိန်၊ စစ်ဆေးမည့် နည်းလမ်းများနှင့် တိုးတက်အောင်ဆောင်ရွက်မည့် လုပ်ငန်းများနှင့် လေ့ကျင့်ရေးလိုအပ်ချက်များ ကဲ့သို့သော အချက်အလက်များကို စီစဉ်မည်ဖြစ်ပါသည်။

၁.၈။ ပတ်ဝန်းကျင်ဖော်ပြချက်

စီမံကိန်းလေ့လာရေး နယ်မြေအတွင်း ဇီဝရုပ်ပတ်ဝန်းကျင် အခြေခံအချက်အလက်အခြေအနေ မှာပုံနှိပ်ထားသော သတင်းအရင်းအမြစ်များမှ ရှိနှင့်ပြီးသား အချက်အလက်ကို အခြေခံသကဲ့သို့ အချက်အလက်ကွာဟမှုကို ဖြည့်ဆည်းရန် စုဆောင်းထားသော ကွင်းဆင်းအချက်အလက် များကိုလည်း အခြေခံထားပါသည်။

လေ့လာမည့် ဧရိယာဆိုသည်မှာ စီမံကိန်းမှသက်ရောက်နိုင်ခြေရှိသည့် အခြေခံအခြေအနေ များကို ပြည့်စုံစွာနားလည်ရန်နှင့် ဖော်ပြရန်လေ့လာရန်လိုအပ်သည့် ဧရိယာကို ရည်ညွှန်း ပါသည်။ ထိုဧရိယာသည် အရင်းအမြစ်များနှင့် သက်ရောက်ခံရသူများအပေါ် ဖြစ်နိုင်ခြေ ရှိသည့် ထိခိုက်မှုများအရ ကွဲပြားပါသည်။ ဤလေ့လာမှု၏ ရည်ရွယ်ချက်အတွက် အဆိုပြု လျှပ်စစ်ဓာတ်အားပေးစီမံကိန်း အနီးတဝိုက် အချင်း ၅ကီလိုမီတာ စက်ဝိုင်းသဏ္ဍာန်ရှိဧရိယာ နှင့်ရေပိုက်လိုင်းတစ်လျှောက် တစ်ဖက်တစ်ချက်ရှိ ၅၀၀ မီတာဧရိယာအား ထည့်သွင်းစဉ်းစား ထားပါသည်။ ဧရိယာအပြင်ဘက်မှ လိုအပ်သည့် အချက်အလက်များကို စုဆောင်းပြီးသည့် အခါ စီမံကိန်းမှ သက်ရောက်နိုင်ခြေရှိသည့် ထိခိုက်မှုကို ခန့်မှန်းနိုင်ပါသည်။

အခြေခံအချက်အလက် လေ့လာမှုများအား ဇီဝရုပ်ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်ကို စုဆောင်းရန် စီမံကိန်းနေရာတွင် စိုစွတ်ရာသီနှင့် ခြောက်သွေ့ရာသီများအတွင်း ကျွမ်းကျင် ပညာရှင်များအဖွဲ့အား ထိထိရောက်ရောက် အသုံးပြုထားသည့် ကွင်းဆင်း လေ့လာရေးခရီး မှတဆင့် ဆောင်ရွက်ပါသည်။ လူမှုရေး၊ လူမှုစီးပွားရေးနှင့်ယဉ်ကျေးမှု အခြေခံအချက်အလက် လေ့လာမှုကို ၂၀၁၆ခုနှစ်၊ နိုဝင်ဘာလတွင် ပြုလုပ်ခဲ့သည့် လူထုပူးပေါင်းညှိနှိုင်းပွဲနှင့် တပြိုင်နက် ပြုလုပ်ဆောက်ရွက်ခဲ့ပါသည်။

၁.၈.၁။ ရာသီဥတု နှင့် မိုးလေဝသ

မြန်မာနိုင်ငံဒေသအတော်များများသည် အပူပိုင်းဒေသဖြစ်ပါသည်။ မြန်မာနိုင်ငံ၏ ရာသီဥတုအား အကြမ်းအားဖြင့် နွေရာသီ၊ မိုးရာသီနှင့် ဆောင်းရာသီဟု ရာသီသုံးခု ခွဲခြားနိုင်ပါသည်။ နွေရာသီမှာ မတ်လမှ မေလလယ်ထိ၊ မိုးရာသီမှာ မေလလယ်မှ အောက်တိုဘာလကုန် အထိဖြစ်၍ ဆောင်းရာသီမှာ နိုဝင်ဘာလမှ ဖေဖော်ဝါရီလကုန်ထိ ဖြစ်ပါသည်။

စီမံကိန်းနေရာတွင် မိုးအများဆုံးရရှိသည့်လမှာ မေလမှအောက်တိုဘာလအထိဖြစ်ပြီး ဇွန်၊ ဇူလိုင်နှင့် ဩဂုတ်လများမှာ အခြားလများနှင့် နှိုင်းယှဉ်လျှင် အစဉ်သဖြင့် အစိုစွတ်ဆုံးလများ ဖြစ်ပါသည်။

တစ်နှစ်ပတ်လုံး ပျမ်းမျှလေတိုက်နှုန်းသည် သိသာထင်ရှားသည့် အမြင့်ဆုံးနှုန်းနှင့် အနိမ့်ဆုံးနှုန်း တို့ဖြင့် အတက်အကျဖြစ်နေပါသည်။ အရှေ့လေနှင့် အရှေ့တောင်လေ တိုက်ခတ်ပါသည်။ တိုက်မြဲလေညွှန်ရပ်မှာ စီမံကိန်းနေရာ၏ အနောက်နှင့် အနောက်တောင်ရှိ စီမံကိန်း သက်ရောက် သူများအား သက်ရောက်စေပါသည်။

၁.၈.၂။ ထိတွေ့ဝန်းကျင် လေအရည်အသွေး

ထိတွေ့ဝန်းကျင်လေအရည်အသွေး စောင့်ကြည့်ခြင်းသည် စီမံကိန်းအနီးဝန်းကျင်တွင် တည်ရှိသော ရွေးချယ်ထားသည့် အခြေခံလေနမူနာ ကောက်ယူရေးတည်နေရာ (၃) ခု၌ ဆောင်ရွက်မည် ဖြစ်ပါသည်။ ထိတွေ့လေအရည်အသွေး စောင့်ကြည့်ခြင်းအား ရွေးချယ်ထားသည့် စောင့်ကြည့်ရေး နေရာများတွင် စိုစွတ်ရာသီနှင့် ခြောက်သွေ့ရာသီနှစ်ခုလုံး၌ ထိတွေ့လေဝန်းကျင် အရည်အသွေး တွင် ရေတိုရေရှည် အလားအလာများကို ဖမ်းယူရန်ဆောင်ရွက်ခဲ့ပါသည်။ စောင့်ကြည့်ခြင်းကို စိုစွတ်နှင့် ခြောက်သွေ့နှစ်ရာသီလုံးတွင် စောင့်ကြည့်ရေးနေရာများ၌ အချိန် ၇၂နာရီစာအတွက် Haz-Scanner အသုံးပြု၍ ဆောင်ရွက်ခဲ့ပါသည်။ ၄င်းအား လေ့လာရေးဧရိယာအတွင်း ထိတွေ့ဝန်းကျင် လေအရည်အသွေးတွင် ရေတိုအလားအလာ၏ ညွှန်းဆိုချက်အဖြစ် အသုံးပြုပါသည်။ Diffusion tube နည်းပညာသုံး စောင့်ကြည့်လေ့လာရေးအား စိုစွတ်နှင့် ခြောက်သွေ့နှစ်ရာသီ လုံးတွင် စောင့်ကြည့်ရေးနေရာတစ်ခုချင်းစီ၌ ရက်သတ္တပတ်သုံးပတ်စာအတွက် ဆောက်ရွက်ခဲ့ ပါသည်။ ရရှိလာသော သတင်းအချက်အလက်ကို ရေရှည် NO_x နှင့် NO_2 ပါဝင်မှု ညွှန်းဆိုချက် အဖြစ် အသုံးပြုခဲ့ပါသည်။

လေ့လာရေး ဧရိယာအတွင်း ဆောင်ရွက်ခဲ့သော စောင့်ကြည့်လေ့လာရေး ရလဒ်များသည် ထိတွေ့လေတွင် NO_x နှင့် NO_2 ပါဝင်မှုများသည် သက်ဆိုင်ရာ လေအရည်အသွေး စံချိန်စံညွှန်း များ အောက်လျော့နည်းနေသည်ဟု ညွှန်ပြနေပါသည်။ သို့သော် ထိတွေ့ဝန်းကျင်လေအရည်အသွေးတွင် SO_2, $PM_{2.5}$ နှင့် PM_{10} ပါဝင်မှုများသည် သက်ဆိုင်ရာ လေအရည်အသွေး စံချိန်စံညွှန်းများထက် ပိုနေကြောင်း တွေ့ ရှိရပါသည်။

၁.၈.၃။ ဆူညံသံ

ဆူညံသံ စောင့်ကြည့်လေ့လာရေးအား စီမံကိန်းလုပ်ငန်းနေရာ အနီးတဝိုက်တည်ရှိသော လက်ရှိ ဆူညံသံလက်ခံသူများ တည်နေရာ (၃) ခုတွင် ဆောင်ရွက်ခဲ့ပါသည်။ နာရီအလိုက် A-weighted ဆူညံသံအတိုင်းအတာများ (LAeq, 1 hour)အား ရုံးဖွင့်ရက်နှင့် အများပြည်သူရုံးပိတ်ရက် နှစ်ခုလုံးတွင် တည်နေရာ တစ်ခုစီတိုင်း၌ (၇၂) နာရီဆက်တိုက် မှတ်တမ်းတင်ထားပါသည်။ တည်နေရာတစ်ခုစီ၌ နေ့အချိန်နှင့် ညအချိန် ဆူညံသံအတိုင်းအတာများအား ၀၇း၀၀နှင့် ၂၂း၀၀နာရီများကြား နှင့် ၂၂း၀၀ နှင့် ၇း၀၀ကြား အသီးသီးတိုင်းတာထားသော နာရီအလိုက် ဆူညံသံအတိုင်းအတာများကို (LAeq, 1 hour) ပျှမ်းမျှယူခြင်းဖြင့် တွက်ချက်ထားပါသည်။

ဆူညံသံ တိုင်းတာသည့် (၃) နေရာများရှိ နေ့အချိန်နှင့် ညအချိန်အတွင်း ပျှမ်းမျှနောက်ခံဆူညံသံ အဆင့်များသည် လမ်းညွှန်ချက်ထက်ကျော်လွန်နေသည်ကို တွေ့ရှိရပါသည်။ နောက်ခံဆူညံသံ အဆင့်များမှာ ပုံမှန်ယေဘုယျအားဖြင့် ကျေးလက် ပတ်ဝန်းကျင်ဖြစ်ပြီး သိသာထင်ရှားသည့် ဆူညံသံအရင်းအမြစ်များမှာ လမ်းမကြီးတစ်လျှောက် ကားအသွားအလာနှင့် စီမံကိန်းစခန်းများ အနီးပတ်ဝန်းကျင်ရှိ လူထုလှုပ်ရှားမှုများ ဖြစ်ပါသည်။ နေ့အချိန်နှင့် ညအချိန်များတွင် နောက်ခံဆူညံသံအဆင့်များမှာ NEQ နှင့် IFC ယေဘုယျ လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်

ဘေးကင်းလုံခြုံရေး လမ်းညွှန်ချက်တန်ဖိုးများမှ ချမှတ်ထားသည့် ဆူညံသံအတိုင်းအတာများထက် ကျော်လွန်နေပါသည်။ NEQ နှင့် IFC လမ်းညွှန်ချက်များအရ ဆူညံသံသက်ရောက်မှုများသည် အနီးဆုံးသက်ရောက်ခံများတွင် အများဆုံး တိုးမြင့်မှုမှာ နောက်ခံဆူညံသံအဆင့် ၃ dB(A) ဖြစ်မနေသင့်ပါ။

၁.၈.၄။ မြေပေါ်ရေအရည်အသွေး

စီမံကိန်းသည်အရှေ့ဘက် နယ်စပ်ဒေသတစ်လျှောက် တောင်တန်းများမှ မြစ်ဖျားခံလာသည့် မြစ်အများအပြားနှင့် ချောင်းငယ်လေးများဖြင့် ပေါင်းစပ်ဖွဲ့စည်းထားသည့် တနင်္သာရီတိုင်း ဒေသကြီးတွင် တည်ရှိပါသည်။

စီမံကိန်းဧရိယာအတွင် အဓိကမြစ်မှာ ဟိန်းဲမြစ်ဖြစ်ပါသည်။ ဟိန်းဲမြစ်သည် စီမံကိန်းနယ်မြေ ၏ အနောက်မြောက်ဘက် (၃) ကီလိုမီတာခန့်တွင် တည်ရှိပါသည်။ ထိုမြစ်သည် ခြောက်သွေ့ရာသီတွင် ရေငံဖြစ်လာပါသည်။ ကံပေါက်တွင်တည်ရှိသော ရေလွှမ်းသည့် ဧရိယာမှာ ၃၇ စတုရန်းကီလိုမီတာခန့်ဖြစ်ပါသည်။ မြစ်၏အစိတ်အပိုင်းအများစုမှာ ဒီရေလွှမ်းမိုးမှုအောက်တွင် ရှိပါသည်။ ၎င်းမြစ်သည် အက်ဒမန်ပင်လယ်အတွင်းသို့ ကန်တော့ပုံစံ မြစ်ဝမှတဆင့် စီးဝင် ပါသည်။ မြစ်ကြောင်းနှင့် ချောင်းငယ်များသည် ရေယာဉ်အငယ်စားများဖြင့် ဖြတ်သန်းသွားလာနိုင်ပြီး ဒီရေတောဝန်းရံ ပေါက်ရောက်ပါသည်။ ၎င်း၏ကမ်းပါးများပေါ်တွင် ကျေးရွာများတည်ရှိ သောကြောင့် မြစ်သည် ငါးဖမ်းလုပ်ငန်းများ၊ ရေကြောင်းသွားလာရေးနှင့် ရေကြောင်းကုန်စည် ပို့ဆောင်ရေး အစရှိသည့် ရည်ရွယ်ချက်များအတွက် အသုံးပြုနေပါသည်။

စိုစွတ်ရာသီတိုင်းတာရေး ရလဒ်များသည် အာဆင်းနစ်နှင့် ရင်နိုက်အဆင့်များမှာ စောင့်ကြည့် လေ့လာရေး တည်နေရာအားလုံးတွင် စံချိန်စံညွှန်းများနှင့် ကိုက်ညီနေကြောင်း ပြသနေပါသည်။ SW4 ၌ သံဓာတ်ပါဝင်မှု (1.16mg/l) မှာ USEPA CCC စံချိန်စံညွှန်း 1.0mg/l ထက် ပိုမို ကျော်လွန်နေသည်ကို တွေ့ရှိရပါသည်။

SW4 ၌ ခဲပါဝင်မှု 4.30x10-3 mg/l မှာ USEPA CCC စံချိန်စံညွှန်း 0.0025mg/l ထက် ကျော်လွန်နေသော်လည်း မြန်မာနိုင်ငံ၏ အမျိုးသားမြေပေါ်ရေအရည်အသွေးစံချိန်စံညွှန်း သတ်မှတ်ချက် 0.01 mg/l ဖြင့် ကိုက်ညီမှု ရှိသည်ကို တွေ့ရှိရပါသည်။ သို့ဖြစ်ပါ၍ ထိုအဆင့် သတ်မှတ်ချက်မှာ မြန်မာနိုင်ငံ၌လက်ခံနိုင်သော အနေအထား ရှိသည်ဟု သတ်မှတ်နိုင်ပါသည်။

SW4 ၌ Chemical Oxygen Demand (COD) အား မြန်မာနိုင်ငံ၏ အမျိုးသားမြေပေါ်ရေ အရည်အသွေး စံချိန်စံညွှန်း 8 mg/l ဖြင့် နှိုင်းယှဉ်တိုင်းတာသောအခါ သတ်မှတ်ချက်ဖြင့် ကိုက်ညီနေသည်ကို တွေ့ရှိရပြီး SW1 (85.0 mg/l), SW2 (101 mg/l), SW3 (12.6 mg/l), SW5 (9.4 mg/l) and SW6 (9.4 mg/l) နေရာများ၌ သတ်မှတ်ချက်ထက် ကျော်လွန်နေသည်ကို တွေ့ရှိရပါသည်။

Biochemical Oxygen Demand (BOD) တိုင်းတာသောအခါ၌လည်း SW1 (5.9 mg/l) and SW4 (4.00 mg/l), SW5 (7.60 mg/l) and SW6 (4.40 mg/l) နေရာများ၌ အမျိုးသားမြေပေါ်ရေ အရည်အသွေးစံချိန်စံညွှန်း (3 mg/l) ထက် ကျော်လွန်နေသည်ကို တွေ့ရှိရပြီး အခြားသော နေရာများ၌ စံချိန်စံညွှန်းဖြင့် ကိုက်ညီမှုရှိသည်ကို တွေ့ရှိရပါသည်။

စုစုပေါင်း အစိုင်အခဲများပျော်ဝင်မှုသည် SW1, SW2 နှင့် SW3 ၌ ပါဝင်မှုမြင့်မားပြီး (10,998mg/l), (9,858mg/l) နှင့် (414mg/l) အသီးသီးရှိပါသည်။ ၄င်းမှာ ရေငန်များတွင် ဆားပျော်ဝင်မှုကြောင့် ဖြစ်ပါသည်။

ခြောက်သွေ့ရာသီ တိုင်းတာရေးရလဒ်များသည် တိုင်းတာသော တည်နေရာအားလုံး၌ အာဆင်းနစ် အနေဖြင့် SW1(0.10mg/l), SW2(0.25mg/l) နှင့် SW6(0.25mg/l) အားလုံး၌ EPA နှင့် အမျိုးသား မြေပေါ်ရေအရည်အသွေး စံချိန်စံညွှန်း (0.05mg/l) အဆင့်များ၏အထက်တွင် ရောက်ရှိနေသည်ကို တွေ့ရှိရပါသည်။ ၄င်းမှာ စီးဆင်းရေမှ သယ်ဆောင်လာသော အနီးအနားဝန်းကျင်မြေသား၌ အာဆင်းနစ် ပါဝင်မှုကြောင့် ဖြစ်နိုင်ပါသည်။ အဘယ်ကြောင့်ဆိုသော် မြေသားနမူနာများတွင်လည်း အာဆင်းနစ် ပါဝင်မှုအဆင့် များမှာ မြင့်မားနေသောကြောင့် ဖြစ်ပါသည်။ (Section 5.35 ကြည့်ရှုနိုင်ပါသည်။)

Cyanide, Iron, Lead, turbidity, salinity, total Suspended Solids, conductivity, flow rate, water dept and water temperature တို့မှာမူ အမျိုးသား မြေပေါ်ရေအရည်အသွေးနှင့် EPA တို့၏ စံချိန်စံညွှန်း သတ်မှတ်ချက်များနှင့် အသီးသီးကိုက်ညီမှု ရှိသည်ကို တွေ့ရှိရပါသည်။

SW1(20.4mg/l) နှင့် SW2(20.4mg/l) တို့၌ Chemical Oxygen Demand (COD) မှာ အမျိုးသား မြေပေါ်ရေအရည်အသွေး စံချိန်စံညွှန်း (8mg/l) များထက် ကျော်လွန်နေသည်ကို တွေ့ရှိရပြီး SW1 (5.6mg/l) ၌ Biochemical Oxygen Demand (BOD) မှာ စံချိန်စံညွှန်း (3mg/l) ထက် ကျော်လွန်နေသည်ကို တွေ့ရှိရပါသည်။ အခြားသော တည်နေရာများ၌မူ BOD နှင့် COD မှာ စံချိန်စံညွှန်းများနှင့် ကိုက်ညီမှုရှိကြောင်း တွေ့ရှိရပါသည်။

ထို့အပြင် ရလဒ်များသည် တိုင်းတာရေးစခန်းအားလုံး၌ စုပေါင်းအစိုင်အခဲပျော်ဝင်မှု (TDS) မြင့်မားနေသကဲ့သို့ လျှပ်ကူးနှုန်းမြင့်မားနေသည်ကို ညွှန်ပြနေပါသည်။ ၄င်းမှာ ရေငန်များတွင် ဆားပျော်ဝင်မှုကြောင့် ဖြစ်ပါသည်။

SW6(2.46mg/l) ၌ Dissolved Oxygen (DO) သည် အမျိုးသား မြေပေါ်ရေအရည်အသွေး (>5 mg/l) ထက် ကျော်လွန်နေသည်ကို တွေ့ရှိရပါသည်။

ခြောက်သွေ့ရာသီရှိ စုပေါင်း Coliform ဘတ်တီးရီးယားအဆင့်များသည် စိုစွတ်ရာသီတိုင်းတာရေးထက် ပိုမိုမြင့်မား နေသည်ကို တွေ့ရှိရပါသည်။ စုပေါင်း Coliform ဘတ်တီးရီးယားတည်ရှိမှုသည် အနည်းဆုံး လက်ရှိမြစ်အတွင်း မစင်စွန့်ပစ်ခြင်းရှိနေကြောင်းကို ဖော်ပြနေပါသည်။ စုပေါင်း Coliform အရင်းအမြစ်များတွင် လူများမှ မိလ္လာရေစွန့်ပစ်ခြင်းနှင့်

တိရိစ္ဆာန်မွေးမြူရေးကဲ့သို့ သွေးနွေး သတ္တဝါများမှ မစင်စွန့်ခြင်း၊ နှစ်ခုလုံးမှ မြစ်အတွင်း သို့ တိုက်ရိုက်စွန့်ထုတ်ခြင်း (သို့) မိုးရွာသွန်းစဉ် စီးဆင်းရေမှ သယ်ဆောင်လာခြင်း တို့ပါဝင်ပါသည်။

၁.၈.၅။ မြေသား

စီမံကိန်းနယ်မြေတွင် မြေသားသည် ကနဦး Gleysol မြေသားများအဖြစ် အမျိုးအစား ခွဲခြားနိုင်ပါသည်။ မြေသားများသည် ဆားငန်သော လမုတောရွံ့မြေများဖြင့် ပေါင်းစပ်ဖွဲ့စည်းထားပါသည်။ ထိုမြေသား တွင်ဆားနှင့်ရေ ပါဝင်မှုမြင့်မားပြီး အောက်ဆီဂျင်ပါဝင်မှုနိမ့်ကာ ဟိုက်ဒရိုဂျင်ဆာလဖိုက်ဒ် ပါဝင်မှု မြင့်မားပါသည်။ ၎င်းတွင် မြေဆွေးအမျိုးအစား မြင့်မားစွာ ပါဝင်ပါသည်(Macnae, 1968)။

အကောင်းဆုံးသော လမုတောပေါက်ရောက်မှုနှင့် ကြီးထွားမှုသည် နုန်းတင်ရေလွှမ်းကမ်းဆင့်နှင့် ရေပါဝင်သည့် မြေမှုန်ကလေးများနန်းချခြင်းမှ ယေဘုယျအားဖြင့် ဖွဲ့စည်းထားသည့် ရွှံ့ဆန်သော မြေများတွင်ဖြစ်ပေါ်ပါသည်။ လမုတောမြေများသည် အများအားဖြင့် အမြစ်ပြန့်နေသည့် အလွှာမျက်နှာပြင်မှလွဲ၍ အောက်ဆီဂျင် နည်းပါးသော အလွှာမျက်နှာပြင် ဖြစ်နေပါသည်။ (Rag 1987) ၂၀၁၆ခုနှစ်၊ စက်တင်ဘာလ၊ ၂၆ရက်နေ့တွင် စီမံကိန်းနေရာ၌ နမူနာ နှစ်နေရာမှ မြေသား နမူနာများ ကောက်ယူခဲ့ပြီး သတ္တုပါဝင်မှုတိုင်းတာ စစ်ဆေးခဲ့ပါသည်။ အပေါ်ယံမြေသားသည် အနက် ၁၀-၃၀ စင်တီမီတာမှလည်းကောင်း၊ အောက်ခံမြေသားသည် အနက် ၂.၇-၃.၀ မီတာမှ လည်းကောင်း ကောက်ယူခဲ့ပါသည်။

ရလဒ်များသည်နမူနာကောက်ယူသည့်နေရာနှစ်ခုလုံး၌ အာဆင်နစ်ပါဝင်မှုမှာ USEPA စောင့်ကြည့်လေ့လာရေး စံညွှန်းထက် ကျော်လွန်နေပါသည်။ တိုင်းတာရရှိမှသာ သတ္တုပါဝင်မှုများသည် အောက်ခံမြေသားအတွက် USEPA RSL စံညွှန်းအောက် လျော့နည်းပါသည်။

၁.၈.၆။ မြေအောက်ရေ

မြေအောက်ရေ နမူနာများအား စီမံကိန်းနေရာမှ ၁ကီလိုမီတာအကွာတွင် တည်ရှိသော မြစ်ကမ်းဘေးရှိ အိမ်ထောင်စု (၃) စု၏ရေတွင်းများ၌ ၂၀၁၆ခုနှစ်၊ စက်တင်ဘာလ၊ ၂၆ရက်တွင် ကောက်ယူခဲ့သည်။ ရလဒ်များသည် စောင့်ကြည့်လေ့လာရေး နေရာတိုင်း၌ သတ္တုပါဝင်မှုမှာ USEPA အမျိုးသားကနဦး သောက်သုံးရေနည်းဥပဒေများနှင့် WHO စံချိန်စံညွှန်းနှင့် ကိုက်ညီနေသည်ကိုတွေ့ရှိရပါသည်။ pH မှာ USEPA စံချိန်စံညွှန်းထက် လျော့နည်းနေပြီး ၂၀၁၃ခုနှစ်တွင် TEAM အကြံပေးအဖွဲ့ ပြုလုပ်ခဲ့သည့် ယခင်မြေအောက်ရေ တိုင်းတာရေးရလဒ်များ (နောက်ဆက်တွဲ-L) နှင့် ကိုက်ညီပါသည်။

၁.၈.၇။ မြေယာရှုခင်းနှင့် အမြင်ပသာဒ

အဆိုပြု လျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် ယခင်စက်ရုံအလွတ်နေရာတွင် တည်ရှိပါသည်။ ၎င်းမှာ နိမ့်ချည်မြင့်ချည်မြေအနေအထားပေါ်တွင် အလယ်ပိုင်းအရှေ့ မြောက်ခြမ်းတွင် အမြင့်ဆုံး မြေသားအမြင့် (မြေသားအမြင့် : ပင်လယ်ရေမျက်နှာပြင်အထက်၂၈ မီတာ) မြောက်ပိုင်းအစွန်း

ကုန်းမြေမှာ ပင်လယ်ရေမျက်နှာပြင်အမြင့် ၁၂-၁၇ မီတာ၊ တောင်ဘက်နှင့် အရှေ့ဘက်ခြမ်း တွင် မြေနိမ့်မြေသားမှာ ပင်လယ်ရေမျက်နှာပြင်အမြင့် ၇.၅ မီတာဖြစ်ပါသည်။ စီမံကိန်း၏ မြောက်ဘက်အပိုင်းတစ်လျှောက်ကုန်းမြေအချို့ မှာပင်လယ်ရေမျက်နှာပြင်အမြင့် ၅ မီတာအောက် လျော့နည်းပါသည်။ စီမံကိန်းနေရာအား စိုက်ပျိုးမြေနှင့် ရာဘာစိုက်ခင်းဟောင်းအချို့ဖြင့် ဝိုင်းရံထားပြီး အဓိကဖြစ်သော ဟိန်းဓါမြစ်မှာ လျှပ်စစ်ဓာတ်အားပေး စက်ရုံနယ်နမိတ်၏ အနောက်မြောက်ဘက် ၃ ကီလိုမီတာခန့် အကွာတွင်တည်ရှိပါသည်။ စက်ရုံနယ်နမိတ်၏ မြောက်ဘက်တွင်ကတ္တရာလမ်းနှင့် စိုက်ပျိုးရေးဧရိယာ၊ တောင်ဘက်တွင် ဟိန်းဓါမြစ်လက်တက်နှင့် စိုက်ပျိုးမြေအချို့၊ အရှေ့ဘက်တွင် ကတ္တရာလမ်း၊ လူနေအိမ်၊ စိုက်ပျိုးရေးဧရိယာနှင့် ဘုန်းကြီးကျောင်းတို့ရှိပါသည်။ အနောက်ဘက်တွင် ဖောက်လုပ်ပြီးသားမြေသားလမ်း၊ မိချောင်းအိုင်နှင့် လှည်းကုန်းကျေးရွာအတွင်းရှိ အနီးဆုံးကျေးရွာ လူနေအိမ်များ တည်ရှိပါသည်။

အဆိုပြု ရေတင်ဌာနနှင့် ရေသန့်စင်စက်တို့သည် ပြင်ကြီးကျေးရွာ နယ်နမိတ်ပေါ်ရှိ ဟိန်းဓါမြစ်ပေါ်တွင်တည်ရှိပါသည်။ တည်နေရာသည် ရွှံ့လတာပြင်နှင့် လမုတောများဖြင့် ဝိုင်းရံထားသည့် မြစ်စွယ်အသေးလေးတွင် တည်ရှိပါသည်။

အချိန်ကြာမြင့်စွာနေထိုင်သော ကျေးရွာနေသူများသည် အထူးသဖြင့် စိုက်ပျိုးမြေအနီးတဝိုက် တွင် မြေယာရှုခင်းနှင့် ကြီးမားသည့် ဆက်စပ်ပတ်သက်မှုရှိပါသည်။ ကျေးရွာနေ ပြည်သူများသည် စိုက်ပျိုးမြေအားလုံးကို အသုံးပြုခွင့်ရှိပြီး ဧရိယာအတွင်းတွင် အသက်မွေးမှုများကို ကောင်းစွာထောက်ပံ့ပေးသည့်အတွက် ၎င်းတို့သည် မြေယာများအပေါ် တန်ဖိုးထားနိုင်ခြေ ရှိပါသည်။ လေ့လာရေးနယ်မြေတွင် ဒေသတွင်းဘုရားများနှင့် ဝတ်ပြုဆုတောင်းသည့် နေရာများရှိပါသည်။ ထိုဘုရားကျောင်းကန်များသို့ လာရောက်လည်ပတ်ကြသူများသည် မြေယာရှုခင်းသာယာပုံနှင့်စီမံကိန်းမြင်ကွင်းအခြေအနေကို အသိအမှတ်ပြု ချီးကျူးမည်ဖြစ်သဖြင့် ၎င်းတို့သည် အရေးပါဆုံးသော ထိခိုက်လွယ်သည့်အရာများ ဖြစ်ပါသည်။

၁.၈.၈။ ကုန်းနေရေနေ ဇီဝမျိုးစုံမျိုးကွဲ

စီမံကိန်းလေ့လာရေးနယ်မြေသည် မြန်မာနိုင်ငံအနောက်ဘက် ကမ်းရိုးတန်းတစ်လျှောက် တနင်္သာရီတောင်တန်းများနှင့် ရခိုင်ရိုးမ အနောက်ဘက်အပိုင်း၏ မြေနိမ့်အမြဲစိမ်းမိုး သစ်တောနှင့်တဝက်အမြဲစိမ်းမိုးသစ်တောများတွင် တည်ရှိနေပါသည်။ သဘာဝတောရိုင်း တိရစ္ဆာန် ရှာဖွေရေးအချက်အလက်များအတွက် ကမ္ဘာ့တောရိုင်း တိရစ္ဆာန်ထိန်းသိမ်းရေး အဖွဲ့အဆိုအရ ၎င်းသည် မြန်မာ့ကမ်းရိုးတန်း မိုးသစ်တောများအဖြစ် အသိများသော ဂေဟဝန်းကျင်တွင် တည်ရှိပါသည်။

ထိုဂေဟဝန်းကျင်သည် အပူပိုင်းစိုစွတ်ရာသီဥတုအတွင်းတည်ရှိပြီး မေလမှ အောက်တိုဘာ လအထိ မုတ်သုန်မိုးရွာသွန်းမှု ရရှိပါသည်။ ကျန်ရှိသောလများတွင် ခြောက်သွေ့ပါသည်။ ဂေဟဝန်းကျင်တွင် ပါဝင်သော စားကျက်များသည် အပူပိုင်းမိုးသစ်တောမှ မြေနိမ့်သစ်တော နှင့်ကမ်းရိုးတန်း နယ်မြေများတစ်လျှောက် လမုပင်များအထိ ပြောင်းလဲကွဲပြားပါသည်။ ဂေဟဝန်းကျင်

အနေအထားဆိုသည်မှာ ၎င်းသည် Sundaic၊ အင်ဒိုချိုင်းနားနှင့် အင်ဒီရန်း ဒေသခွဲတို့ ကြား လမ်းကြောင်းတစ်ခုသဖွယ် တည်ရှိနေသည်ကို ဆိုလိုပါသည်။

ဂေဟာဝန်းကျင်တွင် မျိုးတုန်းမှုနိမ့်ပါးပြီး အပင်နှင့် တိရစ္ဆာန် မျိုးစိတ် အရောနှောများ ကျယ်ပြန့်စွာပါဝင်ပါသည်။ ဂေဟာဝန်းကျင်တွင် ကာကွယ်တောနယ်မြေများသည် ကောင်းစွာ ကိုယ်စား မပြုပဲ ကာကွယ်တောနယ်မြေအတွင်း ၄ ရာခိုင်နှုန်းခန့်သာ ပါဝင်ပါသည်။

ဂေဟာဝန်းကျင်၏ ကမ်းရိုးတန်းဧရိယာများသည် ယခုလက်ရှိတွင် စိုက်ပျိုးရေးအတွက် ရှင်းလင်းထားသော ကြီးမားသည့်မြေကြောများနှင့်အတူ အရည်အသွေးနိမ့်ဆင်းသည့် အခြေ အနေသို့ ရောက်ရှိနေပါသည်။ အထူးသဖြင့် ဆိပ်ကမ်းမြို့ များဖြစ်သည့် ထားဝယ်နှင့် မြိတ်မြို့ များအနီးရှိ ကုန်းမြေသည် အရည်အသွေးကျဆင်းပါသည်။

မြန်မာနိုင်ငံတွင် အဓိကဇီဝမျိုးစုံမျိုးကွဲ ဧရိယာများသည် သဘာဝထိန်းသိမ်းရေးနယ်မြေ၊ ကြိုးပြင်ကာကွယ်တောများ၊ အစုအဖွဲ့ပိုင်ကာကွယ်တောများ၊ အစုအဖွဲ့ပိုင်သစ်တော၊ ကြိုးဝိုင်းတောနှင့် အခြားသောအရင်းအမြစ်နှင့် မြေအသုံးချဧရိယာများပါဝင်သည့် ကွဲပြားသော ကုန်းမြေစီမံမှုအမျိုးအစားများ အောက်တွင်ကျရောက်ပါသည်။ ထို့ကြောင့် ၎င်းတို့သည် အစိုးရ၊ ပုဂ္ဂလိက၊ လူထုဦးဆောင်သော စီမံမှုနှင့်ပူးတွဲစီမံမှု စသည်ဖြင့် ကွဲပြားသော စီမံမှုစနစ်များ အောက်တွင်ရှိနေပါသည်။ ယခင်ဆယ်စုနှစ်များအတွင်း မြန်မာနိုင်ငံရှိ အဓိက ဇီဝမျိုးစုံမျိုးကွဲ ဧရိယာများအား မြန်မာနိုင်ငံတွင် ဇီဝမျိုးစုံမျိုးကွဲ ထိန်းသိမ်းရေးအတွက် ရင်းနှီးမြှုပ်နှံမှုများ သတ်မှတ်ရန်နှင့် ဦးစားပေးရန် ပြန်လည်သုံးသပ်၍ အဆင့်မြှင့်တင်ထားပါသည်။

စုစုပေါင်း အဓိကဇီဝမျိုးစုံမျိုးကွဲ ဧရိယာ ၁၃၂ ခုအားမြန်မာနိုင်ငံအတွက် သတ်မှတ်ထားပြီး မျိုးစိတ်အခြေခံသည့် ရှားပါးမှုနှင့် စီမံကိန်းနေရာအခြေခံသည် ရှားပါးမှုတို့အပေါ်မူတည်၍ ဦးစားပေးပါသည်။ အဓိကဇီဝမျိုးစုံမျိုးကွဲ ဧရိယာသုံးခုအား မျိုးသုန်းမှုပပျောက်ရေး ပူးပေါင်း ရေးအောက်တွင်သတ်မှတ်ပြီး တစ်ခုအား ရေတိမ်ဒေသနေရာအဖြစ်လည်းကောင်း၊ အရေးကြီးသည့်ငှက်မျိုးစိတ် ဧရိယာ ၅၃ ခုအဖြစ်လည်းကောင်း၊ ၆ ခုအား အာဆီယံ အမွေအနှစ်တောများအဖြစ်လည်းကောင်း သတ်မှတ်ထားပါသည်။

စီမံကိန်းနယ်မြေသည် အရေးကြီးသည့် ငှက်မျိုးစိတ် ဧရိယာဖြစ်ပြီး ၂၀၀၄ခုနှစ်တွင် စစ်ဆေး ခဲ့သည့် တနင်္သာရီ အမျိုးသားသစ်တောမှ အနောက်တောင်ဘက် ၁၈ ကီလိုမီတာတွင် တည်ရှိ ပါသည်။ အမျိုးသားသစ်တောသည် ၂၅၉၀၀၀ ဟက်တာကျယ်ဝန်းပါသည်။ စီမံကိန်းနယ်မြေ သည် အရေးကြီးသည့် ငှက်မျိုးစိတ်ဧရိယာဖြစ်သည့် မော်စကိုကျွန်း (Moscos)၊ Archipelago ဘေးမဲ့တောမှ အရှေ့မြောက် ၃၀ ကီလိုမီတာတွင်ရှိပါသည်။ စီမံကိန်းနယ်မြေသည် အဓိက ဇီဝမျိုးစုံမျိုးကွဲ ဧရိယာအတွင်း တည်ရှိမနေပါ။ စီမံကိန်းနယ်မြေသည် ကာကွယ်တောနယ်မြေ နှစ်ခုဖြစ်သည့် တနင်္သာရီအမျိုးသားသစ်တော (အမျိုးသားသစ်တောမှ အနောက်တောင်ဘက် ၁၈ ကီလိုမီတာ)နှင့် မော်စကိုကျွန်း(Moscos)၊ Archipelago ဘေးမဲ့တော (အရှေ့မြောက် ၃၀ ကီလိုမီတာ) အနီးတွင်တည်ရှိပါသည်။ စီမံကိန်းနယ်မြေသည် ကာကွယ်တောနယ်မြေတွင် တည်ရှိမနေပါ။

ERM ၏ ကန်ထရိုက်တာသည် ခြောက်သွေ့နှင့် စိုစွတ်ရာသီနှစ်ခုလုံးတွင် ကွင်းဆင်းလေ့လာ ရေးများ ဆောင်ရွက်ခဲ့ပါသည်။ ကာကွယ်ရေးနယ်မြေနှင့် သက်ရောက်နယ်မြေအတွင်း ဦးစားပေး ဇီဝမျိုးစုံမျိုးကွဲဟန်ဖိုးများ၏ တည်နေရာကိုဆုံးဖြတ်ရန် ကွင်းဆင်းလေ့လာရေးကို ဆောင်ရွက် ခဲ့ပါသည်။ အဆိုပါ ဦးစားပေးတန်ဖိုးများသည် အရေးကြီးသည့် နေထိုင်ကျက်စားမှုအစနှင့် မျိုးစိတ်ထိန်းသိမ်းရေး အရေးပါမှုကိုအဓိကထားပါသည်။ ကွင်းဆင်းလေ့လာရေးတွင် ဦးစားပေး ရမည့်မျိုးစိတ်နှင့် နေထိုင်ကျက်စားသည့် နေရာများကိုသတ်မှတ်ရန် အချက်အလက်ဖြင့် ဆန်းစစ်ခြင်း၊ နမူနာကောက်ယူမည့် နေရာများသတ်မှတ်ခြင်း (ဒေသခံရွာသားများအား မေးခွန်းမေးမြန်ခြင်း အပါအဝင်)၊ အဓိကအပင်နှင့် တိရစ္ဆာန်အုပ်စုများအား အဓိကထားသော ကွင်းဆင်းလေ့လာရေးများနှင့် ရရှိသည့်အပင်နှင့် တိရစ္ဆာန်မှတ်တမ်းများအား မြေပုံရေးဆွဲခြင်း နှင့်အမျိုးအစားခွဲခြားခြင်း တို့ပါဝင်ပါသည်။ နေထိုင်ကျက်စားမှု ဆန်းစစ်ခြင်းအား IFC PS6မှ လိုအပ်သည့် သဘာဝအလျောက် နေထိုင်ကျက်စားမှုနှင့် ပြောင်းလဲလာသည့် နေထိုင်ကျက်စား မှုပြမြေပုံ သတင်းပေးနိုင်ရန် ဆောင်ရွက်ခဲ့ပါသည်။

၁.၉။ လူမှုစီးပွားဝန်းကျင်အခြေခံအချက်အလက်ဖော်ပြချက်

မြန်မာနိုင်ငံသည် အုပ်ချုပ်ရေးရည်ရွယ်ချက်များအတွက် မြို့နယ်များအဖြစ် ထပ်မံခွဲခြားသော ပြည်နယ်များနှင့်တိုင်းဒေသကြီးများအဖြစ် ခွဲခြားထားပါသည်။ စီမံကိန်းနေရာသည် တနင်္သာရီတိုင်းဒေသကြီး၊ ရေဖြူမြို့နယ်တွင် တည်ရှိပါသည်။

စီမံကိန်းနေရာနှင့် (သို့) စီမံကိန်းနှင့် ဆက်စပ်နေသည့် အဆောက်အအုံနှင့် ထိစပ်နေမှုကြောင့် စီမံကိန်းမှ သက်ရောက်နိုင်ခြေရှိသည့် သက်ရောက်ခံများတွင်

- မိချောင်းအိုင်ကျေးရွာ- ၄င်းသည် စီမံကိန်းဘေးကပ်လျက်တွင် တိုက်ရိုက်တည်ရှိ နေပါသည်။ ၄င်းကျေးရွာသည် စီမံကိန်းနေရာနှင့် ကံပေါက်ကျေးရွာကို ဆက်သွယ် ထားသည့် ကားလမ်းတစ်လျှောက်တွင် တည်ရှိပါသည်။
- လှည်းကုန်းကျေးရွာ- ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အနောက်တောင်ဘက် ၀.၆ ကီလိုမီတာခန့် အကွာတွင် တည်ရှိပါသည်။
- ကံပေါက်ကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အနောက်တောင်ဘက် ၂.၁ ကီလိုမီတာခန့် အကွာတွင် တည်ရှိပါသည်။
- ရှင်ပျံကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အရှေ့မြောက်ဘက် ၂.၅ ကီလိုမီတာခန့် အကွာတွင် တည်ရှိပါသည်။
- ပြင်ကြီးကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အနောက်တောင်ဘက် ၃.၃ ကီလိုမီတာခန့်အကွာတွင်တည်ရှိပြီး ရေတင်ဌာနဘေးတွင် တည်ရှိပါသည်။
- ဂန့်ဂေါ်တောင်ကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အရှေ့တောင်ဘက် ၃.၃ ကီလိုမီတာခန့်အကွာတွင် တည်ရှိပါသည်။

- ဖက်တောင်ကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အနောက်တောင်ဘက် ၄.၅ ကီလိုမီတာခန့်အကွာတွင် တည်ရှိပါသည်။
- အုန်းပင်ကွင်းကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အနောက်မြောက် ဘက် ၄.၅ ကီလိုမီတာခန့်အကွာတွင် တည်ရှိပါသည်။
- ရေငံကျေးရွာ - ထိုကျေးရွာသည် စီမံကိန်းနယ်မြေ၏ အရှေ့မြောက်ဘက် ၃.၉ ကီလိုမီတာခန့်အကွာတွင် တည်ရှိပါသည်။

လူထုများအကြားရယူနိုင်သည့် သတင်းအချက်အလက် ပြန်လည်ဆန်းစစ်လေ့လာခြင်းကို လုပ်ဆောင်ခဲ့ပြီး ကွင်းဆင်းအချက်အလက်များသည် လေ့လာရေးနယ်မြေသို့ ကွင်းဆင်း လေ့လာလည်ပတ်ရာမှ စုဆောင်းရရှိပါသည်။ ကွင်းဆင်းအချက်အလက်များသည် နည်းအမျိုးမျိုး ဖြင့်စုဆောင်းရရှိသောကြောင့် သုံးမျိုးဖြစ်နိုင်ပါသည်။ ၎င်းတို့တွင်-

- ကျေးရွာခေါင်းဆောင်များနှင့် အဓိက/အရေးကြီးသည့် မေးမြန်းခြင်း
- ကျေးရွာတစ်ခုစီအတွင်း အဓိကကဏ္ဍများနှင့် အုပ်စုဖွဲ့မေးမြန်းခြင်း
- အိမ်ထောင်စုစစ်တမ်းကောက်ယူခြင်း (စုစုပေါင်း အိမ်ထောင်စု ၃၀၀ စစ်တမ်းကောက်ခြင်း)

၁.၉.၁။ လူဦးရေဆိုင်ရာ အချက်အလက်များ

၂၀၁၇ ခုနှစ်၊ ဇန်နဝါရီလတွင် မြန်မာနိုင်ငံရှိ လူဦးရေသည် ၅၇ သန်းနီးပါးရှိသည်ဟု ခန့်မှန်းရခဲ့ ပါသည်။ ၂၀၁၄ ခုနှစ်တွင် တနင်္သာရီတိုင်းသည် ခရိုင် ၃ ခု၊ မြို့နယ် ၁၆ ခုဖြင့် ဖွဲ့စည်းထားပြီး လူဦးရေ ၁.၄ သန်းခန့်ရှိသည်ဟု ခန့်မှန်းရပါသည်။

၂၀၁၆ ခုနှစ်တွင် စုစုပေါင်းလူဦးရေ၏ ၆၅.၇ ရာခိုင်နှုန်းသည် ကျေးလက်ဒေသများတွင်နေထိုင် ကြ၍ ၃၄.၃ ရာခိုင်နှုန်းသည် မြို့ပြတွင် နေထိုင်ကြသည်ဟု ခန့်မှန်းရခဲ့ပါသည်။ တနင်္သာရီတိုင်း ဒေသကြီးတွင်မူ ကျေးလက်ဒေသတွင် နေထိုင်ကြသော လူဦးရေမှာ ၇၅ ရာခိုင်နှုန်းခန့်ရှိပါ သည်။ ရေဖြူမြို့ နယ်တွင် လူဦးရေ ၁၀၀၇၆၀ ယောက်နီးပါးရှိပြီး အများစုမှာ(၉၆ ရာခိုင်နှုန်းခန့်) ကျေးလက်ဒေသများတွင် နေထိုင်ကြပါသည်။

မြန်မာနိုင်ငံရှိ အကြီးဆုံးလူမျိုးစုမှာ ဗမာဖြစ်ပြီး စုစုပေါင်းလူဦးရေ၏ ထက်ဝက်ကျော်၊ ၆၈ ရာခိုင်နှုန်းရှိပါသည်။ ရှမ်းလူမျိုး ၉ ရာခိုင်နှုန်း၊ ကရင်လူမျိုး ၇ ရာခိုင်နှုန်း၊ ရခိုင်လူမျိုး ၄ ရာခိုင်နှုန်း၊ တရုတ်လူမျိုး ၃ ရာခိုင်နှုန်း၊ အန္ဒိယ ၂ ရာခိုင်နှုန်း၊ မွန်လူမျိုး ၂ ရာခိုင်နှုန်းနှင့် အခြား ၅ ရာခိုင်နှုန်း ခန့် ပါဝင်နေပါသည်။

စီမံကိန်းဧရိယာအတွင်း တည်ရှိနေသော ရွာများအနေဖြင့်ဆိုရလျှင် အကြီးဆုံးရွာမှာ ကံပေါက် ရွာဖြစ်ပြီး လူဦးရေ ၉,၉၇၆ ခန့်ရှိ၍ ဖက်တောင်ရွာမှာ လူဦးရေ ၁၂၅ ဦးဖြင့် အသေးဆုံးရွာ အဖြစ်ရှိနေပါသည်။ ဘာသာစကား။ ကိုးကွယ်ယုံကြည်မှုသည် များပြားလာသော မြန်မာ့လူဦးရေ ကို ထင်ဟပ်လျက်ရှိနေပြီး ရွာတွင်နေထိုင်သော လူမျိုးစုများမှာ မြန်မာစကားပြောသော ဗမာ လူမျိုးများ

ဖြစ်ကြသည်။ သို့သော်လည်း ကံပေါက်တွင် ဟိန္ဒူဘုရားရှိခိုးကျောင်းတစ်ခုနှင့် ဗလီ တစ်ခု ရှိနေပါသည်။

၁.၉.၂။ လူထုကျန်းမာရေး

အမျိုးသမီး မြန်မာနိုင်ငံရှိ လူ့သက်တမ်းမှာ အမျိုးသားများအနေဖြင့် ၆၄နှစ်ဖြစ်ပြီး အမျိုး သမီးများမှာမူ ၆၈နှစ်ဖြစ်သည်။ အဓိကရောဂါဖြစ်ပွားသည့် အကြောင်းရင်းများသည် ကူးစက်ရောဂါမျ ကိုယ်ဝန်ဆောင်ခြင်းနှင့် ကလေးမီးဖွားခြင်းများဖြင့် ဖြင့် အများဆုံးဆက်စပ်လျက် ရှိပါသ သေဆုံးနှုန်းတွင် အဓိကဖြစ်စေသည့် အကြောင်းရင်းများမှာ အများအားဖြင့် ကူးစက်ရောဂါများနှင့် ဆက်စပ်လျက်ရှိနေသည်။ ဥပမာ- ကိုယ်ခံစွမ်းအားကျရောဂါပိုး (HIV)/ ကိုယ်ခံအားကျ ကူးစက်ရောဂါ (AIDS)

သန့်ရှင်းသော သောက်သုံးရေရရှိမှုနှင့် မိလ္လာရေဆိုး သန့်စင်ခြင်းစနစ် အထောက်အပံ့ပေးမှု အပေါ်မူတည်၍ ကူးစက်ရောဂါ ပြန့်ပွားနှုန်းသည် ပိုမိုဆိုးဝါးလာနိုင်ပါသည်။ မန္တလေးတိုင်း ဒေသကြီးအတွက် များပြားလာသော လူဦးရေနှင့်ယှဉ်လျှင် မြို့ပြနေရာများတွင် ၉၆.၇ ရာခိုင်နှုန်း၊ ကျေးလက်နေရာများတွင် ၇၈.၉ ရာခိုင်နှုန်းဖြင့် ပိုမိုကောင်းမွန်သော သန့်ရှင်းသပ်ရပ်သည့် အိမ်သာစနစ်များရှိနေပါသည်။ မန္တလေးတိုင်းဒေသကြီးအတွင်း တိုးတက်လာသော သောက်သုံးရေ ရရှိမှုသည် လူဦးရေ၏ ၈၇.၇ ရာခိုင်နှုန်းထိ ရရှိနေပါသည်။ (လူထုကျန်းမာရေးစစ်တမ်း ၂၀၁၂၊ ကျန်းမာရေး ဝန်ကြီးဌာန)

ကျန်းမာရေးဝန်ကြီးဌာန၏ ၂၀၁၂ ခုနှစ် စစ်တမ်းများအရ မြန်မာနိုင်ငံတွင် ပြည်သူ့ဆေးရုံ ၉၈၇ရုံ ရှိပြီး စုစုပေါင်းခုတင် ၅၄၅၀၃ ခုရှိပါသည်။ လက်ရှိရှိနေသော ကျန်းမာရေးအထောက်အပံ့ များတွင် ဖြည့်စွက်ပြောဆိုရလျှင် တိုင်းရင်းဆေးသုံးစွဲလာမှုသည် ကျယ်ကျယ်ပြန့်ပြန့် ရှိလာပြီး ပြည်တွင်းကျန်းမာရေး ဝန်ဆောင်မှုများ၏ လိုအပ်ချက်တစ်ရပ်အဖြစ် ဖြစ်ပေါ်လာပါသည်။

ကွင်းဆင်းလေ့လာရာ နေရာများတွင် ကျန်းမာရေးမှူးများနှင့် တွေ့ဆုံမေးမြန်းမှုများအရ ကူးစက်ရောဂါများနှင့်အတူ မကူးစက်နိုင်သော ရောဂါများပါရှိနေပါသည်။ ရောဂါဖြစ်ပွားသည့် အဓိက အကြောင်းရင်းများအနေဖြင့် သွေးတိုးရောဂါ၊ ဆီးချိုရောဂါ၊ စိုးရိမ်ရသော အသက်ရှူ လမ်းကြောင်းဆိုင်ရာ ကူးစက်မှု၊ လေဖြတ်ခြင်း၊ တုတ်ကွေးရောဂါများနှင့် ဆက်စပ်နေသော ရိုးရိုးဖျားနာမှုများကို အဓိကအဖြစ်အများဆုံး ရောဂါများအဖြစ် တွေ့ရပါသည်။ လေ့လာခဲ့သည့် နေရာများအတွင်း တိုင်းဒေသကြီးအဆင့်နှင့် အရေအတွက်တူတူ ဖြစ်နေသည့် အလားတူစွာ မိခင်သေနှုန်းသည် ကလေးမွေးဖွားနှုန်း ၁၀၀၀ တွင် ၀.၂ ရာခိုင်နှုန်း ရှိပြီး မွေးကင်းစကလေး သေဆုံးမှုသည် ကလေးမွေးဖွားနှုန်း ၁၀၀၀ တွင် ၀.၁၈ ရာခိုင်နှုန်း ရှိနေသည့်အတွက် ကျန်းမာရေးမှူးများမှ ကိုယ်ဝန်ဆောင်ခြင်းနှင့် ကလေးမီးဖွားခြင်းကို ကျန်းမာရေး ပြဿနာ တစ်ရပ်အနေအဖြစ် ထည့်သွင်းစဉ်းစားခြင်းမရှိပါ။

ကွင်းဆင်းလေ့လာခဲ့သည့် နေရာများတွင် အများဆုံးဖြစ်လေ့ရှိသော ရောဂါဖြစ်ပွားရသည့် အကြောင်းရင်းအနေဖြင့် ငှက်ဖျားရောဂါ၊ သွေးတိုးရောဂါ၊ အသဲရောဂါ၊'ယာဉ်မတော်တဆ'

ထိခိုက်မှုများကို ဖော်ပြထားပါသည်။ ယာဉ်မတော်တဆ ထိခိုက်မှုများကြောင့် အသေအပျောက် အရေအတွက် တိုးလာသည့် အခြေအနေတွင် ငှက်ဖျားရောဂါကြောင့် သေဆုံးမှုများသည် မကြာသေးမီ နှစ်များအတွင်း လျော့ကျလာခဲ့ပါသည်။

၁.၉.၃။ စီးပွားရေး နှင့် အသက်မွေးဝမ်းကျောင်း

၂၀၁၅ ခုနှစ် မြန်မာ့ပြည်တွင်းထုတ်ကုန် ဝင်ငွေသည် ဒေါ်လာသန်းပေါင်း ၆၂ သန်းထိ ရရှိခဲ့ သည်ဟု ခန့်မှန်းရပါသည်။ လူတစ်ဦးချင်းစီ၏အသားတင် ထုတ်လုပ်မှုနှင့် ဝန်ဆောင်မှုတန်ဖိုး အများဆုံး ဒေါ်လာ ၁၁၆၀ ထိရှိခဲ့ပြီး အရှေ့တောင်အာရှတွင် အနိမ့်ဆုံးတစ်ခု ဖြစ်ခဲ့သည့် အပြင် ပြီးခဲ့သည့်နှစ်ထက်နည်းခဲ့သည်။

မြန်မာနိုင်ငံသည် တိုက်ရိုက်စီးပွားရေးစနစ်မှ ဈေးကွက်စီးပွားရေးစနစ်သို့ အကူးအပြောင်း ကာလတွင်ရှိနေပါသည်။ ထိုအခြေအနေတစ်ရပ်ကို ၂၀၁၁ ခုနှစ်တွင် ထုတ်ဖော်ခဲ့သော ပြုပြင် ပြောင်းလဲရေးအစီအစဉ်မှ ထောက်ပံ့ပေးထားပါသည်။ စိုက်ပျိုးရေး၊ သစ်တောနှင့် ငါးဖမ်း လုပ်ငန်းများသည် စီးပွားရေး၏ အဓိကအခန်းကဏ္ဍများတွင် ပါဝင်နေပါသည်။

<u>**စိုက်ပျိုးရေး**</u>

အစဉ်အလာအားဖြင့် မြန်မာနိုင်ငံသည် စိုက်ပျိုးရေးကဏ္ဍတွင် မှီတည်နေသော နိုင်ငံတစ်ခု ဖြစ်သည်။ (ဆက်စပ်နေသော သစ်တောနှင့်ငါးဖမ်းလုပ်ငန်းများလည်း ရှိနေပါသည်) စပါးကဲ့သို့ နှံစားသီးနှံများကို မြန်မာနိုင်ငံ၏ စိုက်ပျိုးမြေ ထက်ဝက်နီးပါးခန့် စိုက်ပျိုးကြသည်။ အခြား စိုက်ပျိုးထုတ်ကုန်များမှာ ပဲ၊ နှမ်း၊ မြေပဲ၊ ကြံ နှင့် သစ်မာတို့ ဖြစ်ကြသည်။ ကွင်းဆင်းလေ့လာခဲ့ သည့် ဒေသများတွင် စိုက်ပျိုးရေးလုပ်ငန်းသည် အဓိကလုပ်ငန်းတစ်ရပ်အဖြစ် ရှိနေပါသည်။

ရေဖြူမြို့ နယ်အတွင်း စိုက်ပျိုးသော သီးနှံများမှာ စပါး၊ နှမ်း၊ ကြံ နှင့် ပြောင်းဖူး တို့ဖြစ်ကြသည်။ ထို့ပြင် ရာဘာ၊ ဆီအုန်း၊ ကွမ်းနှင့် အုန်းသီးတို့ကိုလည်း နှစ်ရှည်သီးနှံများအဖြစ် စိုက်ပျိုး ကြသည်။ ရာဘာ၊ ကွမ်း၊ ခရီ၊ သီဟိုဠ်၊ ပိန္နဲ၊ ကြက်မောက်၊ ကြံနှင့် ဒူးရင်းသီးတို့ကိုလည်း အဓိကဝင်ငွေရသော စိုက်ပျိုးသီးနှံများအဖြစ် တွေ့ရပါသည်။ အခြားသီးနှံများမှာ နာနတ်နှင့် ငရုတ်ကောင်းတို့ဖြစ်သည်။ သီဟိုဠ်နှင့် ကွမ်းသီးတို့ကို ထားဝယ်ဈေးတွင် ရောင်းချလေ့ ရှိသည်။ အိမ်ထောင်စုတော်တော်များများတွင် ဥယျာဉ်ခြံမြေများ ပိုင်ဆိုင်ကြပြီး တစ်ချို့တွင် လည်း လယ်ယာများပိုင်ဆိုင်ကြပါသည်။

စိုက်ပျိုးသီးနှံများအပြင် မွေးမြူရေးသည်လည်း မြန်မာနိုင်ငံ၏ ဝင်ငွေအရင်းအမြစ် နောက်တစ်ခု ဖြစ်သည်။ ဘဲ၊ ကျွဲ၊ နွား၊ ဆိတ်၊ သိုး၊ ကြက်နှင့် ဝက်အပါအဝင် တိရစ္ဆာန်အမျိုးမျိုး မွေးမြူကြပါသည်။ ၂၀၁၄/၂၀၁၅ ခုနှစ်များတွင် ဘဲသည် အများဆုံးမွေးမြူသည့် အရာဖြစ်ခဲ့ပြီး သန်းပေါင်း ၁၈.၃ သန်းထိရှိခဲ့သည်။ အလားတူစွာ နွားနှင့်ကြက်များကိုလည်း မွေးမြူခဲ့ကြသည်။

တနင်္သာရီတိုင်းဒေသကြီးအတွင်း ဘဲမွေးမြူရေးကို အများဆုံးတွေ့ရပြီး ကြက်များလည်း မွေးမြူ ကြပါသည်။ ရွာသားများအနေဖြင့် ဝက်၊ ဆိတ်၊ ဘဲ၊ ကျွဲ၊ သိုးတို့အပြင် ဥနှင့်အသားစားအဖြစ် ကြက်၊

ဘဲစသည်တို့ကို မွေးမြူကြပါသည်။ သို့သော်လည်း မွေးမြူရေးထက် စိုက်ပျိုးရေးလုပ်ငန်း၊ လုပ်ဆောင်သော အိမ်ထောင်စုများပိုများပါသည်။ ငါးဖမ်းလုပ်ငန်းထက်ပင် များပြားသည်ကို တွေ့ရပါသည်။

မွေးမြူရေးတော်တော်များများသည် ကိုယ်ပိုင်စားသောက်ရန် ဖြစ်နေတတ်ပြီး တစ်ချို့ ကိုသာ ဈေးတွင် ရောင်းချသည်ကိုတွေ့ရပါသည်။ မွေးမြူရေးလုပ်ငန်းများကို ဆောင်ရွက်ရာတွင် အမျိုးသားရော အမျိုးသမီးပါ ပါဝင်ကြပါသည်။ ယင်းလုပ်ငန်းတွင် တိရစ္ဆာန်များအတွက် အစာ စုဆောင်းခြင်း၊ တိရတ္ဆာန်တို့၏မစင်များအား စုဆောင်းသိမ်းဆည်းခြင်း၊ နွားနို့ညှစ်ခြင်းနှင့် ရောင်းချခြင်း သို့မဟုတ် အခြားလုပ်ငန်းများအတွက် ယူဆောင်သွားခြင်း၊ ကာကွယ်ဆေး ထိုးခြင်းနှင့် ဆေးကုသခြင်းတို့ ပါဝင်ကြပါသည်။

<u>သစ်တော</u>

၂၀၁၁ ခုနှစ်တွင် မြန်မာနိုင်ငံ၏ ၄၈ ရာခိုင်နှုန်းနီးပါးခန့်ကို သစ်တောများဖြင့် ဖုံးလွှမ်းထား ပါသည်။ FAO အရ ၂၀၁၄ ခုနှစ်နှင့် ၂၀၁၅ ခုနှစ်အတွင်း မြန်မာနိုင်ငံသည် သစ်တောဖုံးလွှမ်းမှု ၁၀.၈ ရာခိုင်နှုန်းခန့် သစ်တောမြေ ဟက်တာပေါင်း ၃.၂ သန်းခန့်ဆုံးရှုံးခဲ့သည်ဟု သိရှိရ ပါသည်။ ၂၀၁၁ ခုနှစ်တွင် သစ်တောကဏ္ဍမှ ပြည်တွင်းထုတ်ကုန်အဖြစ် ၀.၅ ရာခိုင်နှုန်းထိရှိခဲ့ပြီး လူဦးရေ ၃၆၀၀၀ ထိ အလုပ်ခန့်အပ်နိုင်ခဲ့ပါသည်။ သို့သော်လည်း အစိုးရသည် ၂၀၁၆ ခုနှစ်၊ ဩဂုတ်လ မှ ၂၀၁၇ ခုနှစ်၊ မတ်လအတွင်း ယာယီအမျိုးသားသစ်ထုတ်လုပ်မှု တားမြစ်ချက်ကို သဘောတူညီခဲ့ပြီး သစ်တောကို သစ်ထုတ်လုပ်မှု ရာသီတစ်ခုကို ရပ်ဆိုင်းခဲ့သည်။

မြေစာရင်းဌာနအရဆိုရလျှင် ရေဖြူမြို့နယ်သည် အဓိကအားဖြင့် သစ်တောများဖြင့် ဖုံးလွှမ်း လျှက်ရှိပြီး သစ်တောကြိုးဝိုင်းမြေ ၅၂၇၈၈၃ ဧက ပါဝင်နေပါသည်။ ကညင်၊ ဖက်သန်း၊ ကဒွတ်၊ မြရာ၊ ဇင်ပြွမ်းပင်၊ ပျဉ်းကတိုးနှင့် ဒညင်းတို့မှာ အများဆုံးတွေ့ရသော အပင်မျိုးစိတ်များဖြစ်သည်။

ကွင်းဆင်းလေ့လာခဲ့သည့် ဧရိယာအတွင်းရှိ ကျေးရွာများသည် သစ်တောကြိုးဝိုင်းဧရိယာ အတွင်းတွင် ရှိမနေပါ။ ထိုရွာများတွင် သစ်တောလုပ်ငန်းများ လုပ်ကိုင်ခြင်းလည်းမရှိကြပါ။ တစ်ဖက်တွင်လည်း သစ်တောထွက်ပစ္စည်းများ စုဆောင်းရာတွင် အိမ်သုံးအနေဖြင့် ထင်းကောက်ခြင်းများကိုလည်း ကျယ်ကျယ်ပြန့်ပြန့်တွေ့ရပါသည်။ ကွင်းဆင်းလေ့လာခဲ့သည့် ဧရိယာအတွင်းရှိ ကျေးရွာများ၌ ထင်းကိုဟင်းချက်ရာတွင် အသုံးပြုကြသည်။ ထင်းများကို ရွာအနီးတစ်ဝိုက်တွင်သာ ကောက်ယူစုဆောင်းလေ့ရှိပါသည်။ ဥပမာအားဖြင့် စိုက်ပျိုးရေး လုပ်ငန်းများ လုပ်ကိုင်သည့်နေရာ အနီးတစ်ဝိုက်များတွင်ဖြစ်သည်။

<u>ရေလုပ်ငန်း</u>

ငါးဖမ်းလုပ်ငန်းမှ ပြည်တွင်းထုတ်ကုန် ၈ ရာခိုင်နှုန်း နီးပါးရရှိပါသည်။ လုပ်ငန်းကို ကုန်းတွင်း ငါးဖမ်းလုပ်ငန်း၊ ပင်လယ်ငါးဖမ်းလုပ်ငန်းနှင့် ငါးမွေးမြူရေးဟု အပိုင်းသုံးပိုင်းဖြင့် ခွဲခြားထား ပါသည်။

လုပ်ငန်း၏ ၅၂ ရာခိုင်နှုန်းနီးပါးကို ပင်လယ်ငါးဖမ်းလုပ်ငန်းမှရရှိပြီး ကုန်းတွင်းငါးဖမ်း လုပ်ငန်းမှ ၂၇ ရာခိုင်နှုန်း၊ ငါးမွေးမြူရေးမှ ၂၀ ရာခိုင်နှုန်း အသီးသီးရှိနေပါသည်။

ကွင်းဆင်းလေ့လာခဲ့သည့် ဧရိယာအတွင်းရှိ အချို့ကျေးရွာများတွင် ငါးဖမ်းလုပ်ငန်းကို လုပ်ကိုင်ကြသော်လည်း လေ့လာခဲ့သည့် ဧရိယာအတွင်းတွင် အဓိက အသက်မွေးဝမ်းကျောင်း လုပ်ငန်း အဖြစ်ရှိမနေပါ။ ပြင်ကြီးရွာ၊ မိကျောင်းအိုင်ရွာနှင့် အုန်းပင်ကွင်းရွာတို့တွင် ငါးဖမ်း လုပ်ငန်းကို ထင်ထင်ရှားရှားလုပ်ကိုင်ကြပြီး အဓိကအားဖြင့် ဟိန်းဇဲချောင်းတွင် ဖမ်းယူကြပါသည်။ ငါးဖမ်းလုပ်ငန်းတွင် အသုံးပြုသောလှေများမှာ ပုံမှန်အားဖြင့် ၅ မီတာခန့်ရှည်ပြီး အသုံးပြုသောစက်မှာ မြင်းကောင်ရေ ၅/၆ ကောင်အား ရှိသည်။ မလှ၏ခံနိုင်ဝန်မှာ ကီလို ၃၀၀ ခန့်ရှိသည်။ လေ့လာခဲ့သည်ဒေသများတွင် မြပ်ပိုက်၊ ဆွဲပိုက်၊ ငါးမျှားချိတ်နှင့် မျှားတံ၊ လက်လုပ်ဂဏန်းမျိုးတို့ကို ငါးဖမ်းလုပ်ငန်းတွင် ကျယ်ကျယ်ပြန့်ပြန့် အသုံးပြုနေသည်ကို တွေ့ရပါသည်။

၁.၉.၄။ လူထု အခြေခံအဆောက်အအုံများနှင့် ပြည်သူ့ဝန်ဆောင်မှုများ

ကန့်သတ်ထားသော အခွင့်အလမ်းများနှင့်အတူ လက်ရှိတည်ရှိနေသော အခြေခံအဆောက် အအုံများနှင့် ဝန်ဆောင်မှုညံ့ဖျင်းမှုများသည် မြန်မာ့တိုးတက်မှုကို ပိတ်ပင်နေသော အတား အဆီးများအဖြစ် သတ်မှတ်ထားပါသည်။ လူထုအခြေခံအဆောက်အအုံများနှင့် ပြည်သူ့ ဝန်ဆောင်မှုများတွင် လမ်း၊ ကြေးနန်းဆက်သွယ်ရေး၊ သောက်သုံးရေ၊ စွန့်ပစ်ပစ္စည်းများ စနစ် တကျ စီမံခန့်ခွဲခြင်းများကဲ့သို့ အခြေခံအဆောက်အအုံများနည်းတူ အခြေခံကျန်းမာရေးနှင့် ပညာရေးဝန်ဆောင်မှု စီမံချက်များ ပါဝင်ပါသည်။ (ကမ္ဘာ့ဘဏ်၊ ၂၀၁၅)

<u>လျှပ်စစ်မီး ရရှိမှု</u>

အလင်းရောင် ရရှိရာတွင် အရင်းအမြစ်အမျိုးမျိုး ရှိနေပါသည်။ လျှပ်စစ်မီး၊ ဖယောင်းတိုင်နှင့် ဘက်ထရီတို့ကို အသုံးများလေ့ရှိပါသည်။

လျှပ်စစ်မီးရရှိရေးသည် မြန်မာအစိုးရမှ စွမ်းအင်ကဏ္ဍအတွက် ဆောင်ရွက်နေသည့် ရင်းနှီး မြှုပ်နှံမှုပေါ်မူတည်၍ နောင်တွင်ပြောင်းလဲမည့် အလားအလာရှိပါသည်။ တိုးပွားလာသော လူဦးရေအလိုက် လျှပ်စစ်ဓာတ်အား ဖြည့်ဆည်းပေးရန် လျှပ်စစ်ဓာတ်အားပေး စက်ရုံအသစ် အရေအတွက်များလည်း တိုးတက်လာနေပြီ ဖြစ်ပါသည်။

လေ့လာသည့်ဒေသတွင်း အိမ်ထောင်စုအများစုတွင် လျှပ်စစ်မီးရရှိကြပါသည်။ ထိုအိမ်ထောင်စု များတွင် ထက်ဝက်နီးပါး လျှပ်စစ်မီး ၂၄ နာရီ ရရှိကြပါသည်။ လျှပ်စစ်မီး တစ်နေ့ ၁၀ နာရီခန့် ရရှိမည့် အချို့ရွာများတွင် ၃ နာရီသာရရှိပါသည်။ သို့သော်လည်း လျှပ်စစ်မီးပြတ်တောက်မှု များသည် နွေရာသီအပူချိန် အမြင့်ဆုံးအချိန်များတွင် မကြာခဏ ဖြစ်တတ်ပါသည်။ ရွာနေ လူများသည် ကံပေါက်မှ ဂတ်(စ်)ဝယ်ယူနိုင်ပြီး၊ မီးသွေးကိုမူ မင်းသားရွာမှတင်ပို့သော မီးသွေး များကို ရွာအတွင်း ဝယ်ယူရရှိနိုင်ပါသည်။

<u>သယ်ယူပို့ဆောင်ခြင်း</u>

မြန်မာနိုင်ငံတွင် မီးရထားလမ်း၊ ကုန်းတွင်းလမ်း၊ လေကြောင်းလမ်း၊ ရေကြောင်းလမ်း အပါအဝင် သယ်ယူပို့ဆောင်ရေး နည်းလမ်းအမျိုးမျိုး တွေ့ရပါသည်။ တစ်ချို့ နေရာများတွင် သယ်ယူပို့ဆောင်ရေး နည်းလမ်းအမျိုးမျိုး ကောင်းစွာ ဖွံ့ဖြိုးတိုးတက်လာသော်လည်း တစ်ခြား နေရာများတွင် ကန့်သတ်ချက်များရှိနေပါသည်။

စီမံကိန်းနေရာအတွင်း အဓိကသယ်ယူပို့ဆောင်ရေးမှာ ဆိုင်ကယ်ဖြစ်သည်။ ထို့အပြင် ရွာတစ်နှင့်တစ်ရွာသာမက ထားဝယ်မြို့အထိပါ ပြေးဆွဲနေသော လိုင်းကားများရှိပါသည်။ တွေ့ဆုံမေးမြန်းမှုများ ပြုလုပ်ခဲ့ကြသည့် လူအများစုသည် တစ်ခြားရွာများသို့ နေ့စဉ်အသွားအလာ ရှိပါသည်။ ကံပေါက်နှင့် ဖက်တောင်ရွာကြားရှိ လမ်းမှလွဲ၍ စီမံကိန်းနေရာအတွင်း လမ်းများကို ကောင်းစွာ ပြုပြင်ထားပါသည်။

<u>စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု</u>

မြန်မာနိုင်ငံတွင် လူတစ်ဦးချင်းစီ၏ အမှိုက်စွန့်ပစ်မှုနှုန်းသည် တစ်ရက်လျှင် ၀.၄၅ ကီလိုဂရပ်ခန့် ရှိသည်ဟု ခန့်မှန်းရပါသည်။ ယင်းတွင် သဘာဝစွန့်ပစ်ပစ္စည်းများ၊ လုပ်ငန်းသုံးအမှိုက်၊ စာရွက်၊ ပလတ်စတစ် စွန့်ပစ်ပစ္စည်းများ ပါဝင်ပါသည်။ စွန့်ပစ်ပစ္စည်း ၆၅ ရာခိုင်နှုန်းခန့်သည် သဘာဝ စွန့်ပစ်ပစ္စည်းများဖြစ်နေသည်ကို ခန့်မှန်းရပါသည်။ သဘာဝစွန့်ပစ်ပစ္စည်းသည် စိုက်ပျိုးရေး လုပ်ငန်းမှ အများဆုံးထွက်ရှိသောကြောင့် ယင်းစွန့်ပစ်ပစ္စည်းများသည် စိုက်ပျိုးရေးကဏ္ဍ အရွယ်အစားပေါ်မူတည် ထွက်ပေါ်လာခြင်းဖြစ်သည်။

လေ့လာသည့် ဓနရာများတွင် စွန့်ပစ်ရေသည် မြေအောက်နှင့် အနီးဆုံးချောင်းကို တိုက်ရိုက် သက်ရောက်နေပါသည်။ အစိုင်အခဲစွန့်ပစ်ပစ္စည်းများမှာမူ အိမ်တစ်အိမ်ချင်းစီနှင့် သက်ဆိုင် နေပါသည်။ ကံပေါက်၊ လှည်းကုန်းနှင့် မိချောင်းအိုင်တို့တွင် အမှိုက်ပစ်ရန် နေရာများ သီးသန့် ရှိနေသော်လည်း အမှိုက်လာရောက်သိမ်းဆည်းခြင်း(သို့) အမှိုက်သိမ်းစနစ်ရှိမနေပါ။ ခြံဝန်းထဲ တွင်သာ မီးရှို့ခြင်း၊ အမှိုက်ပုံများတွင် စွန့်ပစ်ခြင်းနှင့် အနီးဆုံးချောင်းထဲသို့ စွန့်ပစ်ခြင်းများကို ပုံမှန်လုပ်လေ့လုပ်ထအတိုင်း ဆောင်ရွက်ကြပါသည်။

၁.၉.၅။ ယဉ်ကျေးမှုအမွေအနှစ်များ

ကြိုတင်လေ့လာခြင်းကို ဆက်လက်၍သတင်းရရှိစေရန် လက်တွေ့ကွင်းဆင်းလေ့လာခြင်း ဖြင့်ဆောင်ရွက်ရာ မသိနိုင်သော ရှေးဟောင်းသုတေသန အရင်းအမြစ်များ(သို့) မြေပေါ်ရှိ ရှေးဟောင်း အရင်းအမြစ်များကိုခွဲခြားခဲ့ပါသည်။ သို့သော်လည်း များစွာသောလက်ရှိ ရှေးဟောင်း အမွေအနှစ်နေရာများသည် ယဉ်ကျေးမှုအဝပ္ပအနှစ်နေရာအတွင်း တည်ရှိနေပါသည်။ ခွဲခြား ရရှိသောအရာများမှာ ဘုရားအမျိုးမျိုး၊ ခရစ်ယာန်ဘုရားကျောင်းများနှင့် ဇလီကဲ့သို့သော ဝတ်ပြုနေရာအမျိုးမျိုးတို့ ဖြစ်ပါသည်။ ထိုအရာအများစုမှာ လူများနေထိုင်ရာ နေရာအတွင်းနှင့် အနီးဝန်းကျင်တွင် တည်ရှိပါသည်။ မြင်သာထင်ရှားသော ယဉ်ကျေးမှုအမွေအနှစ်များကို

စီမံကိန်းနေရာအတွင်း မတွေ့ရပါ။ (CCPP လုပ်ငန်းခွင်နယ်နိမိတ်နှင့် အဆိုပြုရေယူ အဆောက်အအုံနှင့် ရေပိုက်လိုင်း)

အမျိုးမျိုးသော အမျိုးသားပွဲတော်များနှင့် အခမ်းအနားများ (မဖော်ပြနိုင်သော ယဉ်ကျေးမှုအမွေအနှစ်)ကို မြန်မာနိုင်ငံအနှံ့အပြားတွင် ကျင်းပကြပါသည်။ ဥပမာအနေဖြင့် သင်္ကြန်ပွဲတော်နှင့် မြန်မာ့နှစ်သစ်ကူးပွဲတော် တို့ဖြစ်ကြပါသည်။ ဘုရားပရဝဏ်များနှင့် ဘုန်းကြီးကျောင်းများသည် ထိုပွဲတော်များနှင့် အခမ်းအနားပွဲများ၏ ဗဟိုသော့ချက် ဖြစ်ပါသည်။

၁.၁၀။ သက်ဆိုင်သူများနှင့် စေ့စပ်ညှိနှိုင်းခြင်း

စီမံကိန်းပါဝင်ပတ်သက်သူများကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ဆောင်မှုတွင် အချို့သောကိစ္စရပ်များ၌ ဆွေးနွေးညှိနှိုင်းခဲ့ပါသည်။ အဓိက ဆွေးနွေးညှိနှိုင်းလုပ်ဆောင်ချက် များမှာ

- စီမံကိန်းအကြောင်း မိတ်ဆက်ခြင်းနှင့် ဆက်လက်လုပ်ဆောင်သွားမည့်စီမံကိန်း ပြုပြင်မှု များအား ဖော်ထုတ်ပြောကြားခြင်း
- ဖြစ်နိုင်သည့် သက်ရောက်မှုများ၊ အဆိုပြုလျော့ချရေး စီမံခန့်ခွဲမှု နည်းလမ်းများနှင့် စောင့်ကြည့်ရေး အစီအစဉ်များအား ရှင်းပြခြင်း
- စီမံကိန်းနှင့်ပတ်သက်၍ သတ်မှတ်ထားသောသက်ရောက်မှုများ၊ အဆိုပြုလျော့ချရေးနည်းလမ်းများနှင့် စောင့်ကြည့်ရေးအစီအစဉ်များအပေါ် သက်ဆိုင်သူများ၏ အမြင်နှင့် သဘောထားများ စုဆောင်းခြင်း
- သက်ဆိုင်သူများမှ ထုတ်ဖော်ပြောကြားလာသောအဓိကပြဿနာရပ်များကို ပြန်လည်ဖြေရှင်းခြင်း

ဆွေးနွေးညှိနှိုင်းစဉ်တစ်လျှောက်တွင် သက်ဆိုင်သူများအား မေးခွန်းများမေးစေရန်နှင့် စိုးရိမ်မှုများကိုဖော်ထုတ်ရန် အားပေးခဲ့ပါသည်။ သက်ဆိုင်သူများမှ အမျိုးမျိုးသောမေးခွန်းများနှင့် ပြဿနာရပ်များ ထွက်လာပါသည်။ အဓိက ပြဿနာရပ်များတွင်

- အလုပ်အကိုင် - ရွာအများစုသည် စီမံကိန်းကြောင့် အလုပ်အကိုင် အခွင့်အလမ်းများ ရလိုသည်ကို ဖော်ပြကြပါသည်။
- မြေပေါ်ရေနှင့် မြေအောက်ရေ၏ အရည်အသွေးနှင့် ရရှိနိုင်မှု- ဒေသခံရွာသားများ အသုံးပြုသည့် ရေများ၏အရည်အသွေးနှင့် ပမာဏကို စီမံကိန်းလုပ်ငန်းများမှ (ဥပမာ ရေဆိုးစွန့်ထုတ်မှု၊ ဟိန်းဖဲမြစ်မှ ရေအသုံးပြုမှု) သက်ရောက်နိုင်သည့် စိုးရိမ်မှုကို ဖော်ပြ ကြပါသည်။
- လျှပ်စစ်ဓာတ်အားရရှိမှု - စီမံကိန်းနေရာအတွင်းရှိ ရွာအများစုမှာ လုံလောက်သော လျှပ်စစ်မရရှိပါ။ ရွာသားများ၏ အဓိကစိတ်ဝင်စားမှုမှာ စီမံကိန်းမှ ဈေးနှုန်းသက်သာ သော လျှပ်စစ်မီးရရှိအောင် မည်သို့ဖြေရှင်းပေးမည်ကို စိတ်ဝင်စားကြပါသည်။

- စီမံကိန်းဖော်ဆောင်သူမှ တာဝန်ယူထားသည့် စီမံခန့်ခွဲမှုအစီအစဉ်ကို စောင့်ကြည့် သည့်အစီအစဉ်နှင့် ဆွေးနွေးညှိနှိုင်းမှု - စီမံခန့်ခွဲမှု အစီအစဉ်ကို စောင့်ကြည့်သည့် အစီအစဉ်ကို ကုမ္ပဏီမှ(သို့) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာနမှ မည်သူက တာဝန် ယူမည်ကို သိချင်ကြပါသည်။
- ဒေသဖွံ့ဖြိုးရေး အစီအစဉ် - ရွာတိုင်းသည် MUPA ၏ ဒေသဖွံ့ဖြိုးရေးအစီအစဉ်ကို စိတ်ဝင်စားသည်ဟု ဖော်ပြကြပါသည်။
- အခြေခံအချက် - အခြေခံအချက်အလက် ကောက်ယူစဉ် အထူးသဖြင့် ရရှိလာသော မြေပေါ်ရေအရည်အသွေး အချက်အလက်များကို သိချင်သည်ဟု တောင်းဆိုကြ ပါသည်။

လူထုဆွေးနွေးညှိနှိုင်းပွဲမှ ရရှိလာသောအချက်များနှင့် စိုးရိမ်မှုများကို ပတ်ဝန်းကျင်ထိခိုက် ဆန်းစစ်မှု အစီရင်ခံစာတွင် ထည့်သွင်းသွားပါမည်။ စောင့်ကြည့်စစ်ဆေးသည့် လုပ်ငန်းစဉ်များ၊ စီမံခန့်ခွဲခြင်း အစီအစဉ်များ၊ သက်ရောက်မှုများကို ခွဲခြားသတ်မှတ်ခြင်းနှင့် ဆန်းစစ်ခြင်းလုပ်ငန်း စဉ်တွင် ထိုအချက်အလက်များကို အသုံးပြုသွားပါမည်။ ဆွေးနွေးညှိနှိုင်းပွဲများကို ထောက်လုပ်ခြင်းနှင့်လည်ပတ်ခြင်း ကာလတစ်လျှောက်လုံး ပြုလုပ်သွားမည်ဖြစ်ပြီး လူထုပူးပေါင်းပါဝင်ပွဲမှ ရရှိလာသော အကြံပြုချက်များကို MUPA မှ လိုက်နာသွားပါမည်။

၁.၁၁။ အဓိက ဝတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုးကျိုးများ ဖြစ်ပေါ်စေသော တည်ဆောက်ရေးလုပ်ငန်းများနှင့် လည်ပတ်ခြင်းလုပ်ငန်းများအား သတ်မှတ်ပြီး ထိုဆိုးကျိုးများ၏ပမာဏ၊ သက်တမ်းနှင့် ဖြစ်နိုင်ချေ ရှိသော သက်ရောက်ခံများအား စစ်ဆေးရန် တန်ဖိုးဖြတ်ပါသည်။

၁.၁၁.၁။ တည်ဆောက်ရေးအဆင့်

တည်ဆောက်ရေးကာလအတွင်း သက်ရောက်ခံများနှင့် ဘေးပတ်ဝန်းကျင်အပေါ် ဆိုးကျိုး ဖြစ်စေနိုင်သော လုပ်ဆောင်မှုများကို အောက်ပါအတိုင်း ခွဲခြားနိုင်ပါသည်။

- မြေယာပြုပြင်ခြင်း
- လျှပ်စစ်ဓာတ်အားစက်ရုံအတွက် ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ပစ္စည်းများနှင့် စက်ယန္တရား များကို ယာယီဆိပ်ခံတံတားနေရာသို့ ဝမ်းပြားရေယာဉ်များဖြင့် ပို့ဆောင်ခြင်း၊ ထိုမှ တစ်ဆင့် ဆောက်လုပ်မည့်နေရာသို့ သံလမ်းများ၊ စက်ယန္တရားကြီးများဖြင့်ပို့ဆောင်ခြင်း
- အုတ်မြစ်ချခြင်းနှင့် တူးဖော်ခြင်းလုပ်ငန်းများမှ တိုက်စားခြင်းနှင့် အနည်အနှစ်ပို့ချခြင်း များတိုးလာခြင်းနှင့် ညစ်ညမ်းနေသည့် မြေပေါ်စီးဆင်းရေများ အပါအဝင် စွန့်ပစ်ရေများ နှင့် စီးဆင်းရေးများ၊ မကောင်းမွန်သည့် အညစ်အကြေး သိုလှောင်ခြင်းနှင့် စုပုံခြင်း။
- စီမံကိန်း ရေလိုအပ်မှုကြောင့် ဒေသတွင်း ရေထောက်ပံ့မှုအပေါ် ဖိအားများရှိလာခြင်း
- ဝန်ချီစက်သင်္ဘောကြီးများဖြင့် ပို့ဆောင်စဉ်ကာလအတွင်း ရရှိနိုင်သော ရေအနက် ပေါ်မူတည်၍ ယာယီဆိပ် တံတားဆီသို့ သောင်တူးစက်များဖြင့် ရှင်းလင်းခြင်း၊

- လျှပ်စစ်ဓာတ်အားစက်ရုံတွင် ပင်မအဆောက်အအုံ တည်ဆောက်ခြင်းနှင့် အခြေခံအဆောက်အအုံတည်ဆောက်ခြင်း၊ ရေတင်ယူသည့်စက်ရုံ၊ ရေသန့်ဝင်သည့်စက်ရုံနှင့် ရေသွယ်ပိုက်လိုင်းများပါဝင်သော ရေတင်ဌာနအဆောက်အအုံ တည်ဆောက်ခြင်း
- အုတ်မြစ်ချရန် တူးဖော်ခြင်းနှင့် လျှပ်စစ်ဓာတ်အားစက်ရုံအစိတ်အပိုင်းများတပ်ဆင်ခြင်း
- ဆောက်လုပ်ရေးကာလတွင်း ထွက်ရှိလာသော ပစ္စည်းများကို စုပုံထားရှိရန် ယာယီအသုံးပြုသောနေရာ
- အန္တရာယ်ရှိသော ပစ္စည်းများ၊ စွန့်ပစ်ပစ္စည်းများနှင့် ရေဆိုးများ သိုလှောင်ခြင်းနှင့် ကိုင်တွယ်ခြင်း
- ဆောက်လုပ်ရေး အလုပ်သမားများနှင့် ကုမ္ပဏီဝန်ထမ်းများအတွက် နေစရာနှင့် သယ်ယူပို့ဆောင်ခြင်း
- ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွင်းရှိ ခင်းမထားသော လမ်းမများပေါ်မှ ယာဉ်များ သွားလာခြင်း
- လုပ်ငန်းခွင် မြေယာရှင်းလင်းခြင်း၊ တည်ဆောက်ခြင်း ပါဝင်သည့် မြေသားပြုပြင်ခြင်း လုပ်ငန်းများနှင့် မြေစာ၊ ကျောက်စာ စုပုံခြင်းနှင့် မြေယာတူးဖော်ခြင်း ပါဝင်သည့် မြေယာညှိခြင်း
- ဘိလပ်မြေဖျော်သည့် နေရာ
- လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၌ ပင်ပအဆောက်အအုံနှင့် အခြေခံအဆောက်အအုံများ၊ ရေသွယ်ပိုက်လိုင်း၊ ရေသန့်စင်စက်ရုံနှင့် ရေတင်စက်ရုံ စသည်တို့ပါဝင်သော ရေတင်ဌာနအဆောက်အအုံ တည်ဆောက်ခြင်း။
- ဆောက်လုပ်ရေးလုပ်ငန်းခွင်နယ်နိမိတ်နှင့် လမ်းမများပေါ် ဆောက်လုပ်ရေးသုံးယာဉ်များ သွားလာမှုကြောင့် ဖုန်မှုန်များ ထုတ်လွှတ်ခြင်း။

<u>လေအရည်အသွေး</u>

စီမံကိန်းတည်ဆောက်ခြင်းတွင် ဆောက်လုပ်ရေးပစ္စည်းများ ရွှေ့ပြောင်းခြင်း၊ မြေသားပြုပြင်ခြင်း၊ ပိုင်တူးခြင်းနှင့် မြေသားလမ်းများပေါ် ဆောက်လုပ်ရေးယာဉ်များ အသုံးပြုမှုကြောင့် လေထုထဲသို့ ဖုန်မှုန့်များ ထုတ်လွှတ်နိုင်ပါသည်။ ဆောက်လုပ်ရေးလုပ်ငန်းများတွင် ထိရောက်သော စီမံခန့်ခွဲမှုများမရှိလျှင် ထိခိုက်လွယ်သော လက်ခံလေထုပေါ်တွင် ကျန်းမာရေးနှင့် ပတ်သက်သည့် ဆိုးကျိုးများ ဖြစ်ပေါ်စေနိုင်ပါသည်။

စီမံကိန်းနေရာမှ ထုတ်လွှတ်လိုက်သော ဖုန်မှုန့်များသည် ဥပမာအားဖြင့် အဆောက်အအုံများ၊ ယာဉ်များစသည့် အရာဝတ္ထုတစ်ခု၏ အပေါ်ယံသို့ ကျရောက်သောအခါ အနှောင့်အယှက် ဖြစ်စရာ အကြောင်းအရာ တစ်ခုဖြစ်လာနိုင်ပါသည်။ ဖုန်မှုန့်ကျရောက်ခြင်းသည် သစ်ရွက်၏ အပေါက်များ ပိတ်ဆို့ခြင်းနှင့် သစ်ရွက်များ၏ အလင်းမှီစု အစာချက်ခြင်းကို နှောင့်နှေးစေနိုင် သဖြင့် ထိခိုက်လွယ်သော အပင်များအပေါ် သက်ရောက်မှုများ ရှိနိုင်ပါသည်။

ဆောက်လုပ်ရေး လုပ်ငန်းခွင်တွင် ဖုန်မှုန့်သိပ်သည်းစေသည့် နည်းလမ်းများနှင့် ကောင်းမွန်သော လုပ်ငန်းခွင် အလေ့အကျင့်များကဲ့သို့သော အကြံပြုထားသည့် ထိန်းချုပ်ရေး နည်းလမ်းများဖြင့် လေထုအရည်အသွေး ဆိုးကျိုးပမာဏကို စဉ်းစားမည်ဆိုလျှင် နည်းပါးသည်ဟု စဉ်းစားနိုင်ပါသည်။

<u>ဖန်လုံအိမ်ဓာတ်ငွေ့</u>

ဆောက်လုပ်ရေးကာလ၌ အောက်တွင် ဖော်ပြထားသည့်အတိုင်း စီမံကိန်းတွင် နယ်ပယ် ၁၊ နယ်ပယ် ၂၊ နယ်ပယ် ၃ ဟူ၍ ပါဝင်ပါသည်။

- နယ်ပယ် ၁ - ဒီဇယ်ဆီ အသုံးပြုသော ယာဉ်များနှင့် မြေညှိစက်၊ ကရိန်း စသဖြင့် စက်ယန္တရားကြီးများမှ ထွက်လာသော တိုက်ရိုက်ထုတ်လွှတ်မှု
- နယ်ပယ် ၂ - လျှပ်စစ်ဓာတ်အား ဝယ်ယူခြင်းမှ သွယ်ဝိုက်ထုတ်လွှတ်ခြင်း
- နယ်ပယ် ၃ - လျှပ်စစ်ဓာတ်အား ဆုံးရှုံးခြင်းမှ သွယ်ဝိုက်ထုတ်လွှတ်ခြင်း

တွက်ချက်ထားသော GHS ထုတ်လွှတ်မှုပေါ်မူတည်၍ တည်ဆောက်ရေးကာလတွင် CO_2e ၃, ၀၇၉ တန် (နယ်ပယ် ၁၊ နယ်ပယ် ၂၊ နယ်ပယ် ၃) ထုတ်လွှတ်မည်ဟု ခန့်မှန်းထားပါသည်။ IFC အရ ထင်ရှားမှုမရှိသော ထုတ်လွှတ်မှုဟု သတ်မှတ်နိုင်ပါသည်။ ဖန်လုံအိမ် ဓာတ်ငွေ့သည် ကမ္ဘာ့လုံးဆိုင်ရာ ညစ်ညမ်းစေသော ဓာတ်ငွေ့ဖြစ်ပါသည်။ လေထုထဲတွင် ဖန်လုံအိမ်ဓာတ်ငွေ့ ပမာဏသည် သာမန်ထက်ကျော်လွန်၍ သိပ်သည်းလာပါက အပူများကို အပြင်သို့မထွက်စေဘဲ လေထုထဲတွင် ထိန်းထားသည်။ လေထုတစ်ခုလုံးအနေနှင့် ဖန်လုံအိမ်ဓာတ်ငွေ့ ထုတ်လွှတ်ခြင်း ကို ခံစားရသော်လည်း ဒေသတွင်း လေထုအနေနှင့် ကြည့်မည်ဆိုလျှင် ဖန်လုံအိမ်ဓာတ်ငွေ့ ဆိုးကျိုးကို အနည်းနှင့်အများ ခံစားရနိုင်ပါသည်။

<u>မြေပေါ်ရေအရည်အသွေး</u>

ဆောက်လုပ်ရေးကာလတွင်း စီမံကိန်းအတွက် ရေအသုံးပြုမှု၊ သင့်လျော်မှုမရှိသော စွန့်ပစ်ပစ္စည်းသိုလှောင်ခြင်းနှင့် စုပုံခြင်း၊ စွန့်ပစ်ရေ စွန့်ထုတ်ခြင်းနှင့် မြေပေါ်စီးဆင်းရေမှ ရေအရည်အသွေးအပေါ် ဆိုးကျိုးများ သက်ရောက်နိုင်ပါသည်။

မြေပေါ်ရေအရည်အသွေးပေါ် ထိခိုက်မှုများသည် ဒေသတွင်ရေရှည် သက်ရောက်မှုများရှိသည် ဟု ခန့်မှန်းထားပါသည်။ မြေပေါ်ရေအရည်အသွေးအပေါ် ထိခိုက်မှုများကို လုပ်ငန်းခွင်တွင် လုံလောက်သော ရေဆိုးသန့်စင်စနစ်များနှင့် ကောင်းမွန်သော တည်ဆောက်ရေး အလေ့အကျင့်များဖြင့် ထိန်းချုပ်နိုင်ပါသည်။ ထို့ကြောင့် ကြွင်းကျန်သက်ရောက်မှုကို နည်းပါးသည်ဟု စဉ်းစား နိုင်ပါသည်။

<u>ဆူညံသံ</u>

မြေယာပြုပြင်ခြင်း၊ ပိုင်ရိုက်စက်များ မောင်းနှင်ခြင်းနှင့် အုတ်မြစ်ချခြင်း လုပ်ငန်းများ၊ ကိရိယာများ တပ်ဆင်ခြင်းနှင့် စက်ရုံတွင်းလမ်းများ၊ ရေနုတ်မြောင်းများနှင့် ခြံစည်းရိုးများ ဆောက်လုပ်ခြင်း စသည့် ဆောက်လုပ်ရေးလုပ်ငန်းများကြောင့် ဆူညံသံများ ဖြစ်ပေါ်လာနိုင်ပါသည်။

သတ်မှတ်ထားသော ဆူညံသံသက်ရောက်ခံများ တည်နေရာနှစ်ခုတွင် ခန့်မှန်းထားသည့် ဆူညံသံအဆင့်သည် နေ့အချိန်တွင် NEQ နှင့် IFC၏ ယေဘုယျ လုပ်ငန်းခွင် ကျန်းမာရေးနှင့်

ဘေးကင်းလုံခြုံရေး လမ်းညွှန်ချက်များအား မလိုက်နာပါ။ စီမံကိန်း တည်ဆောက်ခြင်းကြောင့် ဖြစ်ပေါ်လာသော ဆူညံသံများအတွက် လျော့ချရေးနည်းလမ်းများ လိုအပ်ပါသည်။ ဆူညံသံ အကာအကွယ်များ အသုံးပြုခြင်းကဲ့သို့သော လျော့ချရေးနည်းလမ်းများ အကောင်အထည် ဖော်ခြင်းဖြင့် စီမံကိန်းအနီးဆုံးရှိ လက်ခံသူများအပေါ် မပြောပလောက်သော ဆိုးကျိုးများသာ သက်ရောက်နိုင်သည်ဟု စဉ်းစားနိုင်ပါသည်။

မြေယာရှုခင်းနှင့် အမြင်ပသာဒ

အခြားအဆောက်အအုံများသည် CCPP လုပ်ငန်းခွင်၏ လက်ရှိခြံစည်းရိုးထက် ကျော်လွန်နေခြင်း၊ အချို့ အလင်းထုတ်လွှတ်ခြင်းများသည် အဝေးမှမြင်နိုင်သော်လည်း မြေသားပြုပြင်ခြင်းများ၊ အလင်းထုတ်လွှတ်ခြင်းများ၊ အနှောင့်အယှက်နှင့် အဆောက်အအုံသစ်များ၏ ရုပ်ပိုင်းဆိုင်ရာ တည်ရှိမှုများမှ အမြင်ပသာဒ ထိခိုက်မှုများသည် ဒေသတွင်း စီမံကိန်းဘောင်အတွင်းတွင်သာ ရှိပါသည်။

အဆိုပြုထားသော လျော့ချရေးနည်းလမ်းများပေါ် မူတည်၍ လျော့ချရေးနည်းလမ်းများ အကောင် အထည်ဖော်ပြီးသောအခါ ထိုမကောင်းသော ဆိုးကျိုးများကို မပြောပလောက်သောအဆင့်မှ အလယ်အလတ်အဆင့်ထိ ရှိနိုင်သည်ဟု စဉ်းစားနိုင်ပါသည်။

မြေသားနှင့် မြေအောက်ရေ

ဆောက်လုပ်ရေးကာလတွင် မြေဆီလွှာနှင့် မြေအောက်ရေပေါ် အောက်ပါဆိုးကျိုးများ ဖြစ်ပေါ် စေနိုင်ပါသည်။

- လုပ်ငန်းခွင် ရှင်းလင်းခြင်းကာလအတွင်း မကောင်းမွန်သည့် စီမံခန့်ခွဲမှုများကြောင့် မြေဆီလွှာအရည်အသွေး၊ ပမာဏနှင့် တည်ဆောက်ပုံများ ဆုံးရှုံးခြင်း။
- မသင့်လျော်သော ဆောက်လုပ်ရေး စွန့်ပစ်ပစ္စည်းများ သိုလှောင်ခြင်းနှင့် စုပုံခြင်းများ ကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေများ ညစ်ညမ်းခြင်း။
- မသင့်လျော်သော စွန့်ပစ်ရေများ စွန့်ထုတ်ခြင်းနှင့် ညစ်ညမ်းသော မြေပေါ်စီးဆင်း ရေများကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေများ ညစ်ညမ်းခြင်း။
- မတော်တဆ စိမ့်ဝင်ခြင်းများနှင့် ယိုဖိတ်ခြင်းများကြောင့် မြေဆီလွှာနှင့် မြေအောက် ရေများညစ်ညမ်းခြင်း

ကုမ္ပဏီမှတာဝန်ပေးထားသော EPC Contractor မှ စီမံကိန်းတည်ဆောက်ခြင်းများကို တာဝန် ယူရမည်။ EPC Contractor မှ မြေဆီလွှာနှင့်မြေအောက်ရေ ညစ်ညမ်းခြင်းများကို ကာကွယ်ရန် စွန့်ပစ်ပစ္စည်းများအားလုံးကို လမ်းညွှန်ချက်များနှင့်အညီ ကိုင်တွယ်၊ သိုလှောင်၊ စုပုံရမည်။ အပေါ်ယံမြေလွှာများကို ပြန်လည်အသုံးပြုရန် ထိန်းသိမ်းထားခြင်း၊ စက်ယန္တရားများသွားလာရန် လမ်းကြောင်းများ ပိုင်းခြားထားခြင်း၊ မြေသားများရှင်းလင်းရန် တိကျသော အရေးပေါ်တုန့်ပြန် ဆောင်ရွက်ခြင်း အစီအစဉ်များနှင့် လေ့ကျင့်သင်တန်းများ၊ ယိုဖိတ်ခြင်းနှင့် စိမ့်ဝင်ခြင်းများ အတွက်

ယိုဖိတ်ခြင်းခံရန်ဗန်းများ၊ သင့်တော်သော လောင်စာဆီနှင့် ဓာတုပစ္စည်းများ သိုလှောင်ခြင်းကဲ့သို့သော အခြားလျော့ချရေး နည်းလမ်းများဖြင့် မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းခြင်းကို မပြောပလောက်သော ဆိုးကျိုးဟု သတ်မှတ်နိုင်ပါသည်။

<u>စွန့်ပစ်ပစ္စည်း</u>

ဆောက်လုပ်ရေးကာလတွင် ဆောက်လုပ်ရေးလုပ်ငန်းမှ ကွန်ကရစ်များ၊ စတီးပိုက်စများ၊ ပလက်စတစ်ပိုက်စများနှင့် သစ်သားများ စသောစွန့်ပစ်ပစ္စည်းများ နေ့စဉ်ထွက်ပါသည်။ သုတ်ဆေးများ၊ အင်ဂျင်ဝိုင်များ၊ ချောဆီများ၊ ဘက်ထရီများနှင့် အခြားသော အရည်များမှအပ စွန့်ပစ်ပစ္စည်းအများစုမှာ အန္တရာယ်မရှိနိုင်ပါ။

စွန့်ပစ်ပစ္စည်းများအား စီမံခန့်ခွဲမှုအားနည်းလျှင် ဒေသနေပြည်သူများအား ကျန်းမာရေးနှင့် အခြားသော ထိခိုက်မှုများဖြစ်ပေါ်စေနိုင်သည်။ သောက်သုံးရေနှင့် အစားအစာများ ညစ်ညမ်းစေမှုများ၊ မတော်တဆ ဖိတ်စင်မှုများ၊ ယိုစိမ့်မှုများ၊ လောင်စာနှင့် အခြား အန္တရာယ်ရှိနိုင်သော စွန့်ပစ်ပစ္စည်းများကြောင့်မြေပေါ်ရေညစ်ညမ်းမှုများဖြစ်ပေါ်စေနိုင်ပါသည်။ ထို့အတူ မတော်တဆ ယိုစိမ့်မှုများ၊ လောင်စာနှင့် အခြားသော အန္တရာယ်ရှိပစ္စည်းများ သိုလှောင်မှု ဖိတ်စင်မှုများ စနစ်တကျမရှိလျှင် မြေဆီလွှာပျက်စီးမှုကိုဖြစ်ပေါ်စေနိုင်သည်။ ဆိုးကျိုးများလျော့ကျစေနိုင်သော အစီအစဉ်များပါဝင်သည့် သင့်လျော်သော စွန့်ပစ်ပစ္စည်းများစီမံခန့်ခွဲမှု အကောင်အထည်ဖော် ဆောင်ရွက်လျှင် ထိခိုက်များကို လျော့ကျစေနိုင်သည်။ ထိုသို့အစီအစဉ်များ အကောင်အထည်ဖော် ဆောင်ရွက်ထားမှုကြောင့် ကျန်ရှိနေသော ထိခိုက်မှုများမှာ ဆိုးကျိုးဖြစ်မှု မရှိသလောက် နည်းပါးသွားနိုင်သည်။

<u>ကုန်းနေဇီဝမျိုးစုံမျိုးကွဲများနှင့် ရေနေဇီဝမျိုးစုံမျိုးကွဲများ</u>

ဆောက်လုပ်ရေး ကာလတွင် အပင်များရှင်းလင်းခြင်း၊ မျိုးစိတ်များနေရာ ပြောင်းရွှေ့ခြင်း၊ စက်ယန္တရားများဖြင့် ထိခိုက်ခြင်းနှင့် အခြားသောမျိုးစိတ်များ (ဒေသရင်းမဟုတ်သည့်) ဝင်ရောက်လာမှုများကြောင့် ဒေသတွင်းနှင့် မြစ်အောက်ဘက်ဒေသများရှိ ဇီဝမျိုးစုံမျိုးကွဲများအား ထိခိုက် မှုများ ဖြစ်ပေါ်စေနိုင်သည်။

ထိခိုက်မှုလျော့ချရေး အစီအစဉ်တွင် ဆောက်လုပ်ရေးလုပ်ငန်းကြောင့် ဇီဝမျိုးစုံမျိုးကွဲများအား သိသိသာသာ ထိခိုက်မှုမရှိစေရန် သို့မဟုတ် ထိခိုက်မှုလျော့ချနိုင်ရန် အစီအစဉ်များ ပါဝင်သည့်အတွက် ဇီဝမျိုးစုံမျိုးကွဲများထိခိုက်မှုကို လျော့ကျစေပါသည်။

<u>ပြည်သူများ၏ကျန်းမာရေးနှင့် လုံခြုံမှု</u>

ပတ်ဝန်းကျင်အခြေအနေ ပြောင်းလဲမှုများ၊ ရောဂါများတိုးပွားလာနိုင်မှုများနှင့် မော်တော်ယာဉ်များ ရွေ့လျားမှုများကြောင့် ပြည်သူများ၏ ကျန်းမာရေးနှင့် လုံခြုံရေးကို ထိခိုက်စေနိုင်ပါသည်။ အလုပ်သမားတန်းလျားများ တည်ဆောက်ပေးမှုနှင့် စနစ်တကျနေရာချထားမှုများ၊ အထောက်

အပ်ပစ္စည်းများ ထားရှိမှုများကြောင့် ပြည်သူများ၏ ကျန်းမာရေးနှင့် လုံခြုံရေးထိခိုက်မှုများကို လျော့ကျစေပါသည်။

<u>လူမှုရေးထိခိုက်မှုများ</u>

ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ကြောင့် အလုပ်အကိုင်အခွင့်အရေးများရရှိစေခြင်း၊ ဒေသခံ ပြည်သူများ အကျိုးစီးပွားဖြစ်ထွန်းခြင်းများ ရရှိစေသော်လည်း အလုပ်သမားများ တိုးပွားလာမှုကြောင့် လူမှုရေးဆိုင်ရာ ပြဿနာများ၊ နေရာထိုင်ခင်းပြဿနာများ၊ ဆူညံမှုများနှင့် ဖုန်မှုန့်များဖြစ်ပေါ်စေခြင်း အစရှိသောပြဿနာများ ဖြစ်ပေါ်စေနိုင်ပါသည်။ ထိခိုက်မှုလျော့ချရေး အစီအစဉ်များတွင် ဒေသနေပြည်သူများ အလုပ်အကိုင်အခွင့်အလမ်း အများဆုံးရရှိစေရေး၊ အလုပ်သမားများအား စီမံခန့်ခွဲမှုအစီအစဉ်များ ပါဝင်သောကြောင့် ဒေသနေများအားလူမှုရေး ထိခိုက်မှုများကို လျော့ကျစေသည်။ ထို့ပြင် ထိခိုက်နေပြည်သူများအား ပြန်လည်နေရာချထား ပေးခြင်းများ၊ လျော်ကြေးပေးခြင်းများ၊ သက်ဆိုင်ရာ ပြည်သူများနှင့် ညှိနှိုင်းဆောင်ရွက်ခြင်းများ၊ မြေယာပိုင်ဆိုင်မှုများ၊ ကျန်းမာရေး အခြေအနေများနှင့် အခြားသောလူမှုရေး ကိစ္စများအား စစ်တမ်းကောက်ယူခြင်းနှင့် ညှိနှိုင်းဆောင်ရွက်ခြင်းများ ပါဝင်ပါသည်။ ထိုသို့အစီအစဉ်များ အကောင်အထည်ဖော် ဆောင်ရွက်ထားမှုကြောင့် ကျန်ရှိနေသော ထိခိုက်မှုများမှာ ဆိုးကျိုး ဖြစ်မှု မရှိသလောက်နည်းပါးသွားနိုင်သည်။

<u>ယဉ်ကျေးမှု အမွေအနှစ်</u>

စီမံကိန်းနေရာတွင် ရှေးဟောင်းအမွေအနှစ်ဆိုင်ရာ အရင်းအမြစ်များမရှိပါ သို့သော် ရှေးဟောင်း ယဉ်ကျေးမှုအမွေအနှစ်များ လေ့လာရာနယ်ပယ်တွင် လက်ရှိတည်ရှိနေသော အမွေအနှစ် ဆိုင်ရာနေရာများကို သတ်မှတ်ထားပါသည်။

စီမံကိန်းဆောင်ရွက်မှုကြောင့် ယဉ်ကျေးမှုဆိုင်ရာ အမွေအနှစ်များ ထိခိုက်ပျက်စီးမှု မရှိနိုင်ကြောင်း စစ်တမ်းကောက်ယူမှုနှင့် တွေ့ဆုံမေးမြန်းမှုအရ သိရှိရပါသည်။ ဘာသာရေးဆိုင်ရာ အဆောက် အအုံများထိခိုက်မှုတွင် ဆောက်လုပ်ရေးလုပ်ငန်းတွင်း လိုအပ်သော ရေအတွက် ပိုက်လိုင်းသွယ်မှုကြောင့် ပြင်ကြီးရွာရှိ ဘုန်းကြီးကျောင်းတစ်ခုသာ ထိခိုက်နိုင်ပါသည်။ သင့်လျော်သော ထိခိုက်မှုလျော့ချရေး အစီအစဉ်များကြောင့် ထိခိုက်မှုကြီးကြီးမားမားမရှိနိုင်ပါ။

<u>လေထုအရည်အသွေး</u>

စီမံကိန်းဆောင်ရွက်မှုတွင် အဓိက အခိုးအငွေ့ထုတ်လွှတ်နိုင်သော နေရာများမှာ စက်ရုံစတင် လည်ပတ်သောအချိန်၌ သဘာဝဓာတ်ငွေ့ လောင်ကျွမ်းမှုကြောင့် မီးခိုးခေါင်းတိုင်မှထွက်လာသည့် အခိုးအငွေ့များ၊ ပုံမှန်လောင်ကျွမ်းမှုလုပ်ငန်းများနှင့် အရေးပေါ်အခြေအနေတွင် အသုံးပြုမည့် မီးစက်မှ ဒီဇယ်ဆီ လောင်ကျွမ်းမှုများကြောင့် ဖြစ်ပေါ်နိုင်ပါသည်။

သဘာဝဓာတ်ငွေ့သုံး လျှပ်စစ်ဓာတ်အားပေးစက်ရုံရှိ လောင်ကျွမ်းမှု လုပ်ငန်းများမှထွက်ပေါ် လာနိုင်သော ဓာတ်ငွေ့များမှာ နိုက်ထရိုဂျင်အောက်ဆိုဒ်၊ နိုက်ထရိုဂျင်ဒိုင်အောက်ဆိုဒ်၊ ဆာလဖာဒိုင်အောက်ဆိုဒ်နှင့် ဖုန်မှုန့်များ ((PM10), ($PM_{2.5}$))တို့ ဖြစ်ပါသည်။

သဘာဝဓာတ်ငွေ့သည် လုံလောက်စွာ လောင်ကျွမ်းပြီးနောက် ဖုန်မှုန့်များထွက်ပေါ်လာမှု အနည်းဆုံးဖြစ်စေသည်။ ဟိုက်ဒရိုဂျင်ဆာလဖိုက် ဓာတ်ငွေ့သည်လည်း ပမာဏ အနည်းငယ်သာ ထွက်ပေါ်မည်။ ထို့ကြောင့် စီမံကိန်းကြောင့် လေထုအရည်အသွေးအား ထိခိုက်မှုမှာ မရှိသလောက် နည်းပါးပါသည်။

<u>ဖန်လုံအိမ်အာနိသင် ဓာတ်ငွေ့</u>

စက်ရုံလည်ပတ်ချိန်တွင် အသုံးပြုမည့် လျှပ်စစ်စွမ်းအင်မှာ ကိုယ်ပိုင်လျှပ်စစ်စွမ်းအင် ဖြစ်သဖြင့် Scope 2 emission များမထွက်ပါ။ Scope 1 emission များသည် ဓာတ်ငွေ့သုံး မီးစက်မှအဓိက ထွက်ပေါ်လာနိုင်ပါသည်။

စက်ရုံမှ ကာဗွန်ဒိုင်အောက်ဆိုဒ် ထုတ်လွှတ်မှုမှာ တစ်နှစ်လျှင် ၁၅၇၀၆၄၂.၂၈ တန် သို့မဟုတ် ၁.၅၇ သန်းတန် ဖြစ်ပါသည်။ ၂၀၁၀ ခုနှစ် မြန်မာနိုင်ငံ၏ ဖန်လုံအိမ်အာနိသင် ဓာတ်ငွေ့ ထုတ်လွှတ်မှုမှာ ၃၅၇.၀၂ သန်းတန်ဖြစ်ပါသည်။ ယင်းပမာဏနှင့် နှိုင်းယှဉ်လျှင် စီမံကိန်းမှ ထုတ်လွှတ်မှုမှာ ၀.၄၄ ရာခိုင်နှုန်းဖြစ်ပါသည်။ စီမံကိန်းလည်ပတ်ချိန်တွင် ဖန်လုံအိမ်အာနိသင် ဓာတ်ငွေ့ထုတ်လွှတ်မှုမှာ ADB SPS and EP III(ကာဗွန်ဒိုင်အောက်ဆိုဒ် နှစ်စဉ် ၁၀၀၀၀၀ တန်) နှင့် IFC PS3 (ကာဗွန်ဒိုင်အောက်ဆိုဒ် နှစ်စဉ် ၂၅၀၀၀ တန်) မှသတ်မှတ်ချက်များထက် ကျော်လွန်နိုင်ပါသည်။ ထို့ကြောင့် စီမံကိန်းဆောင်ရွက်သူများမှ ဖန်လုံအိမ်အာနိသင်ဓာတ်ငွေ့ ထုတ်လွှတ်မှုလျော့ကျရေး အစီအစဉ်များရေးဆွဲရန်နှင့် နှစ်စဉ် ဖန်လုံအိမ်အာနိသင်ဓာတ်ငွေ့ ထုတ်လွှတ်နေမှုများကို သင့်လျော်သော သတ်မှတ်ချက်ဘောင်အတွင်း အစီအရင်ခံစာ ရေးသားရမည်။

စီမံကိန်းမှ ဖန်လုံအိမ်အာနိသင်ဓာတ်ငွေ့ လျော့ချရေး အစီအစဉ်များကို အကောင်းဆုံးသော နည်းလမ်းများ အသုံးပြုထား၍ ဖန်လုံအိမ်အာနိသင်ဓာတ်ငွေ့ ထုတ်လွှတ်နေမှုများအား အမြဲမပျက် စောင့်ကြည့်စစ်ဆေးပါသည်။ ထိခိုက်မှုလျော့ချနိုင်မှုမရှိသည့် အခြေအနေတွင်ပင်လျှင် ဆိုးကျိုးထိခိုက်မှုများမှာ အနည်းငယ်သာဖြစ်နိုင်ပါသည်။

<u>မြေပေါ်ရေအရည်အသွေး</u>

စီမံကိန်းလည်ပတ်စဉ်ကာလတွင် အလုပ်သမားများတစ်ကိုယ်ရည် စွန့်ပစ်ရည်များ၊ စနစ်မကျသောအညစ်အကြေး သိုလှောင်ကန်များနှင့်စုပုံမှုများ၊ စီမံကိန်းမှလိုအပ်သော ရေအတွက် ပိုက်သွယ်တန်းမှုများကြောင့် ဒေသတွင်းပြည်သူများ၏ ရေရရှိမှုကို ထိခိုက်စေမှု မြေပေါ်ရေ အရည်အသွေး ထိခိုက်စေမှုများနှင့် အညစ်အကြေးများ မြေအောက်သို့ စိမ့်ဝင်နိုင်မှုတို့ ဖြစ်စေသည်။

စက်ရုံအတွင်းနေရာ အနှံ့အပြားမှထွက်ရှိလာသော စွန့်ပစ်ရေများကို Myanmar NEQ and World Bank/ EHS guidelines ၏ စွန့်ပစ်ခြင်း နည်းလမ်းများနှင့်အညီ စုစည်းခြင်း၊ သန့်စင်ခြင်းများ ပြုလုပ်သွားပါမည်။ ထို့ကြောင့် ထိခိုက်မှုများမရှိသလောက် နည်းပါးပါသည်။

<u>ဆူညံသံ</u>

စက်ရုံ လည်ပတ်စဉ်ကာလတွင် ဆူညံသံထွက်ပေါ်နိုင်သောနေရာများမှာ ရေနွေးငွေ့အပူသုံးမီးစက်(HRSG)၊ ဓာတ်ငွေ့သုံး တာဘိုင်စက်၊ ရေနွေးငွေ့သုံး တာဘိုင်စက်နှင့် အအေးခံစက် တို့မှ ထွက်ပေါ်နိုင်ပါသည်။

စီမံကိန်းလည်ပတ်စဉ်ကာလတွင် NSR1မှထွက်ပေါ်လာမည့် ဆူညံသံသည် NEQ and IFC General EHS Guidelines မှသတ်မှတ်ထားသော နေ့အချိန်ဆူညံသံထုတ်လွှတ်မှုနှင့် ညအချိန် ဆူညံသံထုတ်လွှတ်မှု သတ်မှတ်ချက်ထက် ကျော်လွန်နိုင်ပါသည်။ NSR2 မှထုတ်လွှတ်မည့် ဆူညံသံသည် ညအချိန်တွင် သက်မှတ်ချက်ထက် ကျော်လွန်နိုင်ပါသည်။ စီမံကိန်း လည်ပတ်စဉ်ကာလတွင် ဆူညံသံလျော့ချနိုင်မည့် အစီအစဉ်များ (ဥပမာ- ဆူညံသံတားဆီးနိုင်သောအကာအကွယ်များ တပ်ဆင်အသုံးပြုခြင်း) ရေးဆွဲ၍ အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည် ဖြစ်သောကြောင့် ဆူညံသံများကြောင့် ဒေသခံပြည်သူများ ထိခိုက်မှုမရှိနိုင်ပါ။

<u>မြေယာရှုခင်းနှင့် အမြင်ပသာဒ</u>

အချိန်ကြာမြင့်စွာ စီမံကိန်းတည်ရှိမှုကြောင့် မြေယာရှုခင်းနှင့် အမြင်ပသာဒကို ထိခိုက်မှုများ ရှိနိုင်ပါသည်။ စီမံကိန်းအတွင်းရှိ မီတာ၅၀ ကျော်မီးခိုးခေါင်းတိုင်အားအဝေးမှမြင်နိုင်သောကြောင့် အမြင်ပသာဒကို ထိခိုက်စေနိုင်ပါသည်။ အဆောက်အအုံများ၏ အမြင့်အားဂိုဒေါင်နှစ်ခု ထက် ကျော်လွန်မှုမရှိစေရန်နှင့် အခြားမြင့်မားသော ထောက်ပံ့ရေးပစ္စည်းများအား ၁၀ မီတာထက် မကျော်လွန်စေရန်စီစဉ်ထားပါသည်။ စီမံကိန်းအတွင်း အလယ်အလတ်တန်းစား အဆောက်အဦများသာ အသုံးပြုထားပါသည်။

ထိခိုက်မှုလျော့ချရေးအစီအစဉ်များအတိုင်း အကောင်အထည်ဖော် ဆောင်ရွက်ထားမှုကြောင့် ထိခိုက်မှုအဆင့်မှာ အနည်းဆုံးအဆင့်မှ ထိခိုက်မှုမရှိသည့် သက်ရောက်မှု အဆင့်ထိ တိုးမြှင့်သွားပါမည်။

<u>မြေဆီလွှာနှင့် မြေအောက်ရေ</u>

စီမံကိန်းလည်ပတ်စဉ်ကာလတွင် မြေဆီလွှာနှင့်မြေအောက်ရေထိခိုက်နိုင်မှုများမှာ-

- စီမံကိန်းဆောင်ရွက်စဉ်အတွင်း တိုက်စားမှုကြောင့် မြေဆုံးရှုံးမှုများ
- စိမ့်ထွက်မှုများ၊ ယိုဖိတ်မှုများကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေညစ်ညမ်းမှု
- စနစ်မကျသော စွန့်ပစ်ပစ္စည်းများသိုလှောင်မှု၊ စုပုံမှုများကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေညစ်ညမ်းမှု

- စနစ်မကျသော စွန့်ပစ်ရေများ စွန့်ပစ်မှု၊ စီးဆင်းမှုများကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေညစ်ညမ်းမှု

စနစ်မကျသော စွန့်ပစ်ပစ္စည်းများ သိုလှောင်မှုနှင့် စုပုံမှုများကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေညစ်ညမ်းမှုမှတစ်ဆင့် မြေပေါ်ရေစီးဆင်းမှုအား ညစ်ညမ်းစေနိုင်ပါသည်။ ထို့ကြောင့် ထိခိုက်မှုလျှော့ချရေး အစီအစဉ်တွင် မြေပေါ်ရေ အရည်အသွေးနှင့် စွန့်ပစ်ပစ္စည်းဆိုင်ရာ စီမံခန့်ခွဲမှုအား ဆွေးနွေးရေးဆွဲထားပါသည်။ ထိုသို့ အစီအစဉ်ကောင်းများနှင့် ထိန်းချုပ်မှု ကောင်းများကြောင့် ထိခိုက်မှုပမာဏမှာ မရှိသလောက် နည်းပါးပါသည်။

<u>စွန့်ပစ်ပစ္စည်း</u>

ဘေးအန္တရာယ်ဖြစ်စေနိုင်သော စွန့်ပစ်ပစ္စည်းများနှင့် ဘေးအန္တရာယ်မဖြစ်စေနိုင်သော စွန့်ပစ်ပစ္စည်းများထွက်ရှိခြင်းမှ မြေပေါ်ရေ၊ မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းမှုများ၏ ထိခိုက်မှုများသည် အလယ်အလတ်ထိခိုက်မှုဟု ဆန်းစစ်ထားပါသည်။ အဆိုပါ စီမံကိန်းလည်ပတ်လျှင် ရုံးခန်း၊ ဓာတ်ငွေ့ တာဘိုင်၊ ဓာတ်ခွဲခန်း၊ ဖိအားမြှင့်စက်၊ lube oil systems DG sets၊ ဓာတ်အားပေးရုံနှင့် အလုပ်ရုံနေရာများမှ ဘေးအန္တရာယ် ဖြစ်စေနိုင်သော စွန့်ပစ်ပစ္စည်းများနှင့် ဘေးအန္တရာယ် မဖြစ်စေနိုင်သော စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိလာနိုင်ပါသည်။

လည်ပတ်ခြင်းအဆင့်မှ ထွက်ရှိလာသည့် စွန့်ပစ်ပစ္စည်းများကို ပြန်လည်အသုံးပြု၍ရသော စွန့်ပစ်ပစ္စည်းနှင့် ပြန်လည်အသုံးပြု၍မရသော စွန့်ပစ်ပစ္စည်းဟူ၍ ခွဲခြားသိမ်းဆည်းပါမည်။ ထိုစွန့်ပစ်ပစ္စည်းများကို စီမံကိန်းနေရာတွင်မီးရှို့ ၍ မြေသြဇာအဖြစ် အသုံးပြုပါမည်။

MUPA သည် စွန့်ပစ်ပစ္စည်းအားလုံး သိမ်းဆည်းခြင်း၊ စွန့်ပစ်ခြင်းများကို သတ်မှတ်ထားသည့် လမ်းညွှန်ချက်များဖြင့် လုပ်ဆောင်ပါမည်။

အခြားလျှော့ချမည့် နည်းလမ်းများအဖြစ် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ရုံဖန်ရံခါ စစ်ဆေးမှုများကို ပြင်ဆင်ပါမည်။ အဆိုပြုထားသည့် လျှော့ချမည့်နည်းလမ်းများနှင့် ဆောင်ရွက်ပြီးနောက် ကြွင်းကျန်ထိခိုက်မှု သိသာနိုင်ချေသည် နည်းပါးနိုင်ပါသည်။

<u>ကုန်းနေ၊ ရေနေ ဇီဝမျိုးစုံ/ကွဲ</u>

အခြေခံအဆောက်အအုံနှင့် ဆက်စပ်သည့်နေရာများတွင် ညအချိန်မီးအလင်းရောင် သုံးစွဲမှု များကဲ့သို့ စီမံကိန်းလည်ပတ်ချိန်အတွင်း လုပ်ဆောင်မှုများကြောင့် ဒေသတွင်းရှိ သတ္တဝါများ အပေါ် အနှောင့်အယှက် ဖြစ်စေနိုင်ပါသည်။ ထို့ပြင် ဓာတ်အားလိုင်း ပြုပြင်နေစဉ် အပင်များ ရှင်းလင်းလုပ်ဆောင်မှုများကြောင့် အကျိုးအပဲ့များ လွင့်စင်ပြုတ်ကျခြင်း သို့မဟုတ် ယန္တရားများ တိုက်မိခြင်းများကြောင့် သတ္တဝါမျိုးစိတ်များ သေစေနိုင်ပါသည်။ သို့သော် ထိခိုက်မှုမရှိမှ အနည်းငယ်ထိခိုက်မှုရှိသည်အထိ သတ်မှတ်နိုင်ပါသည်။ လျော်ကြေးပေးဆောင်ရန် လိုအပ်သည်ဟု သတ်မှတ်ထားသော ဇီဝမျိုးစုံ/ကွဲများ၏တန်ဖိုးကို သက်ရောက်နိုင်သည့် နောက်ဆက်တွဲ ထိခိုက်မှုများ မရှိနိုင်ပါ။

လူထုဘေးအန္တရာယ်ကင်းရှင်းရေးနှင့် ကျန်းမာရေး

အလုပ်သမားများ ဝင်ရောက်လာခြင်း၊ ကူးစက်စေတတ်သော ပိုးမွှားများကျက်စားရာနေရာများ ဖြစ်ပေါ်ခြင်း သို့မဟုတ် အခကြေးငွေပေးရသည့် လိင်အလုပ်သမားများ ရှိခြင်းတို့ကြောင့် ကူးစက်ရောဂါ ပျံ့နှံ့မှုများ တိုးလာနိုင်ပါသည်။

ယခင်ရှိနေသည့် စီမံခန့်ခွဲမှု နည်းလမ်းများအရ ထိခိုက်မှုပြင်းအားနှင့် ပမာဏကို ဆန်းစစ်ရာတွင် ထိခိုက်မှု အလယ်အလတ်နှင့် ထိခိုက်မှုမရှိနိုင်ပါ။ ထိခိုက်မှုကြာချိန်သည် ရေရှည်ဖြစ်နိုင် သော်လည်း မပြောပလောက်သည့် ထိခိုက်မှုအဖြစ် ဆန်းစစ်ထားပါသည်။ (ရေရှည်ထိခိုက်မှု ဆိုသည်မှာ-ကျန်းမာရေးဆိုင်ရာ ပြဿနာများနှင့် အခြားသေစေနိုင်သည့်ကိစ္စရပ်များ)

ဆောက်လုပ်ရေးအဆင့်တွင် စီမံကိန်းနေရာသို့ အလုပ်သမားများသွားလာခြင်း၊ ကုန်ပစ္စည်းများ နှင့်စက်ကိရိယာများ သယ်ယူပို့ဆောင်ရေးအတွက် ဒေသတွင်းလမ်းများနှင့် ရေကြောင်းများ အသုံးပြုမှုများ တိုးလာနိုင်ပါသည်။

ယခင်ရှိနေသည့် စီမံခန့်ခွဲမှု နည်းလမ်းများအရ စီမံကိန်းလည်ပတ်ချိန်တွင် ထိခိုက်မှုပြင်အား နှင့် ပမာဏကိုဆန်းစစ်ရာတွင် ထိခိုက်မှုအလယ်အလတ်နှင့် ထိခိုက်မှုမရနိုင်ပါ။ ထိခိုက်မှုကြာချိန်သည် ရေရှည်ဖြစ်နိုင်သော်လည်း မပြောပလောက်သည့် ထိခိုက်မှုအဖြစ် ဆန်းစစ်ထားပါသည်။ (ရေရှည်ထိခိုက်မှု ဆိုသည်မှာ-ယာဉ်မတော်တဆ ထိခိုက်မှုကိစ္စရပ်များ)

လူမှုရေးဆိုင်ရာ ထိခိုက်မှုများ

စီမံကိန်းလည်ပတ်မှုကြောင့် ခန့်မှန်းထားသည့် လူမှုရေးဆိုင်ရာ ထိခိုက်မှုအချို့မှာ အလုပ်အကိုင် ပေါများလာခြင်းနှင့် ကျွမ်းကျင်အလုပ်သမားများ ပြောင်းရွှေ့လာခြင်းတို့ကြောင့် ဒေသတွင်း စီးပွားရေးအတွက် အခွင့်အလမ်း တိုးပွားလာခြင်းတို့သည် ဒေသနေ ပြည်သူများအတွက် ကောင်းကျိုးများ ဖြစ်ပါသည်။

ဆောက်လုပ်နေချိန်အတွင်း အလုပ်သမားအင်အားသည် ၆၀၀ ခန့်ရှိပါမည်။ ကုမ္ပဏီသည် ဒေသတွင်းမှ အလုပ်သမားများ တတ်နိုင်သမျှ ခေါ်ယူမည်ဖြစ်သော်လည်း အခြားနေရာများမှ အလုပ်သမားများ လည်း ပါဝင်မည်ဟု ကြိုတင်ခန့်မှန်းထားပါသည်။ အဆိုပြုထားသော စီမံကိန်း ကဲ့သို့ စီမံကိန်းများ ကနဦးအစတွင် (စီမံကိန်းနှင့် တိုက်ရိုက် မတိုက်ဆိုင်သော) မကျွမ်းကျင်သည့် အလုပ်သမားများ ဝင်ရောက်လာမှုနှင့် အခွင့်အလမ်းရှာဖွေနေသော အလုပ်ရှာသူများအား စီမံကိန်း၏လူမှုရေးဆိုင်ရာ သက်ရောက်မှုနယ်ပယ်တွင်းသို့ ဆွဲဆောင်နိုင်ပါသည်။ လူမှုရေးဆိုင်ရာ သက်ရောက်မှုနယ်ပယ်တွင် အစုအပြုံလိုက် ပြောင်းရွှေ့လာခြင်းသည် ရှိနှင့်ပြီးသား လက်ရှိအခြေခံ အဆောက်အအုံများနှင့် ဝန်ဆောင်မှုများအပေါ် ထပ်ပေါင်းဖိအားပေးနိုင်ပါသည်။

အစုအပြုံလိုက် ရွှေ့ပြောင်းမှုသည်ပျံ့နှံ့ပြီး စီမံကိန်း၏ လူမှုရေးဆိုင်ရာ သက်ရောက်မှုနယ်ပယ်တွင်းရှိ လူထုဝန်းကျင်တစ်ခုလုံးသည် ထိခိုက်နိုင်ပါသည်။ အားနည်းသော သက်ဆိုင်ရာ လူထုများနှင့် လူထုအခြေခံ အဆောက်အအုံများနှင့် ဝန်ဆောင်မှုများသည် အဓိကအားဖြင့် ထိခိုက်နိုင်သကဲ့သို့

ကံပေါက်နှင့် ပြင်ကြီးဆက်သွယ်ထားသော လမ်းအသုံးပြုသူများသည် လည်းထိခိုက်နိုင်ပါသည်။ လူထုကျန်းမာရေးအပေါ် လျော့ချရေးနည်းလမ်းများ မဆောင်ရွက်မီ တွင် စီမံကိန်း၏ထိခိုက်မှုသည် အတော်အတန် အနှုတ်သဘောဆောင်သည့် ထိခိုက်မှုအဖြစ် စဉ်းစားနိုင်ပြီး လျော့ချရေးနည်းလမ်းများ ဆောင်ရွက်ပြီးချိန်တွင် မရှိသလောက် နည်းပါးသော ထိခိုက်မှုသာ ဖြစ်နိုင်သည်ဟု ယူဆနိုင်ပါသည်။

၁.၁၂။ ပတ်ဝန်းကျင် နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်

၁.၁၂.၁။ လျှော့ချရေးနည်းလမ်းများ

စီမံကိန်း၏ ဆောက်လုပ်ရေးအဆင့်တွင် အကြံပြုထားသော လျှော့ချရေးနည်းလမ်းများဖြစ်သည့် ကောင်းမွန်သော ဆောက်လုပ်ရေးနှင့် သန့်ရှင်းရေးထိန်းသိမ်းမှု အလေ့အထများသည် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်တွင် ပါဝင်ပါသည်။

စီမံကိန်းလည်ပတ်ခြင်း အဆင့်အတွက် စီမံကိန်း၏ လျှော့ချရေးနည်းလမ်းများ (လေထုထဲသို့ အခိုးအငွေ့ထုတ်လုပ်မှုနှင့် ဆူညံသံထုတ်လွှတ်ခြင်း)သည် ဒီဇိုင်းသတ်မှတ်ချက်များတွင် တစ်စိတ်တစ်ပိုင်းအဖြစ် ပါဝင်ပါမည်။

ဓာတ်အားဝယ်ယူ သဘောတူညီမှုစာချုပ်အရ စီမံကိန်း၏ ဆောက်လုပ်ရေးချိန်သည် လပေါင်း ၃၀ ခန့်ကြာမည်ဟု ခန့်မှန်းထားပြီး စီမံကိန်းလည်ပတ်ချိန်သည် နှစ် ၃၀ ဖြစ်ပါသည်။

စီမံကိန်း၏ ဆောက်လုပ်ရေးနှင့် လည်ပတ်ခြင်းအဆင့်များအတွက် သတ်မှတ်ထားသော လျှော့ချရေးနည်းလမ်းများ အကျဉ်းချုပ်ကို ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်တွင် ဖော်ပြထားပါသည်။ ၄င်းသည် လျှော့ချရေးနည်းလမ်းများဆောင်ရွက်ခြင်း အတွက် ဦးဆောင် ဆောင်ရွက်ရမည့် တာဝန်များနှင့် ထိုလုပ်ငန်းစဉ်များ လုပ်ဆောင်ရန် အတွက် ငွေကြေးနှင့် လိုအပ်သည့်အစီရင်ခံစာများ မှန်ကန်မှုရှိ/မရှိစစ်ဆေးခြင်းတို့ကို ခွဲခြား ရပါမည်။

စီမံကိန်းဖော်ဆောင်သူသည် စီမံကိန်းတစ်လျှောက်တွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်တွင် ဖော်ပြထားသော လျှော့ချရေးနည်းလမ်းများကို ဆောင်ရွက်ရန် အသေအချာ လုပ်ဆောင်ရပါမည်။

ဇယား ၁.၁ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
(က)	စီမံကိန်းစတင်ရန် ပြင်ဆင်ခြင်းနှင့် တည်ဆောက်ခြင်းကာလ							
၁.၁။	လေအရည် အသွေး	တည်ဆောက်ရေး လုပ်ငန်းများ	ဖုန်မှုန့်များ ကြောင့် လေအရည်အသွေး ထိခိုက် စေခြင်း	• ပစ္စည်းသယ်ယူခြင်းမှ လေထဲသို့ အမှုန်အမွှားများ ပျံ့လွင့်နိုင်ခြင်းဖြစ်ပေါ်နိုင်သော နေရာများတွင် ရေဖြန်းခြင်းလုပ်ငန်းများ လုပ်ဆောင်ခြင်း၊ ယာဉ်များဖြင့် ဖုန်မှုန့်များ ဖြစ်ပေါ်နိုင်သော ပစ္စည်းများ သယ်ယူပို့ဆောင်ခြင်းတွင် အကာအကွယ်များ တပ်ဆင်၍ ဆောင်ရွက်ခြင်းနှင့် လေကာပစ္စည်းများ တပ်ဆင်ခြင်းဖြင့် သဘာဝအလျောက် ဖြစ်ပေါ်လာသော ဖုန့်မှုန့် များကိုကာကွယ်နိုင်သည်။ • ကွန်ကရစ် မခင်းထားသော လမ်းများတွင် လုပ်ငန်းသုံးယာဉ်များဖြင့် ဖြတ်သန်းခြင်း ရှိပါက (လွန်ခဲ့သော (၂) နာရီအတွင်း မိုးရေချိန်လက်မ (၂) မီလီမီတာအောက် တန်ဖိုးရှိပါက) ရေိယာ ၁မီတာ ပတ်လည် အတွက် ၁နာရီ ၂လီတာ နှုန်းဖြင့် ရေဖြန်းခြင်း ဆောင်ရွက်သင့်သည်။ ခြောက်သွေ့ရာသီ အတွင်း ၎င်းလမ်းကို	Engineering & Procurement Contractor (EPC)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	စီမံကိန်း အဆိုပြုသူအား တစ်လလျှင် တစ်ကြိမ် အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အသုံးပြုပါက ရေဖြန်းခြင်းနှင့် အတူ ပေါင်းစပ်ပစ္စည်းများ (Additives) အသုံးပြု၍ ဖုန်မှုန့်များကို အစဉ်အမြဲ ပိုမို လျော့ချပေးနိုင်သည်။ • ခင်းထားသော လမ်းများ တွင် ယာဉ်များ သွားလာ ခြင်း ရှိက ဖုန်မှုန့်များ ဖြစ်ပေါ်ခြင်း နှင့် ဖုန်မှုန့်များ တင်ကျန် ပျံ့နှံ့ခြင်းမှ ကာကွယ်နိုင်ရန် ကားဘီး ရေဆေးခြင်း အား အဓိကထား လုပ်ဆောင်သင့်သည်။ • ပစ္စည်းများ စုပုံခြင်း (ဥပမာ- အုတ်၊ သဲ၊ ကျောက်များ) အား လျော့ချသင့်သည်။ စက်ပစ္စည်း များ လည်ပတ်ခြင်းနှင့် ဖုန်မှုန့်များဖြစ်ပေါ်နိုင်သော လုပ်ငန်းများအား တက်နိုင်သ၍ လေအရည်အသွေး ထိခိုက်မှု မြင့်မားနိုင်သော နေရာများနှင့် ဝေးကွာ၍ ဆောင်ရွက် လုပ်ကိုင်သင့်သည်။				
၁.၂။	လေအရည် အသွေး	လုပ်ငန်းလည်ပတ်သည့်ကာလ	NOx ထုတ်လွှတ်မှု ကြောင့် လေအရည်အ	• IFC General EHS Guidelines မှ ချမှတ်ထားသော လေအရည်အသွေး ထုတ်လွှတ်မှုနှင့် ပတ်ဝန်းကျင် လေအရည် အသွေး စံချိန်စံညွှန်းများနှင့်အညီ အရေးပေါ်	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) Long term	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊	လစဉ် အဖွဲ့အစည်း အတွင်း	စီမံကိန်း အဆိုပြုသူ မှ

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျှော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			သွေး ထိခိုက်စေခြင်း	ဒီဇယ်သုံး ခဲတ်အားပေးမီးစက်အား တပ်ဆင်ထိန်းသိမ်းသုံးစွဲ၍ လေအရည် အသွေး ထိခိုက်မှု မြင့်မားနိုင်သော နေရာများ (ASR)၏ အဝေးတွင် ထားရှိရမည် ဖြစ်ပြီး NOx ထုတ်လွှတ်မှုအား စံချိန်စံညွှန်းများ ထက် ကျော်လွန်ခြင်း မဖြစ်စေရန် လျှော့ချထိန်း သိမ်းရမည်။ • NOx စောင့်ကြည့်တိုင်းတာခြင်း နှင့် အချိန်နှင့်တပြေးညီ တိုင်းတာခြင်းများ ဆက်လက် လုပ်ဆောင်သင့်သည်။	service agreement	ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	အစီရင်ခံစာ တင်ပြခြင်း။	တာဝန်ယူ ခြင်း။
၁.၃။	လေအရည် အသွေး	စောင့်ကြပ်ကြည့် ရှုခြင်း	ဖုန်မှုန့်၊ NOx၊ SO2 နှင့် PM ထုတ်လွှတ်မှု များကြောင့် လေအရည်အ သွေး ထိခိုက် စေခြင်း။	• လုပ်ငန်းခွင်အတွင်း PM10 ထွက်ရှိမှုအား သိရှိစေရန် လက်ကိုင်တိုင်းတာနိုင်သော စောင့်ကြည့် တိုင်းတာရေးပစ္စည်းများ အသုံးပြု၍ စောင့်ကြည့် တိုင်းတာသင့်သည်။ • ဆောက်လုပ်ရေးကာလ အတွင်း လေအရည် အသွေးအပေါ် သက်ရောက်မှုများအား စောင့်ကြည့် တိုင်းတာသင့်ပြီး လိုအပ်သော လျှော့ချရေး နည်းလမ်းများအား အချိန်နှင့် တပြေးညီ ဆောင်ရွက်သင့်သည်။ • ခေါင်းတိုင် (33t/78RH-100GT) အား Continuous Emission Monitoring	Engineering & Procurement Contractor (EPC)	စီမံကိန်းအတွင်း ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	စီမံကိန်း အဆိုပြုသူအား တစ်လလျှင် တစ်ကြိမ် အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				စက်များတပ်ဆင်၍ အချိန်နှင့်အမျှ ထိန်းချုပ်ခန်းသို့ အချက်အလက်များ တင်ပြ ဆောင်ရွက်ရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းစဉ် အတွင်း လျော့ချရေး နည်းလမ်းများအား စနစ်တကျ လုပ်ဆောင်နိုင်ရန်အတွက် မိုးလေဝသ အချက်အလက်များ စောင့်ကြည့်ခြင်းကို စီမံကိန်း၏ အဆောက်အအုံများနှင့် ကင်းလွတ်သော တစ်နေရာ၌ တိုင်းတာထား သင့်သည်။				
၂.၁။	ဖန်လုံအိမ် ဓာတ်ငွေ့	သယ်ယူပို့ဆောင် ရေးလုပ်ငန်းများနှင့် လုပ်ငန်းသုံး စက်ကြီးများ အသုံးပြုခြင်း အစရှိသောဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များ	ဖန်လုံအိမ် ဓာတ်ငွေ့ ထုတ်လွှတ်မှု	• လေအရည်အသွေး ထိခိုက်မှု လျော့ချရေး လုပ်ငန်းများအတိုင်း ပြုလုပ်ဆောင်ရွက်ရန်။ • အင်ဂျင်စက်များနှင့် စက်ပစ္စည်းများ အတွက် Preventive Vehicle Maintenance Plan များ ထားရှိ၍ စနစ်တကျ သုံးစွဲမှုရှိစေရန် စီစဉ် ဆောင်ရွက်ခြင်း။	Engineering & Procurement Contractor (EPC)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	စီမံကိန်း အဆိုပြုသူအား တစ်လလျှင် တစ်ကြိမ် အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost
၂.၂။	ဖန်လုံအိမ် ဓာတ်ငွေ့	စောင့်ကြပ်ကြည့် ရှုခြင်း	ဖန်လုံအိမ် ဓာတ်ငွေ့	• နှစ်စဉ် ဖန်လုံအိမ်ဓာတ်ငွေ့ ထုတ်လွှတ်ခြင်း နှင့် လေထုညစ်ညမ်းစေသောအရာများ	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့်	နှစ်စဉ် အဖွဲ့အစည်း အတွင်း	စီမံကိန်း အဆိုပြုသူ မှ

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			ထုတ်လွှတ်ခြင်း	ထုတ်လွှတ်ခြင်းကို ကိန်းဂဏ္ဍာန်း များအား ပြုစု၍ CO2eq unit ဖြင့် အစီရင်ခံဖော်ပြရန်။ • ထုတ်လွှတ်မှု ထိန်းချုပ်ရေး လုပ်ငန်း အနေဖြင့် သဘာဝ အလျောက် သစ်တောများ ပြန်လည် စိုက်ပျိုးခြင်းနှင့် စီးပွားဖြစ် သစ်တောများ စိုက်ပျိုးခြင်းများ အပါအဝင် Kyoto Protocol မှ သင့်တင့်သော လုပ်ငန်းစဉ်များနှင့် voluntary carbon market များဖြင့် ချိတ်ဆက် ဆောင်ရွက်သင့်သည်။	long term service agreement (LTSA)	ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	အစီရင်ခံစာ တင်ပြခြင်း။	တာဝန်ယူခြင်း။
၃.၁။	မြေပေါ်ရေ အရည် အသွေး	စွန့်ပစ်ရည် ထုတ်လွှတ်မှုနှင့် စီးဆင်းမှု	စွန့်ပစ်ရည် ထုတ်လွှတ်မှု၊ စီးဆင်းမှု နှင့် စွန့်ပစ် ပစ္စည်းများ သိုလှောင် ခြင်း၊ စွန့်ပစ်ခြင်း နှင့် ရေသုံးစွဲခြင်းတို့ အား စနစ် မကျသော အသုံးပြုမှုများ ကြောင့်	• ဆောက်လုပ်ရေး အလုပ်သမား များအတွက် စီမံကိန်းအတွင်း ကောင်းမွန်လုံလောက်သော အိမ်သာနှင့် ဆက်စပ်ပစ္စည်းများ ထားရှိ ခြင်းနှင့် စွန့်ပစ်ပစ္စည်းများအား သတ်မှတ်ထားသော နေရာများတွင် စနစ်တကျ စွန့်ပစ်စေရန် အသိပညာ ပေးခြင်းများ ဆောင်ရွက်ရမည်။ • ကားဘီးသန့်စင်ရေးလုပ်ငန်းများ၊ အပေါ်ယံမြေဆီလွှာများ၊ သဲအိတ်များ၊ တူးဖော်ထားသော မြေသားများနှင့် ပြန်လည်	Engineering & Procurement Contractor (EPC)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	စီမံကိန်း အဆိုပြုသူအား တစ်လလျှင် တစ်ကြိမ် အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			မြေပေါ်ရေ အရည် အသွေး ထိခိုက်မှု ဖြစ်စေခြင်း။	စိုက်ပျိုးထားသော သီးနှံများ၊ ကျောက်ခဲများ၊သင့်လျော်သော ကျောက်ခဲ၊ ပစ္စည်းများဖြင့် ယာယီ ပိတ်ဆို့မှု ပြုလုပ် ထားသောနေရာများ၊ ဆောက်လုပ်ရေး အတွက် အသုံးပြုရန် ပြင်ဆင်စုပုံထားသော ပစ္စည်းများ(သို့) စွန့်ပစ်ပစ္စည်း များအား မိုးရွာသွန်းချိန်တွင် မိုးကာများ(သို့) အခြားသော အကာအကွယ်များ အသုံးပြု၍ ဖုံးကာထားသင့်သည်။ • မိုးရွာသွန်းမှုအခြေအနေအား စနစ်တကျ ပုံမှန်ကောက်ယူ၍ ရေနုတ်မြောင်းများ ပြုလုပ်ခြင်း၊ စစ်ဆေးခြင်းနှင့် ထိန်းသိမ်းခြင်း လုပ်ငန်းများ၊ ရေစီးဆင်းရာ လမ်းကြောင်းတစ်လျောက် တိုက်စားမှု ထိန်းချုပ်ခြင်း နှင့် နုန်းမြေများ ဖယ်ရှားခြင်း လုပ်ငန်းများကို စနစ်တကျ ဆောင်ရွက် ရမည် ဖြစ်သည့် အပြင် ဆောက်လုပ်ရေး လုပ်ငန်း များမှ ထွက်ရှိလာသော စွန့်ထုတ် အရည်များ၏ တန်ဖိုးသည်လည်း IFC guideline အတွင်း ရှိစေရမည် ဖြစ်သည်။				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• ဆီများဖြင့် ညစ်ညမ်းနေသော ရေများအား ပြည်တွင်း လိုင်စင်ရ စွန့်ပစ်အရည် ထိန်းသိမ်းရေး တတိယအဖွဲ့အစည်းများနှင့် ချိတ်ဆက်၍ စွန့်ပစ်င်းနှင့် ရေ၊အဆီ ခွဲထုတ်ကိရိယာများ အသုံးပြု ခွဲထုတ်ပြီးမှသာလျှင် ရေနုတ်မြောင်းများ အတွင်းသို့ စွန့်ပစ်ရမည်ဖြစ်သည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းသုံးပစ္စည်းများ စီမံခန့်ခွဲရေး အစီအစဉ်အား ချမှတ်၍ ဆောက်လုပ်ရေးလုပ်ငန်းအတွင်း ပစ္စည်းများ အလွန်အကျွံ အသုံးပြုခြင်းအား လျော့ချ နိုင်ပြီး ဆောက်လုပ်ရေးလုပ်ငန်းပြီး ဆုံးချိန်၌ အပိုပစ္စည်းများမှ ထွက်ရှိ လာသော စွန့်ပစ် ပစ္စည်းများအား လျော့ချနိုင်သည်။ • စွန့်ပစ်ပစ္စည်းအမျိုးအစားများပေါ် မူတည်၍ ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းနှင့် အန္တရာယ် မရှိသော စွန့်ပစ်ပစ္စည်းအဖြစ် ခွဲခြား သတ်မှတ်၍ စွန့်ပစ်ရမည်။ (ဥပမာ- စာကြွင်းစာကျန်များ အား ကြွက်၊ ခြင်၊ ယင်များ လာရောက်ခြင်းမှ ကာကွယ်ရန် နှင့်				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အနံများ သက်သာစေရန် အတွက် အဖုံးဖြင့် အမှိုက်ပုံးများ အား ထားရှိခြင်း) • စီမံကိန်းမှ ချုပ်ဆိုထားသော contractors များနှင့် ချိတ်ဆက်၍ စွန့်ပစ်ပစ္စည်း များအား သိမ်းဆည်းရမည်။ • စီမံကိန်းအတွင်း အနည်အနစ် စစ်ထုတ်ခြင်း နည်းလမ်းများ၊ အနည်အနစ် စုပုံစေခြင်း နည်းလမ်းများနှင့် ဓာတုဗေဒ သန့်စင်ခြင်း နည်းလမ်းများ အစရှိသဖြင့် စွန့်ပစ်အရည် သန့်စင်နိုင်သော ပစ္စည်းများနှင့် နည်းလမ်း များကို တပ်ဆင် ဆောင်ရွက်ရမည်။				
၃.၂။	မြေပေါ်ရေ အရည်အသွေး	လုပ်ငန်း လည်ပတ်သည့် ကာလ	စွန့်ပစ်ရည် ထုတ်လွှတ်မှု၊ စီးဆင်းမှု နှင့် စွန့်ပစ် ပစ္စည်းများ သိုလှောင် ခြင်း၊ စွန့်ပစ်ခြင်း နှင့် ရေသုံးစွဲခြင်းတို့ အား စနစ် မကျသော အသုံးပြုမှုများ	• ရေဆိုး စွန့်ထုတ်ရာ နေရာ၌ ၇ ရက်လျှင် တစ်ကြိမ် အပုချိန် တိုင်းတာ စောင့်ကြည့်ခြင်းအား ဆောင်ရွက်ရမည် ဖြစ်ပြီး စွန့်ထုတ်အရည် အပူချိန်သည် စံချိန်စံညွှန်းများထက် ကျော်လွန်နေပါက စွန့်ပစ်မှုအား ရပ်တန့်စေရမည်။ • ခွဲထုတ်လိုက်သော အဆီများ အား အန္တရာယ်ရှိသော စွန့်ပစ် အဆီများအဖြစ် စနစ်တကျ ကိုင်တွယ် စွန့်ပစ်ရမည်။ ဆီသန့်စင်ထားသော အရည်များ အား	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) Long term service agreement (LTSA)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် အဖွဲ့အစည်း အတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			ကြောင့် မြေပေါ်ရေ အရည် အသွေး ထိခိုက်မှု ဖြစ်စေခြင်း။	စက်ရုံ၏စွန့်ပစ်အရည်များ နှင့်အတူ စွန့်ပစ်နိုင်သည်။စီမံကိန်း၏ အနီးရှိချောင်းသို့ စွန့်ပစ်ရေများစွန့်ထုတ်ရာတွင် နည်းပညာ အသေးစိတ်ဖြင့် တွက်ချက်၍ ရေအေးများ အဖြစ် စီးဆင်းစေရမည်။ • စီမံကိန်းတစ်ခုလုံးမှ မိလ္လာနှင့် စွန့်ထုတ် အရည်များအား စနစ်တကျ စုပေါင်း၍ WB /IFC မှ အပူစွမ်းအင်သုံး လုပ်ငန်းများ အတွက် ချမှတ်ထားသော EHS Guidelines နှင့်အညီ စွန့်ထုတ်အရည် သန့်စင်စက် (STP)များ၌ သန့်စင်ရမည် ဖြစ်သည်။ သန့်စင်ရန်မလိုသော စွန့်ထုတ် အရည်များအား စီမံကိန်း ဝန်းကျင် နေရာများနှင့် ဟိန်းဲဖမြစ် အတွင်းသို့ တိုက်ရိုက်စွန့်ပစ်မည် ဖြစ်သည်။ • STP များ၏ လုပ်ဆောင်နိုင်မှု အရည်အသွေးအား တိုင်းတာနိုင်ရန်အတွက် STP၏ စွန့်ထုတ်နေရာများ၌ စွန့်ထုတ် အရည် သတ်မှတ်ချက်များကို စဉ်ဆက် မပြတ် လေ့လာခြင်း၊ စောင့်ကြည့် ခြင်းများ ဆောင်ရွက်ရမည်။				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျှော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• စွန့်ပစ်ပစ္စည်းအမျိုးအစားများပေါ် မူတည်၍ ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းနှင့် ဘေးအန္တရာယ် မရှိသော စွန့်ပစ်ပစ္စည်းအဖြစ် ခွဲခြားသတ်မှတ်၍ စွန့်ပစ်ရမည်။ (ဥပမာ-စားကြွင်းစားကျန်များ အား ကြွက်၊ ခြင်၊ ယင်များ လာရောက်ခြင်းမှ ကာကွယ်ရန် နှင့် အနံ့များ သက်သာစေရန် အတွက် အဖုံးဖြင့် အမှိုက်ပုံးများ အား ထားရှိခြင်း) • စွန့်ပစ်ပစ္စည်းများ ထုတ်ပိုးထားရှိမှုအား ယိုဖိတ်မှု၊ ယိုစိမ့်မှုများ မရှိစေရန် စစ်ဆေးမှုများ ပြုလုပ်၍ စနစ်တကျ ထုတ်ပိုးထားရမည်။ • စီမံကိန်းမှ ချုပ်ဆိုထားသော contractors များနှင့် ချိတ်ဆက်၍ စွန့်ပစ်ပစ္စည်း များအား သိမ်းဆည်းရမည်။				
၃.၃။	မြေပေါ်ရေ အရည် အသွေး	စီမံကိန်း လည်ပတ်သည့် ကာလ	စီမံကိန်း အတွင်း ရေရယူမှု ကြောင့် ရပ်ရွာနေ ပြည်သူများ၏	• စီမံကိန်းမှ WB/ IFCတို့မှ ချမှတ်ထားသော Guideline သတ်မှတ်ချက်များနှင့်အညီ ရေရယူ အသုံးပြုရမည်။	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) Long term service agreement	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း	လစဉ် အဖွဲ့အစည်း အတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			ရေ အသုံးပြုမှုအား ထိခိုက် စေခြင်း၊ ရေစိမ့်မဝင်နိုင် သော မျက်နှာပြင်များ ပေါ်များ လာခြင်း၊	• စီမံကိန်း၏ အဆောက်အဦ မျက်နှာပြင်မှ စီးဆင်းရေ များအတွက် လုံလောက်သော အကျယ်အဝန်းရှိသော ရေစီးရေလာ မြောင်းများ ထားရှိရမည်။	(LTSA)	လုံခြုံမှုဆိုင်ရာ အဖွဲ့		
၃.၄။	မြေပေါ်ရေ အရည် အသွေး	မြေပေါ်ရေ အရည် အသွေး စောင့်ကြည့်လေ့ လာခြင်း	စွန့်ပစ်အရည် စွန့်ပစ်ခြင်း နှင့် စီးဆင်း ခြင်း၊ စနစ် မကျသော စွန့်ပစ်ပစ္စည်း သိုလှောင် ခြင်း၊ စွန့်ပစ် ခြင်းနှင့် ရေ အသုံးပြုခြင်း၊	• ESMP အခန်း၌ အသေးစိတ် ဖော်ပြထား သကဲ့သို့ စီမံကိန်း လည်ပတ်ဆဲ ကာလအတွင်း pumping station အနီး ဟိန်းဖဲမြစ် အတွင်း up and downstream မြေပေါ်ရေ အရည်အသွေး စောင့်ကြည့် တိုင်းတာခြင်း လုပ်ငန်းအား စံချိန်စံညွှန်း သတ်မှတ်ချက်များ နှင့်အညီ တိုင်းတာ ဆောင်ရွက် ရမည်။	Engineering & Procurement Contractor (EPC) မှတဆင့် ပတ်ဝန်းကျင် ထိန်းသိမ်းခြင်း ဆိုင်ရာ အကြံပေးဖြစ် သော တတိယအဖွဲ့ အစည်းမှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	စီမံကိန်း အဆိုပြုသူအား စောင့်ကြည့်တိုင်း တာခြင်းဆိုင်ရာ အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
၃.၅။	မြေပေါ်ရေ အရည် အသွေး	မြေပေါ်ရေ အရည် အသွေး စောင့်ကြည့်လေ့ လာခြင်း	စွန့်ပစ်အရည် စွန့်ပစ်ခြင်း နှင့် စီးဆင်းရေ ထွက်ရှိခြင်း၊ စနစ် မကျသော စွန့်ပစ်ပစ္စည်း သိုလှောင် ခြင်း၊ စွန့်ပစ် ခြင်းနှင့် ရေ အသုံးပြုခြင်း၊	• ESMP အခန်း၌ အသေးစိတ် ဖော်ပြထားသကဲ့သို့ စီမံကိန်း လည်ပတ်ဆဲ ကာလအတွင်း မြေပေါ်ရေ အရည်အသွေး စောင့်ကြည့် တိုင်းတာခြင်း လုပ်ငန်းအား ဆောင်ရွက် သင့်သည်။	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement (LTSA) မှတဆင့် ပတ်ဝန်းကျင် ထိန်းသိမ်းခြင်း ဆိုင်ရာ အကြံပေးဖြစ် သော တတိယအဖွဲ့ အစည်းမှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် အဖွဲ့အစည်း အတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။
၄.၁။	ဆူညံသံ	ဆောက်လုပ်ရေး အလုပ် များ အတွက် လုပ်ငန်းသုံး ဝန်ချီ စက်ကြီး များ အသုံးပြုခြင်း အပါအဝင်ဆော	ဆူညံသံ သက်ရောက်မှု မြင့်မား လာခြင်း၊	• ဆူညံသံအကာအကွယ်ပစ္စည်းများ အသုံးပြု ခြင်းသည် ဆူညံသံ သက်ရောက်မှု လျော့ချ ရေး အတွက် အလွန်အရေးပါသည်။ စီမံကိန်း ၏ခြံစည်းရိုးတွင် ဆူညံသံ အကာအကွယ်ပစ္စည်းများအား ဆူညံသံထိခိုက်မှု မြင့်မားနိုင်သော	ခန့်အပ်ထား သော Engineering & Procurement Contractor	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
		က်လုပ်ရေးလုပ်ငန်းဆောင်ရွက်မှုများ အားလုံးပါဝင်သည်။		နေရာများအား (NSR) ဆူညံသံထွက်ရှိရာနေရာများမှ ဖုံးကွယ်နိုင်ရန် လုံလောက်သည့် အမြင့်ဖြင့် ရပ်ရွာများကို မျက်နှာမူလျက် တပ်ဆင်ထားရမည်။ ဆူညံသံ အကာအကွယ် ပစ္စည်းသည် ထုထည်အားဖြင့် ၂၀တုရန်းမီတာလျှင် ၇ ကီလိုဂရမ် အနည်းဆုံးရှိရမည် ဖြစ်ပြီး အပေါက်၊အဖာများ ကင်းရှင်းရမည်။ • ရွေ့လျား ဆောင်ရွက်ရသော ပစ္စည်းများအား ချောဆီ ဖြည့်ပေးခြင်း၊ ပျက်ဆီးနေသော ပစ္စည်းများအား သိမ်းဆည်းခြင်း နှင့် ပြန်လည်အစားထိုးခြင်း အစရှိသဖြင့် စက်ပစ္စည်းများ အား ပုံမှန်ထိန်းသိမ်းခြင်း လုပ်ငန်းများဆောင်ရွက်ရမည်။ • စက်ပစ္စည်းများ၊ ဆောက်လုပ် ရေးသုံး ပစ္စည်းများ (ဥပမာ-ကားများ) အား အလုပ်ချိန် အတွင်း အလွန်အကျွံ အသုံးပြုခြင်း မဖြစ်စေရန် ခေတ္တရပ်နားခြင်း၊ အနား ပေးခြင်းများ ဆောင်ရွက်ရမည်။ • စက်ပစ္စည်းများအား တစ်ချိန်တည်း အမြောက်အများ အသုံးပြုခြင်းအား	(EPC) မှ တာဝန်ယူခြင်း	လုံခြုံမှုဆိုင်ရာ အဖွဲ့		

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စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				လျော့ချရမည့် အပြင် ဆူညံသံ ထွက်ပေါ်နိုင်သောလုပ်ငန်းများ (ဥပမာ- ကျောက်ခွဲစက်များ နှင့် ကွန်ကရစ် သယ်ဆောင် ကားများ) အား ထိခိုက်မှု မြင့်မားနိုင်သော နေရာများ (NSR) နှင့် ဝေးနိုင်သမျှ ဝေးကွာစွာ ထားရှိရမည်။ • လုပ်ငန်းသုံး ပစ္စည်းများအသုံးပြုရန် စုပုံခြင်း နှင့် အခြားသော အကာအကွယ် အဆောက်အဦများ လုပ်ဆောင်ရန်သင့်ပါက လုပ်ဆောင်နိုင်ပြီး ၎င်းသည် တည်ဆောက်ရေး လုပ်ငန်းများမှ ထွက်ရှိလာမည့် ဆူညံသံများကို NSR များထံသို့မရောက်ရှိစေပဲ အကာအကွယ် ဖြစ်စေမည်ဖြစ်သည်။				
၄.၂။	ဆူညံသံ	လုပ်ငန်းလည်ပတ်သည့်ကာလ	ဆူညံသံ သက်ရောက်မှု မြင့်မားလာခြင်း၊	• ဆူညံသံ အကာအကွယ်များ တပ်ဆင်ခြင်းနှင့် ဆူညံသံ ထိန်းချုပ်ကိရိယာများ တပ်ဆင်ခြင်းတို့မှအပ EPC constractor မှ လုပ်ငန်း အတွင်း အလေ့အကျင့် ကောင်းများ ဖန်တီးပေးခြင်းဖြင့် စီမံကိန်း လည်ပတ်ဆဲ	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) Long term service agreement	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း	လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူမှ တာဝန်ယူခြင်း။

စဉ်	သက်ရောက်မှုနယ်ပယ်	စီမံကိန်းလုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိအဖွဲ့အစည်း	တာဝန်ယူဆောင်ရွက် ရမည့်အဖွဲ့အစည်း	အစီရင်ခံစာတင်ပြခြင်း	ကုန်ကျစရိတ်
				ကာလ အတွင်း ဆူညံသံ သက်ရောက်မှုများအား လျော့ချပေးနိုင်သည်။ • ဆူညံသံနိမ့်သော ပစ္စည်းကိရိယာများအား ရွေးချယ်အသုံးပြုခြင်း။ • ထူးခြားသော လုပ်ငန်း ဆောင်ရွက်မှုများ နှင့် အထူးသဖြင့် လူနေဧရိယာများ ၌ ရွေ့လျားဆောင်ရွက်မှုများအတွက် အချိန်ကန့်သတ်ခြင်းများ၊ ။ • ဆူညံသံထွက်ရှိရာ နေရာများ အား ထိခိုက်မှုနည်းပါးသော နေရာများသို့ ပြောင်းရွှေ့ခြင်း။ • စက်ပစ္စည်းများအား တုန်ခါမှု ထိန်းချုပ်ကိရိယာများ တပ်ဆင် အသုံးပြုခြင်း။ • ဆူညံသံထွက်ရှိသော စက်များ အား အလုံပိတ်အခန်းများ၌ ထားရှိခြင်းနှင့် အသံထိန်းချုပ် ထားရှိခြင်း။ • ရေမြေ အနေအထားပေါ် မူတည်၍ ဒီဇိုင်းရေးဆွဲကာ အကာအကွယ်ယူပြီး ဆူညံသံလျော့ချခြင်း။ • ဆူညံသံအကာကွယ်များ အသုံးပြုခြင်းနှင့် ဆူညံသံလမ်းကြောင်းလွှဲခြင်း	(LTSA)	လုံခြုံမှုဆိုင်ရာ အဖွဲ့		

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
၄.၃။	ဆူညံသံ	စောင့်ကြပ်ကြည့် ရှုခြင်း	ဆူညံသံ သက်ရောက်မှု မြင့်မားလာခြင်း	• EPC Contractor မှ ဆောက်လုပ်ရေး ကာလ တစ်လျှောက် ဆူညံသံ စောင့်ကြည့်တိုင်းတာခြင်း လုပ်ငန်းအား ထိခိုက်မှုမြင့်မား နိုင်သောနေရာများ (NSR) ၌ လစဉ် တိုင်းတာ၍ ဆူညံသံအဆင့် များအား စောင့်ကြည့် လေ့လာရမည်။ • EPC contractor မှ လုပ်ငန်းသုံး ပစ္စည်းများ၏ ဆူညံသံထွက်ရှိမှု အဆင့်များအား စစ်ဆေးမှုများ ပြုလုပ်၍ ထိခိုက်မှုမြင့်မား နိုင်သော နေရာများ၌ သက်ရောက်မှုများမှာ စံချိန် စံညွှန်းများထက် ကျော်လွန်ခြင်း မရှိစေရန် ပြုလုပ်ရမည်။	Engineering & Procurement Contractor (EPC)မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost
၅.၁။	မြင်ကွင်းပသာဒ	တည်ဆောက် ရေးကာလ	ဆောက် လုပ်ရေး လုပ်ငန်းများ နှင့် အဆောက် အအုံများကြောင့် မြင်ကွင်းပသာ ဒ ထိခိုက်ခြင်။	• စီမံကိန်းဧရိယာ အပြင်ဘက် အပါအဝင် ယာယီ မြေလုပ်ငန်းပြုလုပ်ရာ နေရာများ၌ စိုက်ပျိုးမြေများ ရှင်းလင်းခြင်း အား တက်နိုင်သမျှ အနည်းဆုံး ဖြစ်စေရန် ဆောင်ရွက်ရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်း နေရာများအား စနစ်တကျ သတ်မှတ်ခြင်း အပါအဝင် ဆောက်လုပ်ရေးဆိုင်ရာ အလေ့အကျင့် ကောင်းများ ကျင့်သုံးခြင်း။	Engineering & Procurement Contractor (EPC)မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• စီမံကိန်းဧရိယာအတွင်း သစ်ပင်၊ ပန်းပင်များစိုက်ပျိုးနိုင်ရန်အတွက် နေရာလွတ်များ ထားရှိဆောင်ရွက်ခြင်း။ • Light pollution/spill အား လျော့ချနိုင်ရန်အတွက် စီမံကိန်းအတွင်း အလင်းရောင် ရရှိမှုအား စီမံခန့်ခွဲခြင်းနှင့် အလင်း ထုတ်လွှတ်သော လုပ်ငန်းများအား စီမံ ဆောင်ရွက်ခြင်း။ • မီးအလင်းအသုံးပြုရသော လုပ်ငန်းများအား လျော့ချရန် နှင့် လုပ်ငန်းများကို နေ့အချိန်တွင်သာ ပြုလုပ်ရန်။ • အကာအကွယ်များ၊ ပုံစံကွက်များနှင့် ပြတင်းပေါက် အကာများ ထားရှိခြင်းဖြင့် ပြင်ပမှ အလင်းဝင်ရောက်မှုအား လျော့ချ နိုင်သည်။ • မလိုအပ်ဘဲ အလင်းသုံးစွဲမှုအား တတ်နိုင်သမျှ လျော့ချ အသုံးပြုရမည်။				
၅.၂။	မြင်ကွင်းပသာဒ	လုပ်ငန်း လည်ပတ်သည့် ကာလ	လုပ်ငန်းဆော င်ရွက် စဉ် အတွင်း အဆောက်အ	• အလင်းရောင်လိုအပ်သော နေရာများ၌ အလင်းရောင် ရရှိစေရန်နှင့် မလိုအပ်သော သုံးစွဲမှုများမရှိစေရန် ဂရုစိုက်၍ design ရေးဆွဲ တပ်ဆင်ရမည်။ အကာအကွယ်များ၊	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့်	လစဉ် အဖွဲ့အစည်းအတွ	စီမံကိန်း အဆိုပြုသူ မှ

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			အုံများ၊ အလင်း ထွက်ရှိမှုများ ကြောင့် အမြင်ပဒေသာ ထိခိုက်ခြင်း။	ပုံစံကွက်များနှင့် ပြတင်းပေါက် အကာများ ထားရှိခြင်းဖြင့် ပြင်ပမှ အလင်းဝင်ရောက်မှုအား လျော့ချနိုင်သည်။ မလိုအပ်ဘဲ အလင်းသုံးစွဲမှုအား တက်နိုင်သမျှ လျော့ချ အသုံးပြုရမည်။ • အနုပညာလက်ရာမြောက်သော design များ စနစ်တကျရေးဆွဲ တည်ဆောက်ရမည်။ ဒီဇိုင်း texture များရေးဆွဲခြင်း၊ အဆောက်အအုံများ (မီးတိုင်များ၊ ရုံးခန်းများ၊ သိုလှောင်ခန်းများ၊ မီးခိုးတိုင်များ) ဆေးသုတ်ခြင်းအား ပတ်ဝန်းကျင်သွင်ပြင် နှင့်အညီ ရေးဆွဲပုံဖော်ရမည်။ ဘုရားစေတီပုထိုးများကဲ့သို့ အမြင်ပဒေသာများ တွေ့မြင်ကြည့်ရှုခံစား နိုင်စေရန် အဆောက်အအုံများ အကြား စကြံနံလမ်းများ ထည့်သွင်း တည်ဆောက် ရမည်။ • စီမံကိန်း ဘေးဝဲယာ တစ်လျှောက်တွင် သစ်ပင်၊ ပန်းပင်များကို စိုက်ပျိုးခြင်းဖြင့် အမြင်ပဒေသာကို သာယာ လှပစေရမည်။	service agreement (LTSA)	ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	င်း အစီရင်ခံစာ တင်ပြခြင်း။	တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• လုပ်ငန်းသုံးပစ္စည်းများအားလုံး ပြုပြင်ထိန်းသိမ်းမှုများ ကောင်းမွန်စွာ ပြုလုပ်ထားခြင်း၊ သာယာလှပသော လုပ်ငန်းခွင် ဖြစ်စေရန် ထိန်းသိမ်းထားရှိခြင်း နှင့် ချို့ယွင်းချက်များရှိပါက ပြန်လည်ပြုပြင် ဆောင်ရွက်ခြင်း များ ပြုလုပ်ရမည်။				
၅.၃။	မြင်ကွင်းပသာဒ	စောင့်ကြပ်ကြည့် ရှုခြင်း	တည် ဆောက်ဆဲ ကာလ နှင့် ဆောက် လုပ်ရေး ကာလ အတွင်း အမြင်ပဒေသာ ထိခိုက်ခြင်း။	• ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်စဉ် ကွင်းဆင်း စစ်ဆေးခြင်းများလည်း ဆောင်ရွက်ရမည်။ • စီမံကိန်း၏ဆောက်လုပ်ရေး လုပ်ငန်းများနှင့် Water Supply Site အပါအဝင် စီမံကိန်း လည်ပတ်ဆောင်ရွက်မှုများ၌ ရှုခင်းနှင့် အလင်းရောင် စီမံခန့်ခွဲမှုအစီအစဉ် များ ချမှတ်ဆောင်ရွက်ရမည်။	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost
၅.၄။	မြင်ကွင်းပသာဒ	စောင့်ကြပ်ကြည့် ရှုခြင်း	တည် ဆောက်ရေး ကာလ နှင့် လုပ်ငန်းဆော င်ရွက်သည့်ကာ လ အတွင်း	• စီမံကိန်းလည်ပတ်ဆောင်ရွက်မှုအတွက် အလင်းရောင် စီမံခန့်ခွဲမှုအစီအစဉ် များ ချမှတ်ဆောင် ရွက်ရမည်။ • စီမံကိန်းတစ်ခုလုံးအတွက် ရေးဆွဲထားသော အလင်းရောင် စီမံခန့်ခွဲမှုအစီအစဉ် ၌ Water	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့၊ ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း	လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			အမြင်ပဒေသာ ထိခိုက်ခြင်း။	Supply Facilities အတွက်ပါ ထည့်သွင်းရေးဆွဲထားရမည်။	(LTSA)	လုံခြုံမှုဆိုင်ရာ အဖွဲ့		
၆.၁။	စွန့်ပစ် ပစ္စည်းများ	ဇီဝလောင်စာများ စွန့်ပစ်ခြင်း	ဇီဝလောင်စာ များ စနစ်တကျ မစွန့်ပစ်ခြင်း ကြောင့် ထိခိုက်မှုများ။	• မည်သည့်အခြေအနေမျိုး၌မဆို စိုက်ပျိုးသီးနှံများအား မီးရှို့ ဖျက်ဆီးခြင်း လုံးဝမပြုလုပ်ရပါ။ • ရပ်ရွာ ပြည်သူများ၏ အမျိုးမျိုးသော လုပ်ငန်းများ အတွက် ဇီဝလောင်စာများ ဖြစ်သော ပေါင်းပင်၊ မြက်ပင်၊ သစ်ပင်များအား ပြန်လည် အသုံးပြုမည် ဖြစ်သည်။ • MUPA မှ ဇီဝလောင်စာများအား ရပ်ရွာပြည်သူများအတွက် ဦးစားပေး အသုံးပြုစေရမည် ဖြစ်သည်။ စီမံကိန်း အတွင်း ဘေးကင်းလုံခြုံမှုရှိ စေရန်နှင့် စီမံကိန်း အတွင်း ဝင်ရောက်ခွင့် အခက်အခဲများ အဆင်ပြေ ချောမွေ့စေရန် ဇီဝလောင်စာ များအား MUPA မှ ရိပ်သိမ်း ထား၍ ရပ်ရွာပြည်သူများ အလွယ်တကူ ရရှိနိုင်စေရန် သင့်တော်သောနေရာ၌ ထားသို ဆောင်ရွက်ရမည်။	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လုပ်ငန်းခွင် ရှင်းလင်းရေးပြု လုပ်နေစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာတင် ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• ရပ်ရွာပြည်သူများမှ ရယူခြင်း မရှိသေးသော ဇီဝလောင်စာများ ကိုလည်း နောက်ပိုင်းတွင် ပြန်လည်အသုံးပြုနိုင်ရန် စနစ်တကျ သိုလှောင် ထိန်းသိမ်း ထားရှိရမည်။				
၆.၂။	စွန့်ပစ် ပစ္စည်းများ	ဆောက်လုပ်ရေး ကာလ အတွင်း စွန့်ပစ် အစိုင်အခဲများသို လှောင်ခြင်းနှင့် စွန့်ပစ်ခြင်း။	အန္တရာယ်ရှိ သော ဓာတ်ဆီ၊ လောင်စာဆီ များ မတော် တဆ ယိုစိမ့်ခြင်း နှင့် ယိုဖိတ်ခြင်း ကြောင့် မြေပေါ်ရေများ အား ထိခိုက်စေနိုင် ခြင်း။ မသန့်ရှင်းတော့ အစားအစာ များနှင့် ရေများကြောင့်	• စွန့်ပစ်ပစ္စည်းများ စုဆောင်းခြင်းနှင့် သိုလှောင်ခြင်း အစီအမံများအား အခန်း (၉) တွင် ဖော်ပြထားသည့်အတိုင်း စီမံဆောင် ရွက်ရမည်။ • စီမံကိန်း စတင် တည်ဆောက်ချိန်တွင် MUPA အနေဖြင့် စီမံကိန်းနှင့် ပတ်သတ် ဆက်နွယ်သူများ၊ ရပ်ရွာ လူကြီးများ နှင့်အတူ ဆောက်လုပ်ရေးကာလအတွင်းဖြစ်ပေါ်လာ နိုင်သော စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်းနှင့် ပတ်သတ်၍ ရပ်ရွာအတွင်း စွန့်ပစ်ပစ္စည်း စီမံထားရှိနိုင်မှု အခြေအနေများအား လေ့လာ၍ ပူးပေါင်းဆောင်ရွက်ရမည်။ • စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း အစီအစဉ်တစ်ခု၌ စီမံခန့်ခွဲခြင်း၊ ရှောင်ရှားခြင်းနည်းလမ်းများ၊ လျော့ချခြင်းနည်းလမ်းများနှင့် ပြန်လည်	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			လုပ်သားများ ၏ ကျန်းမာရေး အား ထိခိုက်စေခြင်း ။	အသုံးပြုခြင်း နည်းလမ်းများကို ပါဝင် ရေးဆွဲ၍ မဖြစ်မနေ အကောင်အထည် ဖော် ဆောင်ရွက်ရမည်။ • စီမံကိန်းအတွင်း အလုပ်သမား များအား စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်းနှင့် ပတ်သက်သော အသိပညာများ သိရှိနား လည် စေရမည်။ • ဆောက်လုပ်ရေးဧရိယာ အတွင်း အမှိုက် စွန့်ပစ်နိုင်ရန် အမှိုက်ပုံးများထားရှိခြင်းနှင့် သင်္ကေတများ ထားရှိခြင်းများ စီမံ ဆောင်ရွက်ရမည်။ • စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ရန်နှင့် သိမ်းဆည်းရန် contractors များ ခန့်အပ်ရာ၌ စွန့်ပစ်ပစ္စည်း မည်သို့မည်ပုံ သိမ်းဆည်းမည်ကို စာချုပ်စာတမ်း၌ ရှင်းလင်းစွာ ထည့်သွင်းဖော်ပြသင့်သည်။ စွန့်ပစ်ပစ္စည်း နောက်ဆုံး စွန့်ပစ်ရာ နေရာအား စနစ်တကျ လေ့လာ၊ စစ်ဆေး၍ IFC စံချိန်စံညွှန်းများနှင့်အညီ ပတ်ဝန်းကျင်ထိခိုက်မှု မဖြစ်စေရန် စီမံဆောင်ရွက် ရမည် ဖြစ်ပြီး အမြဲမပြတ် စောင့်ကြည့် တိုင်းတာရမည်။				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• ခန့်အပ်ထားသော Contractor သည် စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်း ဆိုင်ရာ အစီရင်ခံစာအား တစ်နှစ်လျှင် တစ်ကြိမ် တင်ပြရမည်။				
၆.၃။	စွန့်ပစ် ပစ္စည်းများ	လုပ်ငန်းလည်ပတ်သည့် ကာလ အတွင်း စွန့်ပစ် အစိုင်အခဲများသို လှောင်ခြင်းနှင့် စွန့်ပစ်ခြင်း။	အန္တရာယ်ရှိသော ဓာတ်ဆီ၊ လောင်စာဆီ များ မတော်တဆ ယိုစိမ့်ခြင်း နှင့် ယိုဖိတ်ခြင်း ကြောင့် မြေပေါ်ရေများ အား ထိခိုက်စေနိုင်ခြင်း။ အန္တရာယ်ရှိသော ဓာတ်ဆီ၊ လောင်စာဆီ များ မတော်တဆ	• စွန့်ပစ်ပစ္စည်းများ စုဆောင်းခြင်းနှင့် သိုလှောင်ခြင်း အစီအမံများအား အခန်း (၉) နှင့် အခန်း (၁၂) (မြေပေါ်ရေ၊ မြေဆီလွှာနှင့် မြေအောက်ရေ) အခန်းတို့တွင် ဖော်ပြထားသည့် အတိုင်း စီမံဆောင်ရွက်ရမည်။ • စီမံကိန်းလည်ပတ်သည့်ကာလတွင်စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း အစီအစဉ်တစ်ခု၌ စီမံခန့်ခွဲခြင်း၊ ရှောင်ရှားခြင်းနည်းလမ်းများ၊ လျော့ချခြင်းနည်းလမ်းများနှင့် ပြန်လည်အသုံးပြုခြင်း နည်းလမ်းများကို ပါဝင်ရေးဆွဲ၍ မဖြစ်မနေ အကောင်အထည်ဖော် ဆောင်ရွက်ရမည်။ • စီမံကိန်းအတွင်း အလုပ်သမား များအား စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်းနှင့် ပတ်သက်သော အသိပညာများ သိရှိနားလည် စေရမည်။	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement (LTSA)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူမှ တာဝန်ယူခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
			ယိုစိမ့်ခြင်း နှင့် ယိုဖိတ်ခြင်း ကြောင့် မြေဆီလွှာအား ထိခိုက်စေနိုင်ခြင်း။ မသန့်ရှင်းတော့ အစားအစာ များနှင့် ရေများကြောင့် လုပ်သားများ ၏ ကျန်းမာရေး အား ထိခိုက်စေခြင်း ။	• လုပ်ငန်းဧရိယာ အတွင်း အမှိုက် စွန့်ပစ်နိုင်ရန် အမှိုက်ပုံးများထားရှိခြင်းနှင့် သင်္ကေတများ ထားရှိခြင်းများ စီမံဆောင်ရွက်ရမည်။ • စွန့်ပစ်ပစ္စည်း စွန့်ပစ်မှု အစီအမံများအား ရက်သတ္တပတ် ၂ ပတ်လျှင် ၁ကြိမ် အနည်းဆုံး တိုင်းတာစစ်ဆေး ရမည် ဖြစ်ပြီး စွန့်ပစ်ပစ္စည်းများအား စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်းဆိုင်ရာ အလေ့အကျင့်ကောင်းများဖြင့် စနစ်တကျ စွန့်ပစ်ရမည် ဖြစ်သည်။ • စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ရန်နှင့် သိမ်းဆည်းရန် contractors များ ခန့်အပ်ရာ၌ စွန့်ပစ်ပစ္စည်း မည်သို့မည်ပုံ သိမ်းဆည်းမည်ကို စာချုပ်စာတမ်း၌ ရှင်းလင်းစွာ ထည့်သွင်းဖော်ပြသင့်သည်။ စွန့်ပစ်ပစ္စည်း နောက်ဆုံး စွန့်ပစ်ရာ နေရာအား စနစ်တကျ လေ့လာ၊ စစ်ဆေး၍ IFC နှင့် NEQ စံချိန်စံညွှန်းများနှင့်အညီ ပတ်ဝန်းကျင်ထိခိုက်မှု မဖြစ်စေရန်				

စဉ်	သက်ရောက်မှုနယ်ပယ်	စီမံကိန်းလုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိအဖွဲ့အစည်း	တာဝန်ယူဆောင်ရွက် ရမည့်အဖွဲ့အစည်း	အစီရင်ခံစာတင်ပြခြင်း	ကုန်ကျစရိတ်
				စီမံဆောင်ရွက် ရမည် ဖြစ်ပြီး အမြဲမပြတ်စောင့်ကြည့် တိုင်းတာရမည်။ • ခန့်အပ်ထားသော Contractor သည် စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ခြင်း ဆိုင်ရာ အစီရင်ခံစာအား တစ်နှစ်လျှင် တစ်ကြိမ် တင်ပြရမည်။				
၆.၄။	စွန့်ပစ်ပစ္စည်းများ	စောင့်ကြပ်ကြည့်ရှုခြင်း	တည်ဆောက်ရေး ကာလနှင့် လုပ်ငန်းဆောင်ရွက်သည့် ကာလနှင့် ပြုပြင်ထိန်းသိမ်းခြင်းကာလ အတွင်း စွန့်ပစ်ပစ္စည်း စွန့်ထုတ်ခြင်း၊ သိုလှောင်ခြင်း နှင့် စွန့်ပစ်ခြင်းများ၏ သက်ရောက်မှုများ။	• ESMP အခန်း၌ ဖော်ပြထားသကဲ့သို့ စီမံကိန်း၏ ဆောက်လုပ်ရေး ကာလနှင့် လည်ပတ်သည့်ကာလ အတွင်း အောက်ဖော်ပါအချက်များကို တိုင်းတာစောင့်ကြည့်သင့်သည်။ • Waste Management Plan ၌ ဖော်ပြထားသကဲ့သို့ စီမံကိန်း ဧရိယာအတွင်း စွန့်ပစ်ပစ္စည်း ခွဲခြား သတ်မှတ်ခြင်း၊ သယ်ယူပို့ဆောင်ခြင်းနှင့် စွန့်ပစ်ခြင်း ဆိုင်ရာ အလေ့အကျင့် ကောင်း များအား စောင့်ကြည့် လေ့လာခြင်း။ • Waste Management Plan ၌ ဖော်ပြထားသကဲ့သို့ စွန့်ပစ်ပစ္စည်း သိမ်းဆည်းရန် ခန့်အပ်ထားသော Contractor အား စာချုပ်စာတမ်း၊	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) (သို့မဟုတ်) စီမံကိန်းအဆိုပြုသူ (သို့မဟုတ်) long term service agreement	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်းအဆိုပြုသူအား အစီရင်ခံစာတင်ပြခြင်း။	တည်ဆောက်ဆဲကာလအတွင်း EPC Contract orမှ တာဝန်ယူခြင်း လုပ်ငန်းဆောင်ရွက်စဉ်အတွင်း စီမံကိန်းအဆိုပြုသူ

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အစီရင်ခံစာ များ အသုံးပြုစေခြင်းဖြင့် စောင့်ကြည့် လေ့လာခြင်း။	(LTSA) မှ တာဝန်ယူခြင်း			မှ တာဝန်ယူ ခြင်း။
၇.၁။	မြေဆီလွှာ အရည်အသွေး	တည်ဆောက်ရေး လုပ်ငန်းများ	အပေါ်ယံမြေ ဆီလွှာ ဆုံးရှုံးခြင်း ကြောင့် မြေဆီလွှာအား ထိခိုက်စေခြင်း ။	• စီမံကိန်းဧရိယာအား တိကျစွာ သတ်မှတ်ထားရမည် ဖြစ်ပြီး လုပ်ငန်းဆောင်တာများ ကိုလည်း မိုးသည်းထန်စွာ ရွာသွန်းခြင်း၊ အလွန်အမင်း ပူပြင်းခြောက်သွေ့ခြင်းနှင့် လေပြင်းတိုက်ခြင်း စသည့် ပြင်းထန်သည့်ရာသီဥတုအခြေအနေတို့မှ ရှောင်ရှားနိုင်ရန် အစီအစဉ်ဆွဲ ပြုလုပ်ဆောင်ရွက်ရမည်။ • ယာယီမြေသုံးစွဲရာနေရာများ၌လည်း စိုက်ပျိုးသီးနှံများ ပြန်လည် စိုက်ပျိုး၍ ထိန်းသိမ်း ခြင်းများ ဆောင်ရွက်ရမည်။ • ယာဉ်ကြီးများ သွားလာခြင်း ကြောင့် မြေလွှာများ ပျက်ဆီးခြင်း နှင့် အပေါ်ယံ မြေဆီလွှာ သိပ်သည်း စေခြင်းမှ ကာကွယ် နိုင်ရန် လမ်းကြောင်း များ တစ်သတ်မတ်တည်း သတ်မှတ် ပေးရမည်။	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လမ်းကြောင်းအစီ အစဉ်ချထားမှု များ နှင့် အပေါ်ယံ မြေဆီလွှာများ စီမံခန့်ခွဲမှုဆိုင်ရာ လုပ်ငန်းဆောင် တာများအား စီမံကိန်း အတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့အစည်း နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေး နှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့အစည်းအား တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• အပေါ်ယံမြေဆီလွှာအား တတ်နိုင်သရွေ့ ပြန်လည် အသုံးပြုပေးရမည်။ • ရေလွှဲမြောင်းများ၊ မြေတား နံရံများ၊ အနည်ကျကန်များပြုလုပ်ခြင်းဖြင့်မြေတိုက်စာမှုများအား ထိန်းချုပ်ရမည်။ • အပေါ်ယံမြေဆီလွှာနှင့် အောက်ပိုင်းမြေဆီလွှာ ခွဲခြားထားမှုအား မြေပေါ်ရေ အရင်းအမြစ်များ (သို့) မြေအောက် ရေတွင်းများနှင့် အနည်းဆုံး မီတာ ၅၀ အကွာတွင် ထားရှိရမည်ဖြစ်ပြီး လေတိုက်စားခြင်းမှ ကာကွယ် နိုင်ရန် သဘာဝအတိုင်း လေအကာ အကွယ်ရှိသောနေရာ များ၌ ထားရှိရမည်။ • လေတိုက်စားခြင်းမှ ကာကွယ်နိုင်ရန် အပေါ်ယံ မြေဆီလွှာအား ထားရှိလျှင် မြေပြင်မှ အမြင့်၂ မီတာထက် ကျော်လွန်ခြင်း မရှိဘဲ ထားရှိရမည် ဖြစ်ပြီး လေထုဖြင့် ထိတွေ့ခြင်းနှင့် ရေတိုက်စား စီးဆင်းခြင်းတို့အား လျော့ချပေးနိုင်ရန် နှင့် ရေစုပ်ယူမှု အားနည်းစေရန်				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အပေါ်ယံလွှာမှာ အနည်းငယ် သိပ်သည်းနေရမည် ဖြစ်သည်။				
၇.၂။	မြေဆီလွှာ နှင့် အနည် အနှစ်များ၏ အရည် အသွေး	လုပ်ငန်း ဆောင်ရွက်သည့် ကာလ	တိုက်စား ခြင်းကြောင့် မြေဆီလွှာများ ဆုံးရှုံးခြင်း နှင့် ၎င်းတို့ကြောင့် ဖြစ်ပေါ်လာ သော မြေဆီလွှာ ထိခိုက်မှုများ။	• စီမံကိန်း၏မျက်နှာပြင်များမှ မိုးရွာသွန်းချိန်တွင် ဖြစ်ပေါ် လာသော စီးဆင်းရေများအား ကောင်းမွန်စွာ စီးဆင်းနိုင်စေရန် ရေနုတ်မြောင်းများတွင် လုံလောက်သော အကျယ်အဝန်း ရှိရမည်။	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement (LTSA)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။
၇.၃။	မြေဆီလွှာ နှင့် အနည် အနှစ်များ၏ အရည် အသွေး	စောင့်ကြပ်ကြည့် ရှုခြင်း	တိုက်စား ခြင်းကြောင့် မြေဆီလွှာများ ဆုံးရှုံးခြင်း နှင့် ၎င်းတို့ကြောင့် ဖြစ်ပေါ်လာ သော မြေဆီလွှာ ထိခိုက်မှုများ။	• ESMP အခန်း၌ ဖော်ပြထား သကဲ့သို့ စီမံကိန်းလည်ပတ်သည့် ကာလ အတွင်း မြေဆီလွှာ စောင့်ကြည့်တိုင်းတာခြင်း လုပ်ငန်းအား ၆လလျှင် တစ်ကြိမ် မတော်တဆ ယိုဖိတ်ထားသောနေရာများ၊ စွန့်ပစ်ပစ္စည်း သိုလှောင် ထားရှိသော နေရာများအား စံချိန်စံညွှန်း သတ်မှတ် ချက်များ နှင့်အညီ စောင့်ကြည့် တိုင်းတာ သင့်သည်။ မြေအောက်ရေ စောင့်ကြည့် တိုင်းတာခြင်း လုပ်ငန်းအား စီမံကိန်း	စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) Long term service agreement (LTSA)	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံမှုဆိုင်ရာ အဖွဲ့	၆ လ တစ်ကြိမ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				လည်ပတ်သည့်ကာလတွင် စောင့်ကြည့် တိုင်းတာရန် မလိုအပ်ပါ။				
၈.၁။	ကုန်နေ၊ရေနေ ဇီဝမျိုးစုံမျိုးကွဲ များ	လုပ်ငန်းခွင် ပြင်ဆင်ခြင်း နှင့် ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်မှုများ	နေထိုင် ကျက်စားရာ ဒေသများ ဆုံးရှုံးခြင်း။	• စိုက်ပျိုးမြေများ ရှင်းလင်းခြင်း အတွက် အပြစ်ပေးခြင်း၊ အလုပ်ထုတ်ခြင်းနှင့် သတိပေးခြင်းများ အစရှိသော တင်းကြပ်သည့် စည်းမျဉ်း စည်းကမ်းများ ချမှတ်ပြီး စီမံကိန်းမှ ဝန်ထမ်းများ၊ အလုပ်သမားများ၊ ဆက်စပ် ပါဝင်ပတ်သက်သူများနှင့် ပါဝင်ပတ်သတ်သူများအားလုံး ပါဝင်၍ လိုက်နာဆောင်ရွက် စေရမည် ဖြစ်သည်။ • စီမံကိန်းအဆိုပြုသူသည် အလုပ်သမား၊ ဝန်ထမ်းများ အားလုံး၏ တရားမဝင် စိုက်ပျိုးသီးနှံများ ရိတ်သိမ်းခြင်း နှင့် အပြစ်ပေးခြင်းများ အားလုံး အတွက် တာဝန်ရှိသော ပုဂ္ဂိုလ် ဖြစ်သည်။ • လမ်းအသုံးပြုခြင်းအတွက် ဆောက်လုပ်ရေးလုပ်ငန်းနှင့် လုပ်ငန်းလည်ပတ်ရေး ယာဉ်များသာ အသုံးပြုရန် ကန့်သတ်ထားသင့်ရမည်။	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆို င်ရာ အဖွဲ့။	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• စီမံကိန်း ဧရိယာအတွင်းမှ သစ်နှင့် ဆက်စပ်ပစ္စည်းများ သယ်ဆောင်ခြင်းကို စစ်ဆေးဂိတ်များ အသုံးပြု၍ ယာဉ်များအား စိစစ်သင့်သည်။				
၈.၂။	ကုန်နေ၊ရေနေ ဇီဝမျိုးစုံမျိုးကွဲ များ	လုပ်ငန်းခွင် ပြင်ဆင်ခြင်း နှင့် ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်မှုများ	သတ္တဝါများ၏ နေထိုင် ကျက်စားမှုအမှု အကျင့်အား အနှောက် အယှက် ဖြစ်စေခြင်း	• လုပ်ငန်းသုံးယာဉ်များအား မလိုလားအပ်သော ဆူညံသံများ မဖြစ်ပေါ်စေရန် စက်မှုဆိုင်ရာ စံချိန်စံညွှန်းများ နှင့်အညီ ထိန်းသိမ်းထားရှိရမည်။ • အမြန်နှုန်း ကန့်သတ်ချက် ဆိုင်းဘုတ်များ ထားရှိ၍ လမ်းအသုံးပြုမှုဆိုင်ရာ သတိပေး signs များ ထားရှိရမည်။ • ညအချိန် အလင်းရောင် လိုအပ်သော လုပ်ငန်းနေရာများ ၌ အလင်းအသုံးပြုခြင်းအား လိုအပ်မှသာ အသုံးပြုရမည် ဖြစ်ပြီး လိုအပ်သည့်နေရာများ ကိုသာ တိုက်ရိုက်အသုံးပြုစေပြီး သတ္တဝါများ၏ ကျင်လည် ကျက်စားရာ နေရာများအား ဖြစ်နိုင်သမျှ ရှောင်ရှားရမည်။	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆို င်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• အလုပ်သမားများအား အပင်နှင့်သတ္တဝါများ၏ အဖိုးတန်မှုအား အသိပညာ ပေးခြင်းများ ပြုလုပ်ရန်နှင့် အမဲလိုက်ခြင်း၊ သတ်ဖြတ်ခြင်း များအား တားမြစ်ရန် စီမံ ဆောင်ရွက်မည်ဟု ကတိပြုရမည်။				
၈.၃။	ကုန်နေ၊ရေနေ ဇီဝမျိုးစုံမျိုးကွဲ များ	လုပ်ငန်းခွင် ပြင်ဆင်ခြင်း နှင့် ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်မှုများ	ထိန်းသိမ်းကာ ကွယ် ရန် လိုအပ်သော မျိုးစိတ်များ အား ထိခိုက်မှုများ။	• Biodiversity Action Plan ၌ Sonneratia griffithii ၏ အရေအတွက်အား စီမံခန့်ခွဲမှု အစီအမံများ ထည့်သွင်း ရေးဆွဲရမည်။ • Sonneratia griffithii ၏ တည်နေရာများအား စီမံကိန်း ဧရိယာအတွင်း စနစ်တကျ မှတ်သား၍ ဆောက်လုပ်ရေး ကာလနှင့် လုပ်ငန်း လည်ပတ်စဉ် အတွင်း ရှောင်ရှား ဆောင်ရွက်ရမည်။ • ဆောက်လုပ်ရေးကာလအတွင်း ဆောက်လုပ်ရေးလုပ်ငန်းများကြောင့် Sonneratia griffithii အပေါ် သက်ရောက်မှုများအား လစဉ်စောင့်ကြည့်မှုများ ဆောင်ရွက်၍ ထိခိုက်မှုများ ရှိလာပါက	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆို င်ရာ အဖွဲ့။	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အစီအမံများချမှတ်ပြီး ပြုပြင်ထိန်းသိမ်းရမည်။				
၈.၄။	ကုန်နေ၊ရေနေ ဇီဝမျိုးစုံမျိုးကွဲများ	လုပ်ငန်းခွင် ပြင်ဆင်ခြင်း နှင့် ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်မှုများ	နေထိုင်ကျက်စားရာ ဒေသများအား ပျက်ဆီးစေခြင်း။	• စီးဆင်းရေလမ်းကြောင်းများမှရေအရင်းအမြစ်များဆီသို့ တိုက်ရိုက်စီးဆင်းနိုင်သော နေရာများ၌ စိုက်ပျိုးသီးနှံများ ပြန်လည်စိုက်ပျိုးခြင်းဖြင့် ကာကွယ်မှုများ မပြုလုပ်မီ အနည်အနှစ်နှင့် တိုက်စားမှု ထိန်းချုပ်ရေး ကိရိယာများ အသုံးပြု၍ အပေါ်ယံမြေဆီလွှာများ ပျက်ဆီးမှု မဖြစ်စေရန် ထိန်းသိမ်းရမည်။ • အဆီများ၊ ဓာတုပစ္စည်းများနှင့် စွန့်ပစ်အစိုင်အခဲများ၊ ဆောက်လုပ်ရေးနှင့် ဝန်ထမ်းသုံး စွန့်ပစ်ပစ္စည်းများအား စွန့်ပစ်ရာ၌ ပိုးမွှားများလာရောက်ခြင်းမှ ကာကွယ်နိုင်ရန် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်းဆိုင်ရာ သင့်တော်သော Contractors များနှင့် ချိတ်ဆက်၍ ကိုင်တွယ် ထိန်းသိမ်း စွန့်ပစ်ရမည်။ • ဆောက်လုပ်ရေးနှင့် လုပ်ငန်းလည်ပတ်ရေးဆိုင်ရာ ယာဉ်အသုံးပြုမှုများအတွက် ဆူညံသံနှင့်	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့။	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				ဖုန်မှုန့်များ ထုတ်လွှတ်မှုအား လျော့ချနိုင်ရန် ၁နာရီလျှင် ကီလိုမီတာ ၄၀ နှုန်းဖြင့်သာ အမြင့်ဆုံး မောင်းနှင်းရန် ကန့်သတ်ထားရမည်။				
၈.၅။	ကုန်နေ၊ရေနေ ဇီဝမျိုးစုံမျိုးကွဲ များ	လုပ်ငန်းခွင် ပြင်ဆင်ခြင်း နှင့် ဆောက်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်မှုများ	အမဲလိုက် ခြင်း အပါ အဝင် ယာဉ် တိုက်မှုများ ကြောင့် သတ္တဝါများ သေဆုံးခြင်း	• ဆောက်လုပ်ရေးနှင့် လုပ်ငန်းလည်ပတ်ရေးဆိုင်ရာ ယာဉ်အသုံးပြုမှုများအတွက် သတ္တဝါများကို ထိခိုက်မိခြင်းမှ ကာကွယ်နိုင်ရန် ၁နာရီလျှင် ကီလိုမီတာ ၄၀ နှုန်းဖြင့်သာ အမြင့်ဆုံး မောင်းနှင်းရန် ကန့်သတ်ထားရမည်။ • အလုပ်သမားများအား အရေးကြီးသော မျိုးစိတ်များ နှင့် ၎င်းတို့၏ ကျက်စားရာ နေရာတို့၏ အဖိုးတန်မှုများအား အသိပညာ ပေးခြင်းများ ပြုလုပ်ရန်နှင့် အမဲလိုက်ခြင်း၊ သစ်နှင့် ဆက်စပ်ပစ္စည်းများ သယ်ဆောင်ခြင်းတို့အား တားမြစ်ရန် စီမံ ဆောင်ရွက်မည် ဟု ကတိပြုရမည်။ • လမ်းအသုံးပြုခြင်းအတွက် ဆောက်လုပ်ရေးလုပ်ငန်းနှင့် လုပ်ငန်းလည်ပတ်ရေး ယာဉ်များသာ အသုံးပြုရန် ကန့်သတ်ထားရမည်။	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				• အလုပ်သမားများအား တောရိုင်းတိရစ္ဆာန်များ၊ ရေလမ်းကြောင်းတစ်လျှောက် ငါးဖမ်းလုပ်ငန်းများနှင့် တရားမဝင်သော ငါးဖမ်း စက်များ အသုံးပြုခြင်းဖြင့် အမဲလိုက်ခြင်းတို့မှ တင်းကြပ်စွာ တားမြစ်ထားရမည်။				
၉.၁။	လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှု	အထွေထွေ ဆောက်လုပ်ရေး လုပ်ငန်းများ	ဆောက် လုပ်ရေး အလုပ် သမား များ၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုအား ထိခိုက်ခြင်း။	• လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆိုင်ရာ အစီအမံများအား အကောင်အထည် ဆောင်ရွက်၍ လုပ်ငန်းခွင်အတွင်း နည်းဥပဒေများ ချမှတ်ဆောင်ရွက်ရမည်။ • စီမံကိန်းစတင်သည်နှင့် လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆိုင်ရာ အစီအမံ အား စတင် အကောင်အထည်ဖော် ကျင့်သုံးရမည်။ ထိုအစီအစဉ်၌ စက်ရုံ၏ လုပ်ငန်းဆောင်ရွက်မှုများ၊ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ် အဆင့်ဆင့်နှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့။	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				စီမံဆောင်ရွက်ချက်များ အားလုံးပါဝင် ရေးဆွဲထားရမည်။ • တာဝန်ရှိသူများသာလျှင် လုပ်ငန်းခွင်အတွင်း ဝင်ရောက်ခွင့် ရှိစေရန် စီမံဆောင်ရွက်ထားရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းခွင်များ၌ Sub-Contractors များ ခန့်အပ်ရန်ရှိပါက အရည်အချင်း ပြည့်ဝသော Sub-Contractors များကိုသာ ရွေးချယ်ခန့်အပ် ရမည်။ • လုပ်ငန်းခွင်ရှိ အလုပ်သမား အားလုံးသည် စီမံကိန်း တာဝန်ရှိသူများနှင့်အတူ လုပ်ငန်းခွင် အတွင်း ထိခိုက်မှု ဖြစ်နိုင်ချေများ၊ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းမှု ဆိုင်ရာ ကိစ္စရပ်များကို ဆွေးနွေး တင်ပြဆောင်ရွက်ရမည်။ • လုပ်ငန်းခွင် အတွင်း တစ်ကိုယ်ရည် အကာအကွယ် ပစ္စည်းများအား အစဉ်အမြဲ ဝတ်ဆင် ထားရမည်။ ချော်လဲကျခြင်းများ မဖြစ်ပေါ်စေရန် ချော်မလဲနိုင်သော				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				ဖိနပ်များ၊ အဆူးအနှောင့်ပါသော ဖိနပ်များ ဝတ်ဆင်ဆောင်ရွက်ရမည်။ • ဝန်ချီစက်ပစ္စည်းများနှင့် ကရိန်းများအား စနစ်တကျတပ်ဆင်ခြင်း၊ စစ်ဆေးခြင်းများ ပုံမှန် ပြုလုပ်ရမည်။ လမ်းတစ်လျောက်၌ အစောင့်များဖြင့် ထားရှိ ဆောင်ရွက်ရမည်။ • ငြမ်းတပ်ဆင်ဆောင်ရွက်ခြင်းများ၌လည်း Factor Act (1951) စံချိန်စံညွှန်းများနှင့်အညီ တပ်ဆင်ဆောင်ရွက်ပြီး ပုံမှန်စစ်ဆေးရမည်။ • အမြင့်သို့ တက်ရောက်ရန်ရှိပါက အမြင့်ပေ ၂ မီတာထက် ကျော်လွန်လျှင် လုံခြုံရေး ခါးပတ်များ တပ်ဆင်ခြင်း၊ အကာအကွယ်ဦးထုပ်များ၊ အဝတ်များ ဝတ်ဆင်ခြင်းနှင့် ဘေးကင်းရာ လမ်းကြောင်းများ၊ သံတန်းများအား ထားရှိ၍ (ယာယီဆိပ်ခံ တံတား အပါအဝင်) လုပ်ငန်း ဆောင်ရွက်စဉ်အတွင်း အသုံးပြုရမည် ဖြစ်ပြီး အသုံးပြုပြီးတိုင်း နှင့် တစ်လလျှင် (၁) ကြိမ် ပုံမှန် စစ်ဆေးပေးရမည်။ • ဆူညံသံထုတ်လွှတ်မှုအား လျော့ချခြင်းမပြုနိုင်သော နေရာများ၌				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				ဆူညံသံ ထုတ်လွှတ်မှုမှာ ၈၅ dB(A)ထက် ကျော်လွန်နေပါက သင့်လျော်သော ဆူညံသံ ခံနိုင်ရည်ရှိ အကာအကွယ်များ ဝတ်ဆင်အသုံးပြုရမည်။ အသုံးပြုသူအနေဖြင့် အကာအကွယ် ဝတ်ဆင် ထားပါက အခြားသော အန္တရာယ်များကိုလည်း သတိပြုဆောင်ရွက်ရမည်။ • စီမံကိန်းဆောင်ရွက်သူအနေဖြင့် လိုအပ်သော ဘေးကင်း လုံခြုံမှု ဆိုင်ရာ အစီအမံများနှင့် သတိပေး ဆိုင်းဘုတ်များကို မြေ လုပ်ငန်း ဆောင်ရွက်ရာ နေရာများ၊ အဝင်အထွက် ပြုလုပ်ရာ နေရာများ၌ ပြုလုပ် ထားရှိရမည်။ • EPC contractor အနေဖြင့်လည်း IFC Performance Standard 2 Requirement 1 အရ အလုပ်သမားနှင့် အလုပ်ခွင် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ စံချိန်စံညွှန်းများကို လိုက်နာ ဆောင်ရွက်ရမည်။ • EPC Contractor နှင့် Sub-Contractors များအနေဖြင့်				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အလုပ်သမားများနှင့်ပတ်သတ်၍ လုပ်ငန်းခွင်အတွင်း အတင်းအကြပ် လုပ်ငန်း ဆောင်ရွက်စေခြင်းများနှင့် ကလေး အလုပ်သမားများ မရှိစေရေး လုပ်ငန်းတွင်း စံသတ်မှတ်ချက်များ ထားရှိဆောင်ရွက်ရမည်။				
၉.၂။	လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှု	ဆောက်လုပ်ရေး လုပ်ငန်းစဉ် အတွင်း အလုပ်သမားများ ၏ ကျန်းမာရေး နှင့် ထိခိုက်မှုများအား စောင့်ကြည့် တိုင်းတာခြင်း။		• Company ၏ အလုပ်သမားများအားလုံး ကျန်းမားရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ သင်တန်းများအား တက်ရောက်ပြီး ဖြစ်စေရန် နှစ်စဉ်သုံးသပ် စစ်ဆေးရမည်။ • စီမံကိန်း ဆောင်ရွက်နေသော နေရာများ၊ ဆောက်လုပ်ရေး အလုပ်သမားများ၏ ယာယီ တည်းခိုရာ နေရာများ၌ EPC contractor ၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ဆိုင်ရာ အစီအစဉ်များနှင့်အညီ အလုပ်သမားများ၏ ကျန်းမာရေးအခြေအနေများအား နေ့စဉ်လေ့လာခြင်းနှင့် ထိခိုက်မှုအသေးစားများ၊ ရောဂါ ကူးစက်မှုများ၊ အန္တရာယ် ရှိနိုင်သော အခြေအနေများ၊ မတော်တဆ	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				ထိခိုက်မှုများအား လစဉ် လေ့လာခြင်းများကို စောင့်ကြည့်လေ့လာ အကဲဖြတ် ရမည်။ • လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ စောင့်ကြည့်တိုင်းတာခြင်းများ နှင့် လေ့လာခြင်းများအား အကောင်အထည်ဖော် ဆောင်ရွက်လုပ်ကိုင်ရမည်။				
၁၀.၁ ။	ရပ်ရွာပြည်သူ များ၏ ကျန်းမာရေး	ဆောက်လုပ်ရေး လုပ်သား ဝန်ထမ်းများ ဝင်ရောက် လာခြင်း။	ရောဂါများ များလာခြင်း။	• MUPA အနေဖြင့် အလုပ်သမားများ၏ ကျန်းမာရေးအခြေအနေ၊ ရေရယူသုံးစွဲမှု အခြေအနေနှင့် လိင်ပိုင်းဆိုင်ရာ ဘေးကင်းမှု အလေ့အကျင့်ကောင်းများ၊ STIs နှင့် HIV/AIDS ကဲ့သို့သော ကူးစက်ရောဂါ ကူးစက်နိုင်မှု အခြေအနေများအား ရပ်ရွာကျန်းမာရေးအဖွဲ့များ၊ အစိုးရတာဝန်ရှိသူများ နှင့် သက်ဆိုင်ရာ အစိုးရ မဟုတ်သော အဖွဲ့အစည်းများ နှင့် ချိတ်ဆက်၍ လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အစီအစဉ်များ ချမှတ် ဆောင်ရွက်ရမည် ဖြစ်ပြီး အလုပ်သမားများ ခန့်အပ်ရာ၌ လည်း ကူးဆက်ရောဂါများ မပျံ့နှံ့စေရန် ကြိုတင်	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				စစ်ဆေးပြီးမှသာ ခန့်အပ်ခြင်း များ ဆောင်ရွက်ရမည်။ ထိုသို့ ပြုလုပ်ခြင်းဖြင့် အလုပ်သမား များနှင့် ၎င်းတို့နေရပ်မြို့ ရွာများ ၌ ကူးစက်ရောဂါပျံ့ပွားမှုအား လျော့ချနိုင်မည် ဖြစ်သည်။ • မိန်းကလေးသုံး လိင်ပိုင်းဆိုင်ရာ အကာအကွယ်ပစ္စည်း (female Condoms) များ ရယူနိုင်ခြင်း အပါအဝင် လိင်ပိုင်းဆိုင်ရာ ဘေးကင်းမှု အလေ့အကျင့် ကောင်းများအား ပံ့ပိုးကူညီ ဆောင်ရွက်မှုများ ပြုလုပ်ရမည်။ ထိုသို့ပြုလုပ်ခြင်းဖြင့် အလွယ်တကူ မသိနိုင်သော ကူးစက်ရောဂါ ပျံ့ပွားမှု များအား လျော့ချနိုင်သည်။ • ယာယီအလုပ်သမားများနှင့် ရပ်ရွာပြည်သူများ အမြဲတစေ ထိတွေ့ခြင်းမှ လျှော့ချ နိုင်စေရန် အလုပ်သမားများ တည်းခိုရာ နေရာများ၌ နေ့စဉ်လုပ်ငန်းဆောင်တာများလွယ်ကူချော မွေ့စေရန် ပြုလုပ် ဆောင်ရွက်ရမည်။ ထိုသို့ပြုလုပ်ရာ တွင် အပန်းဖြေနေရာများ တည်ဆောက်ခြင်းနှင့် ကျန်းမာရေး				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				စောင့်ရှောက်မှု ဆိုင်ရာ အဆောက်အအုံများ တည်ဆောက်ခြင်းတို့ ပါဝင်သည်။ • MUPA အနေဖြင့် ဒေသခံပြည်သူများ၊ အစိုးရများ၊ အရေးပေါ် ကူညီကယ်ဆယ်ရေး အဖွဲ့များ၊ ကျန်းမာရေး စောင့်ရှောက်မှု ဆိုင်ရာ အဖွဲ့များနှင့် ချိတ်ဆက်၍ အရေးပေါ် ကြိုတင် ကာကွယ်ခြင်း၊ ပြင်ဆင်ခြင်းနှင့် တုန့်ပြန်ခြင်းဆိုင်ရာ အစီအစဉ်များ (EPPRPs)ချမှတ်၍ စီမံကိန်းအတွင်းနှင့် အနီးဝန်းကျင်ဒေသများတွင် ဖြစ်ပေါ်လာနိုင်သော အကျိုး သက်ရောက်မှုများကို ကြိုတင်ကာကွယ်နိုင်သည်။ • အလုပ်သမားဆိုင်ရာ လုပ်ထုံး လုပ်နည်းများ ချမှတ်ဆောင်ရွက် ရမည်။ ထိုအလုပ်သမားဆိုင်ရာ လုပ်ထုံးလုပ်နည်းများသည် အလုပ်ရှင်များ၊ ချိတ်ဆက် လုပ်ကိုင်သူများ အားလုံးနှင့် အလုပ်သမားဝန်ထမ်းအားလုံး အကျုံးဝင်သည်။ မည့်သည့် အလုပ်ရှင်၊အလုပ်သမားဝန်ထမ်းမဆို				

စဉ်	သက်ရောက်မှုနယ်ပယ်	စီမံကိန်းလုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိအဖွဲ့အစည်း	တာဝန်ယူဆောင်ရွက် ရမည့်အဖွဲ့အစည်း	အစီရင်ခံစာတင်ပြခြင်း	ကုန်ကျစရိတ်
				လုပ်ထုံးလုပ်နည်းအား ဖောက်ဖျက်ပါက လုပ်ထုံး လုပ်နည်းနှင့်အညီ အပြစ်ပေး အရေးယူခြင်းခံရမည်။ လုပ်ထုံးလုပ်နည်းတွင် လူမှုဆက်ဆံရေးပျက်ပြားစေနိုင်သော စီးပွားဖြစ်လိင်လုပ်သား များနှင့် ပတ်သက်ဆက်နွယ်မှုများကိုလည်း ထည့်သွင်း ရေးဆွဲရမည်။				
၁၁.၁ ။	ရပ်ရွာပြည်သူများ၏ ကျန်းမာရေး	ဆောက်လုပ်ရေး လုပ်ငန်း များ နှင့် ပစ္စည်း များ သယ်ယူ ပို့ဆောင်ခြင်း	ယာဉ်ကြောပိတ်ဆို့မှုများ ကြောင့် ရပ်ရွာပြည်သူများ၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ သက်ရောက်မှုများ	• ယာဉ်အန္တရာယ်ဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်တစ်ခု အား အကောင်အထည် ဖော် ဆောင်ရွက်ရမည်။ ဤအစီအစဉ်တွင် လုပ်ငန်းသုံး ပစ္စည်းများ၊ ပို့ကုန်၊ သွင်းကုန် ပစ္စည်းများ သယ်ယူပို့ဆောင်ခြင်း၊ အလုပ်သမားများ ဝင်၊ထွက်သွားလာခြင်း တို့နှင့် ပတ်သက်၍ ဖြစ်ပေါ် လာနိုင်သော ယာဉ်အန္တရာယ်များကို လျော့ချနိုင်ရန် စီမံ ဆောင်ရွက်ရမည်။ ဤအစီအစဉ် တွင် ယာဉ်ပျက်စီးနေမှု အခြေအနေအား စီမံခန့်ခွဲခြင်း၊ စီမံကိန်းနှင့် မသက်ဆိုင်သူများအား ခေါ်ယူတင်ဆောင်ခြင်းနှင့် ယာဉ်မောင်းနှင်နေစဉ် ဖုန်းပြောခြင်း၊	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့။	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အရက်သေစာ သောက်စားခြင်းနှင့် မူးယစ်ဆေးဝါးသုံးစွဲခြင်း၊ MUPA နယ်နိမိတ်အတွင်းမှအပ မလိုလားအပ်သောနေရာများ၌ ယာဉ်ရပ်တန့်ခြင်း အစရှိသည်တို့အား တားမြစ် ဆောင်ရွက်ခြင်း နှင့် အမြန်နှုန်း ကန့်သတ်ချက်များ အပါအဝင် ယာဉ်မောင်းနှင်ခြင်း ဆိုင်ရာ အလေ့အကျင့်ကောင်းများ ကျင့်သုံးခြင်းတို့ ပါဝင်ရမည်။ • လုပ်ငန်းသုံးယာဉ်များအား အလုပ်သမားများအားလုံး မောင်းနှင် ဆောင်ရွက်နိုင်စေရန် သင်တန်းများ ပို့ချပြီး သင်တန်းတက်ရောက်ခြင်းအား လုပ်ငန်းဆောင်တာတစ်ခု အဖြစ် ပါဝင်ဆောင်ရွက်စေရမည် ဖြစ်သည်။ • စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်အား ချမှတ်၍ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ ဤအစီအစဉ်တွင် အန္တရာယ်ရှိသော စွန့်ပစ် ပစ္စည်းများနှင့် အခြားသော စွန့်ပစ်ပစ္စည်းများ				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				စွန့်ပစ်ခြင်းနှင့် စီမံခန့်ခွဲခြင်း လုပ်ငန်းစဉ်များ ပါဝင်ရေးဆွဲရမည်။ • လမ်းအန္တရာယ်ကင်းရှင်းရေး အသိပညာပေး ဟောပြောပွဲများ စီမံ ဆောင်ရွက်ရမည်။ စီမံကိန်း သက်ရောက်နယ်ပယ်အတွင်းရှိ ရပ်ရွာပြည်သူများအား ယာဉ်အန္တရာယ် ကင်းရှင်းရေးနှင့် ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အမူအကျင့်များနှင့်ပတ်သက်၍ အသိပညာပေးပွဲများ ကျင်းပပေးရမည်။ ထိုသို့ပြုလုပ်ရာတွင် ရပ်ရွာအဖွဲ့အစည်းများ၊ NGO များ၊ အစိုးရအဖွဲ့များနှင့် ပူးပေါင်းဆောင်ရွက်ရမည်။ ကျောင်းသား၊ကျောင်းသူများ အတွက် ယာဉ်အန္တရာယ် ကင်းရှင်းရေး အသိပညာများ ရရှိနိုင်စေရန် ကျောင်းများတွင် အဓိကထား ဦးစားပေး ဆောင်ရွက်ရမည်။ • MUPA အနေဖြင့် ယာဉ်အန္တရာယ်ကြောင့် ထိခိုက်သေဆုံးသွားသော မွေးမြူရေးတိရစ္ဆာန်များအတွက် နစ်နာကြေးနှုန်းထားများနှင့်				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				လုပ်ထုံးလုပ်နည်းများ ပါဝင်သော မွေးမြူရေးဆိုင်ရာ ထိခိုက်မှု ညှိနှိုင်းဆောင်ရွက်ခြင်း မှုဘောင်များ ချမှတ်ဆောင်ရွက် ရမည်။ အများပြည်သူ ဆွေးနွေးပွဲများ၌ အများပြည်သူ များ၏ သဘောထား ခံယူ၍ ထိုမှုဘောင်အား ဆွေးနွေး အတည်ပြုထားရမည်။ • MUPA အနေဖြင့် ဆောက်လုပ်ရေးလုပ်ငန်းများ အတွက် လမ်းအသုံးပြုမှုအပေါ် အများပြည်သူများနှင့် တိုင်ပင်ခြင်း၊ ဆွေးနွေးခြင်း၊ အသိပေးခြင်းများ ဆောင်ရွက်ရမည်။ ထိုသို့ဆောင်ရွက်ခြင်းဖြင့် အများပြည်သူများမှ မြင့်တက်လာသော ယာဉ်ကြော ပိတ်စို့မှုများ၊ ယာဉ်အသုံးပြုမှု ဆိုင်ရာ ဥပဒေများကို သိရှိနားလည်ပြီး အကြံညာဏ် ကောင်းများ ပေးအပ်နိုင်မည် ဖြစ်သည်။ • MUPA အနေဖြင့် စီမံကိန်း သက်ရောက် နယ်ပယ် အတွင်း ဖြစ်ပေါ် လာနိုင်သော အရေးပေါ် အခြေအနေ များ အတွက်				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				အသေးစိတ် လုပ်ထုံးလုပ်နည်း များ၊ ညှိနှိုင်းဆောင်ရွက်မှုများနှင့် လေ့လာ သုံးသပ်မှုများ ပါဝင်သော အရေးပေါ် တုန့်ပြန်မှု ဆိုင်ရာ အစီအစဉ်များ ချမှတ် ဆောင်ရွက်ရမည်။ ERP ၌ အဓိက ဖြစ်ပွားရသော အကြောင်းအရင်းများကို လေ့လာသုံးသပ်ခြင်း အပါအဝင် အရေးပေါ် အခြေအနေများ၊ တုန့်ပြန် မှုများ ကို စောင့်ကြည့် လေ့လာခြင်းနှင့် စီမံခန့်ခွဲခြင်း ဆိုင်ရာ အစီအစဉ်များ ပါဝင် ရေးဆွဲထား ရမည်။ • အများပြည်သူများနှင့် အလုပ်သမားများ၏ သဘောထားအား သိရှိနိုင်စေရန် အများ ပြည်သူ သဘောထား ခံယူပွဲများ ကျင်းပ၍ ရပ်ရွာပြည်သူများနှင့် ဆွေးနွေးတိုင်ပင် ရမည်။				
၁၁.၂ ။	ရပ်ရွာ ပြည်သူများ ၏ ကျန်းမာရေးနှင့်	ဆောက်လုပ်ရေး လုပ်ငန်းများ	ရပ်ရွာ အတွင်း အခြေခံ အဆောက်အအုံများ အပေါ်	• အလုပ်သမားများ၏ ယာယီ တည်းခိုရာ နေရာများ၌ လိုအပ်သည် များကို ဖြည့်ဆည်း ပေးရမည်။ (ဥပမာ-အပန်းဖြေ နေရာများ) ထိုသို့ပြုလုပ်ခြင်းဖြင့် အလုပ် သမားများ အနေဖြင့် ရပ်ရွာပြည်သူများထံမှ အခြေခံလို	ခန့်အပ်ထား သော Engineering & Procurement	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့နှင့် စီမံကိန်း အဆိုပြုသူ တို့၏ ကျန်းမာရေးနှင့်	လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း။	EPC Contract or Cost

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
	ဘေးကင်း လုံခြုံမှု		သက် ရောက်မှုများ	အပ်ချက်များ၊ ဝန်ဆောင်မှုများ ရယူခြင်းမှ လျော့ချနိုင်သည်။ • MUPA Company အနေဖြင့် တစ်ချိန် တည်းတွင် အလုပ်သမား အားလုံးအတွက် လုံလောက်သော ဆေးဝါး ထောက်ပံ့မှု ပေးနိုင်ရမည်။ • MUPA အနေဖြင့် စီမံကိန်း၏ ထိခိုက်မှု များအပေါ် လျော့ချရေး နည်းလမ်းများ အကောင်အထည်ဖော် ဆောင်ရွက်ရာတွင် ရပ်ရွာတာဝန်ရှိသူများနှင့် အများပြည်သူနှင့် သက်ဆိုင်သော လုပ်ငန်း ဆောင်ရွက်သူများ ထံမှ အကြံဉာဏ်များ ရယူဆောင်ရွက် ရမည်။ • ပြင်ကြီးရွာမှ ကန်ပေါက်ရွာထိ လမ်းကြောင်း တစ်လျောက် စီမံကိန်းကြောင့် လမ်း အသုံး ပြုသူများအား ထိခိုက်မှုများကို လျော့ချ နိုင်စေရန်နှင့် လမ်းအဆင့် မြင့်တင် ဆောင် ရွက်နိုင်စေရန် ယာဉ်အန္တရာယ် ဆိုင်ရာ စစ်တမ်းများကောက်ယူ ဆောင်ရွက် ရမည်။ • ရပ်ရွာတာဝန်ရှိသူများနှင့် ပူးပေါင်း၍ Social investment plan and (or) corporate	Contractor (EPC) မှ တာဝန်ယူခြင်း	ဘေးကင်းလုံခြုံမှုဆိုင်ရာ အဖွဲ့။		

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
				social responsibility plan (or) program များ ချမှတ် ဆောင်ရွက်ရမည်။ အစီအစဉ်၏ တစ်စိတ်တစ်ပိုင်း အနေဖြင့် MUPA မှ ရပ်ရွာအတွင်း အခြေခံအဆောက်အအုံ များနှင့် ဝန်ဆောင်မှု လုပ်ငန်းများကို အဆင့်မြင့်တင်ဆောင်ရွက်နိုင်စေရန် အခွင့်အလမ်းများရှာဖွေ ဆောင်ရွက်ပေးရမည်။ • ရပ်ရွာတာဝန်ရှိသူများနှင့် ပူးပေါင်း၍ ရပ်ရွာနှင့် လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးအစီအစဉ် များ ချမှတ် ဆောင်ရွက်ရမည်။ ထိုအစီအစဉ်များတွင် လုပ်ငန်းခွင်အတွင်းနှင့် အလုပ်သမားများ၏ ယာယီတည်းခိုရာ နေရာများ၌ အလုပ်သမား များ၏ ဖျားနာမှု များနှင့် ထိခိုက်ဒဏ်ရာ ရနိုင်မှု များအား ကျန်းမာရေး စောင့်ရှောက်မှု ဆိုင်ရာ ဝန်ဆောင်မှု ထောက်ပံ့ ပေးခြင်းများ ပါဝင်ရေးဆွဲထားရမည်။				

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျှော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
၁၂.၁ ။	အလုပ် ခန့်အပ်ခြင်းနှင့် စီးပွားရေး	ဆောက်လုပ်ရေး လုပ်ငန်းများ နှင့် ဖျက်သိမ်းရေး လုပ်ငန်းများ	အလုပ် ခန့်အပ်ထားခြင်း ဆိုင်ရာ အခွင့် အလမ်းများ နှင့် ရပ်ရွာ စီးပွားရေး လုပ်ငန်း အခွင့် အလမ်းများ	• ရပ်ရွာပြည်သူများ အနေဖြင့် ဤသက်ရောက်မှုအား အကျိုးခံစားခွင့် အများစု ရရှိနိုင်စေရန် ပြည်နယ်အဆင့် နှင့် နိုင်ငံအဆင့် ရွေးချယ်မှုများ၊ သင်တန်းများ ပေးအပ်ပြီးနောက် အလုပ်သမားများသည် စီမံကိန်း အနီးတစ်ဝိုက်မှ အများဆုံး ခေါ်ယူမည်ဖြစ်သည်။ စီမံကိန်းသက်ရောက်နယ်ပယ် အတွင်းတွင် အလုပ်သမား များ၏ ပညာရေး နှင့် အလုပ် အတွေ့အကြုံမှာမူ လျှော့ပါးနေသေးသည်။ စီမံကိန်း အနေဖြင့် စီမံကိန်းအနီးမှ ရပ်ရွာပြည်သူများအား အလုပ်အကိုင် အခွင့်အလမ်းများ ပိုမိုရရှိနိုင်စေရန်နှင့် ခန့်အပ်ခြင်း ဆိုင်ရာ လုပ်ငန်းများ (သတင်း အချက်အလက်များ၊ သင်တန်းပို့ချမှုများ၊ ဆွေးနွေးမှုများ) အတွက် အစီအစဉ်များ ချမှတ်ဆောင်ရွက် ရမည်။ အဓိကအားဖြင့် အလုပ်ခန့်အပ်ခြင်း လုပ်ငန်းစဉ် အတွင်း တန်းတူညီမျှမှုနှင့် ခွဲခြားဆက်ဆံခြင်း မရှိရလေအောင် စီမံဆောင်ရွက်ရမည်။	ခန့်အပ်ထား သော Engineering & Procurement Contractor (EPC) (သို့မဟုတ်) စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement (LTSA) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လုပ်ငန်း ဆောင်ရွက်သည့် ကာလနှင့် ဖျက်သိမ်းစဉ်ကာလအတွင်း၌ လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း နှင့် လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	တည် ဆောက် ဆဲ ကာလ တွင် EPC Contract orမှ တာဝန်ယူ ခြင်း။ လုပ်ငန်း ဆောင် ရွက်စဉ် ကာလ အတွင်း စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူ ခြင်း။

စဉ်	သက်ရောက်မှု နယ်ပယ်	စီမံကိန်း လုပ်ငန်းစဉ်	ထိခိုက်မှု	လျော့ချရေးနည်းလမ်းများ	တာဝန်ရှိ အဖွဲ့အစည်း	တာဝန်ယူ ဆောင်ရွက် ရမည့် အဖွဲ့အစည်း	အစီရင်ခံစာ တင်ပြခြင်း	ကုန်ကျ စရိတ်
၁၃.၁ ။	ယဉ်ကျေးမှု အမွေအနှစ် များ	ဆောက်လုပ်ရေး လုပ်ငန်းများ နှင့် ဖျက်သိမ်းရေး လုပ်ငန်းများ	ယဉ်ကျေးမှု အမွေအနှစ် အဆောက်အအုံများနှင့် ဘုန်းကြီးကျောင်းများ အပေါ် သက်ရောက်မှုများ	• EPC contractor အနေဖြင့် ပြင်ကြီးရွာတွင် Water Intake Pipeline ၏ ဆောက်လုပ်ရေးလုပ်ငန်း ဆောင်ရွက်ရန်အတွက် အနီးရှိ ဘုန်းကြီးကျောင်းများနှင့် ဆွေးနွေးမှုများ ပြုလုပ်၍ ဘာသာရေးလုပ်ငန်းများ ဆောင်ရွက်နေစဉ်အတွင်း ဆောက်လုပ်ရေးလုပ်ငန်းများ ဆောင်ရွက်ခြင်း မပြုမိစေရန် အထူးဂရုစိုက် လုပ်ဆောင် ရမည်။	ခန့်အပ်ထားသော Engineering & Procurement Contractor (EPC) (သို့မဟုတ်) စီမံကိန်း အဆိုပြုသူ (သို့မဟုတ်) long term service agreement (LTSA) မှ တာဝန်ယူခြင်း	စီမံကိန်းအတွင်း စီမံခန့်ခွဲမှု ဆိုင်ရာ အဖွဲ့	လုပ်ငန်း ဆောင်ရွက်ဆဲ ကာလနှင့် ဖျက်သိမ်းစဉ်ကာလအတွင်း၌ လစဉ် စီမံကိန်း အဆိုပြုသူအား အစီရင်ခံစာ တင်ပြခြင်း နှင့် လစဉ် အဖွဲ့အစည်းအတွင်း အစီရင်ခံစာ တင်ပြခြင်း။	တည်ဆောက်ဆဲ ကာလတွင် EPC Contract orမှ တာဝန်ယူခြင်း။ လုပ်ငန်း ဆောင်ရွက်စဉ် ကာလ အတွင်း စီမံကိန်း အဆိုပြုသူ မှ တာဝန်ယူခြင်း။

၁.၁၂.၂။ စောင့်ကြပ်ကြည့်ရှုခြင်း အစီအစဉ်

ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာထိခိုက်မှုများ စောင့်ကြပ်ကြည့်ရှုခြင်းနှင့် အကောင်အထည် ဖော်ဆောင်ရွက်ခြင်းများအတွက် ကုမ္ပဏီနှင့် EPC ကန်ထရိုက်တာတို့၏ အခန်းကဏ္ဍနှင့် တာဝန်များကို သတ်မှတ်ပြီးဖြစ်ပါသည်။ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုခြင်း၊ ရူပ ဝန်းကျင်ဆိုင်ရာ၊ ဇီဝပန်းကျင်ဆိုင်ရာနှင့် သက်ဆိုင်ရာအရေးပါသည့် လူမှုပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစိတ်အပိုင်းများအတွက် ဆောင်ရွက်ချက်ညွှန်ပြမှုကို ခွဲခြားဖော်ထုတ်ထားပြီး ဖြစ်ပါသည်။ တိုင်းတာရမည့်အချက်များ၊ အသုံးပြုမည့်နည်းလမ်းများ၊ နမူနာကောက်ယူမည့် နေရာ၊ တိုင်းတာမည့်အကြိမ်၊ ရှာဖွေဖော်ထုတ်မည့်အတိုင်းအတာ၊ ကုန်ကျစရိတ်နှင့် အကောင် ထည်ဖော်ဆောင်မှုနှင့် ကြီးကြပ်မှုအတွက် တာဝန်များပါဝင်သော ဆောင်ရွက်ချက် ညွှန်ပြမှု တစ်ခုချင်းစီအတွက် စောင့်ကြပ်ကြည့်ရှုခြင်း အစီအစဉ်ကိုလည်း စီမံကိန်းအဆင့်အားလုံး အတွက် ပြင်ဆင်ထားပါသည်။

ဇယား ၁.၂ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
စီမံကိန်း ကြိုတင်စီစဉ်ခြင်းကာလနှင့် ဆောက်လုပ်ဆဲကာလ							
အထွေထွေ	လျှော့ချရေးနည်းလမ်းများ လိုက်နာဆောင်ရွက်မှုအား စစ်ဆေးခြင်း။	EPC contractor Manual ၌ ပါဝင်သော ESMP planရှိ လျှော့ချရေး နည်းလမ်းများအား အထွေထွေ လိုက်နာ ဆောင်ရွက်မှုကို စောင့်ကြည့် စစ်ဆေးခြင်း။	စီမံကိန်းဆောင်ရွက်မည့် နေရာများ နှင့် ဆောက်လုပ်ရေး လုပ်သားများ၏ ယာယီ တည်းခိုရာ နေရာများ	စီမံကိန်းဆောင်ရွက်ရာ နေရာအားလုံးအား အမြင်အားဖြင့် စောင့်ကြည့် စစ်ဆေးခြင်း။	နေ့စဉ်	EPC Contractor ၏ EHS team	EPC Contractor Cost (included in Capex cost)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
လေ အရည်အသွေး	လေထု ညစ်ညမ်းစေခြင်း။	NO_2 (Average 1-hour) and SO_2 (Average 24-hour), and $PM_{2.5}$,PM_{10} (Average 24-hour)	1. (AQM1: 14° 35' 39.20" N, 98°01'30.00"E, လှည်းကုန်းရပ်ကွက်, ကန်ပေါက်ကျေးရွာ) (Baseline AQ Measurement) 2. (AQM2: 14° 36' 15.43" N, 98° 01' 40.05" E, မိချောင်းအိုင်ရပ်ကွက်, ကန်ပေါက် ကျေးရွာ) (Baseline AQ Measurement) 3. (AQM3, 14° 37' 28.10" N, 98°02'49.40"E, ရှင်ပုံကျေးရွာ၊ ရေဖြူမြို့နယ်) (Baseline AQ Measurement) 4. စီမံကိန်း တည်ဆောက်မည့် နေရာ (14°36'40.25"N, 98° 1'51.41"E) 5. လုပ်ငန်းသုံးရေ ရယူမည့် အဆောက်အဦးတည်ဆောက်မည့် နေရာ (14°38'18.15"N, 98° 1'14.27"E)	EPAS-Haz Scanner အသုံးပြု၍ ၂၄ နာရီ တိုင်းတာခြင်း။	တစ်နှစ် (၂ ကြိမ်)	စီမံကိန်း အဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (6,000,000 MMK/time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
			6. ယာယီဆိပ်ခံ တံတား တည်ဆောက်မည့် နေရာ (14°38'23.05"N, 98° 0'51.34"E)				
ဆူညံသံ သက်ရောက်မှု	ဆူညံသံ သက်ရောက်မှုဖြစ်ပေါ်ခြင်း။	ဆူညံသံအဆင့်များ (Leq), Day (Leq), night (Leq) and hourly (Leq)	1) (AQM1: 14° 35’ 39.20” N, 98° 01’ 30.00” E, လည်းကုန်း ရပ်ကွက်, ကန်ပေါက် ကျေးရွာ) (Baseline AQ Measurement) 2) (AQM2: 14° 36’ 15.43” N, 98° 01’ 40.05” E, မိကျောင်းအိုင် ရပ်ကွက်, ကန်ပေါက် ကျေးရွာ) (Baseline AQ Measurement) 3) (AQM3, 14° 37’ 28.10” N, 98° 02’ 49.40” E, ရှင်ပုံကျေးရွာ, ရေဖြူမြို့နယ်) (Baseline AQ Measurement)	Digital Sound Level Meter အသုံးပြု၍ ၂၄ နာရီတိုင်းတာခြင်း။	တစ်နှစ် (၄ ကြိမ်)	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (300,000 MMK / time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
			4) စီမံကိန်း တည်ဆောက်မည့် နေရာ (14°36'40.25"N, 98° 1'51.41"E) 5) လုပ်ငန်းသုံးရေ ရယူမည့် အဆောက်အဦးတည်ဆောက် မည့် နေရာ (14°38'18.15"N, 98° 1'14.27"E) 6) ယာယီဆိပ်ခံတံတား တည်ဆောက်မည့် နေရာ (14°38'23.05"N, 98° 0'51.34"E)				
	အလုပ်သမားများ၏ ကျန်းမာရေး	ဆူညံသံ အဆင့်များ (Leq)	တည်ဆောက်ရေး လုပ်ငန်းဧရိယာအတွင်း သတ်မှတ်ထားသော နေရာများ။	Digital Sound Level Meter အသုံးပြု၍ ၂၄ နာရီ တိုင်းတာခြင်း။	လစဉ်	EPC Contractor	EPC Contractor Cost (included in Capex cost)
မြေဆီလွှာ အရည်အသွေး	မြေဆီလွှာ ညစ်ညမ်းမှု	pH, salinity, NH_4, total P, heavy metals	1. တည်ဆောက်ရေး လုပ်ငန်းခွင်များ(သို့) ယာယီ စုပြုံသည့် နေရာများ(သို့) ဖိတ်စင်နိုင်သည့် နေရာများ 2. စီမံကိန်း တည်ဆောက်မည့် နေရာ ၏ အခြေခံ မြေဆီလွှာ အခြေအနေ S1:	Standard analytical methods**	အန္တရာယ်ရှိသော ပစ္စည်းများ၊ အဆီများနှင့် အဆိပ်အတောက်ဖြစ်စေသော ဓာတုသော ပစ္စည်းများ၏ ယိုစိမ့်မှုများ၊	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (2,000,000 MMK / time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
			(14°36'45.00"N, 98° 1'51.65"E)		ယိုဖိတ်မှုများ ဖြစ်ပေါ်သောအခါ။		
မြေပေါ်ရေ အရည်အသွေး	မြေပေါ်ရေ အရည်အသွေးအားညစ်ညမ်း	pH, Electrical Conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg); Arsenic (As).	1. ဟိန်းဇဲမြစ် (ရေစုပ်ယူမည့်နေရာမှ မြစ်အပေါ်ဘက်အခြမ်း, 14°38'24.10"N, 98° 1'14.86"E) 2. ဟိန်းဇဲမြစ် (ရေစုပ်ယူမည့်နေရာမှ မြစ်အောက်ဘက်ခြမ်း,14°38'23.62"N, 98° 1'4.14"E) 3. မိချောင်းအိုင်ချောင်း (ချောင်းအပေါ်ဘက်ခြမ်း, 14°36'23.61"N, 98° 1'51.47"E) 4. မိချောင်းအိုင်ချောင်း (ချောင်းအောက်ဘက်ခြမ်း, 14°36'25.90"N, 98° 1'47.80"E)	Standard analytical methods**	တစ်နှစ် (၂ကြိမ်)	စီမံကိန်း အဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (3,500,000/time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
မြေအောက်ရေ အရည်အသွေး	မြေအောက်ရေအား ညစ်ညမ်းစေခြင်း။	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended, Solids (TSS), Total Coliform Bacteria (TCB), Total Residual, Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb), Mercury (Hg), Arsenic (As).	1. လည်းကုန်းရွာရှိ နေအိမ်တစ်ခု၌ (98°1'32.31"E, 14°36'16.11"N) 2. ရှင်ပုံရွာရှိ နေအိမ်တစ်ခု၌ (14°37'28.10"N, 98° 2'49.40"E) 3. ပြင်ကြီးရွာရှိ နေအိမ်တစ်ခု၌ (14°38'15.38"N, 98° 1'3.44"E) 4. မိကျောင်းအိုင်ရွာရှိ နေအိမ်တစ်ခု၌ (14°36'33.91"N, 98° 1'43.50"E)	Standard analytical method**	တစ်နှစ် (၁ကြိမ်)	စီမံကိန်း အဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (2,400,000 MMK/time)
အနည်အနှစ်များ	အနည်အနှစ်များ စုပုံလာခြင်း	pH, salinity, NH_4^+, total P, heavy metals, TSS	• အခြေနေပေါ်မူတည်၍ ဖြစ်ပေါ်လာသော နေရာများ • လုပ်ငန်းသုံးရေ ရယူမည့် အဆောက်အဦး တည်ဆောက်မည့် နေရာများ။	Standard analytical methods**	အန္တရာယ်ရှိသော ပစ္စည်းများ၊ အဆီများနှင့် အဆိပ်အတောက်ဖြစ်စေသော ဓာတုပစ္စည်းများ၏ ယိုစိမ့်မှုများ၊	စီမံကိန်း အဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (3,600,000MMK/ time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
			(14°38'18.15"N, 98° 1'14.27"E) • ယာယီဆိပ်ခံတံတား တည်ဆောက်မည့် နေရာများ။ (14°38'23.05"N, 98° 0'51.34"E)		ယိုဖိတ်မှုများ ဖြစ်ပေါ်သောအခါများ နှင့် အခြေနေပေါ် မူတည်၍ ညစ်ညမ်းမှု ဖြစ်ပေါ်လာသော အခါများ။		
လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	အလုပ်သမားများ၏ ကျန်းမာရေးနှင့် ဆောက်လုပ်ရေးလုပ်ငန်းများ ကြောင့် မတော်တဆ ထိခိုက်မှုများ၊ အနာတရများ။	ဖြစ်ပေါ်လာနိုင်သော ထိခိုက်မှုများ၊ အနာတရများ၊ လုပ်ငန်းခွင် ကူးစက်ရောဂါများ နှင့် အန္တရာယ်ရှိသော အခြေအနေများ	စီမံကိန်း လုပ်ငန်းနေရာများနှင့် ဆောက်လုပ်ရေးလုပ်သားများ၏ ယာယီတည်းခိုရာ နေရာများ	EPC contractor မှ စီစဉ်ထားသော ဆောက်လုပ်ရေးကာလအတွင်း လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး အစီအစဉ်များ အတိုင်း။	ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးဆိုင်ရာ လမ်းညွှန်ချက်များ အတိုင်း။	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
အများပြည်သူ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	ယာဉ်ကြောပိတ်ဆို့မှု များကြောင့် ဖြစ်ပေါ်လာနိုင်သော အများပြည်သူအခက်အခဲများ နှင့် ဘေးအန္တရာယ်များ	မတော်တဆမှုများ၊ ထိခိုက်မှုများနှင့် တိုင်ကြားမှုများ	စီမံကိန်းအတွင်း ဆက်သွယ်ထားသော လမ်းတစ်လျှောက်	မတော်တဆမှုများ၊ ထိခိုက်မှုများနှင့် အများပြည်သူများ၏တိုင်ကြားမှုများ	အခြေအနေအရ	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	အများပြည်သူ စိုးရိမ်မှုများ	အများပြည်သူများမှ တိုင်ကြားမှုများ။	စီမံကိန်းလုပ်ငန်းဧရိယာ အနီးတဝိုက်မှ အများပြည်သူများ	အများပြည်သူများ၏မကျေလည်မှုများ ဖြေရှင်းပေးမည့် အစီအစဉ်အရ	စဉ်ဆက်မပြတ်	အဆိုပြုစီမံကိန်း	EPC Contractor Cost

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
							(included in Capex cost)
			လုပ်ငန်းလည်ပတ်ဆဲကာလ				
အထွေထွေ	လျှော့ချရေးနည်းလမ်းများ လိုက်နာဆောင်ရွက်မှုအား စစ်ဆေးခြင်း။	EPC contractor Manual ၌ ပါဝင်သော ESMP planရှိ လျှော့ချရေးနည်းလမ်း များအား အထွေထွေ လိုက်နာ ဆောင်ရွက်မှုကို စောင့်ကြည့် စစ်ဆေးခြင်း။	စီမံကိန်းဆောင်ရွက်မည့် နေရာများ	စီမံကိန်းဆောင်ရွက်ရာ နေရာအားလုံးအား အမြင်အားဖြင့် စောင့်ကြည့် စစ်ဆေးခြင်း။	နေ့စဉ်	EHS Team	Included in operation and maintenance (O&M) cost
လေထုထဲသို့ ထုတ်လွှတ်မှုများ	ခေါင်းတိုင်မှ အခိုးအငွေ့ ထုတ်လွှတ်မှုများ	NOx, SO_X	အဓိက ခေါင်းတိုင်မှ အခိုးအငွေ့ ထုတ်လွှတ်မှုများနှင့် အခြားမှ ထုတ်လွှတ်မှုများ	USEPA နည်းလမ်းများနှင့် CEMS ကိရိယာများ အသုံးပြု၍ တစ်နှစ်တာ အခိုးအငွေ့ ထုတ်လွှတ်မှု တိုင်းတာခြင်း	စဉ်ဆက်မပြတ် တိုင်းတာခြင်း နှင့် တစ်နှစ် (၁ကြိမ်)	EHS Team	Installation included in EPC Cost Monitoring and maintenance in O&M cost (10,000 USD / time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
လေထုထဲသို့ ထုတ်လွှတ်မှုများ	လေထု ညစ်ညမ်းမှုများ	NO2 (average 1-hour) and SO2 (average 24-hour) PM, PM10 and PM2.5 (average 24- hour)	• စီမံကိန်းလုပ်ငန်းခွင် (14°36'40.25"N, 98° 1'51.41"E) • လှည်းကုန်းရွာရှိ နေအိမ်တစ်ခု၌ (98°1'32.31"E, 14°36'16.11"N) • ရှင်ပုံရွာရှိ နေအိမ်တစ်ခု၌ (14°37'28.10"N, 98° 2'49.40"E) • ပြင်ကြီးရွာရှိ နေအိမ်တစ်ခု၌ (14°38'15.38"N, 98° 1'3.44"E) • မိကျောင်းအိုင်ရွာရှိ နေအိမ်တစ်ခု၌ (14°36'33.91"N, 98° 1'43.50"E)	နိုင်ငံတကာ အဖွဲ့အစည်းများ၊ USEPA၊ European Committee များမှ ချမှတ်ထားသော စံသတ်မှတ်ချက်များ နှင့် နည်းလမ်းများ	တစ်နှစ် (၂ ကြိမ်)	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	6,000,000 MMK/time
ဖန်လုံအိမ် ဓာတ်ငွေ့ ထုတ်လွှတ်မှု	ရာသီဥတုပြောင်းလဲမှုများ	ဖန်လုံအိမ် ဓာတ်ငွေ့ ထုတ်လုပ်မှု	စက်ရုံထိန်းချုပ်ခန်း	သဘာဝဓာတ်ငွေ့ သုံးစွဲမှုနှင့် ထုတ်လွှတ်အခိုးအငွေ့ ထွက်ရှိမှုပမာဏ	တစ်နှစ် (၁ ကြိမ်)	EHS Team	Included in operation and maintenance (O&M) cost for disclosure
ဆူညံသံ	ဆူညံသံ သက်ရောက်မှု မြင့်မားလာခြင်း	ဆူညံသံအဆင့်များ (Leq),	စီမံကိန်းနယ်နိမိတ်မှ စ၍ ၅၀၀ မီတာအတွင်း	Digital Sound Level Meter (24- hour)	တစ်နှစ် (၃ ကြိမ်)	Power Plant's EHS team	Included in operation

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
		Day (Leq), night (Leq) and hourly (Leq)	ဆူညံသံသက်ရောက်မှု မြင့်မားနိုင်သော နေရာများ				and maintenance
	လုပ်သားများ၏ ကျန်းမာရေး	ဆူညံသံအဆင့်များ (Leq),	• စက်ရုံဧရိယာအတွင်း သတ်မှတ်ထားသော နေရာများ • ပြင်ကြီးရွာရှိ ရေရယူမည့်စက်ရုံ နေရာ၌ (14°38'18.15"N, 98° 1'14.27"E)	Digital Sound Level Meter (24-Hour)	လစဉ်	Power Plant's EHS team	(O&M) cost
မြေပေါ်ရေ အရည်အသွေး	မြေပေါ်ရေ အရည်အသွေး	အပူချိန်	စွန့်ပစ်ရေ စွန့်ထုတ်သည့် နေရာ၌	Standard analytical method**	တစ်ပတ် (၁ကြိမ်)	Power Plant's EHS team	Included in operation and maintenance (O&M) cost
	မြေပေါ်ရေ အရည်အသွေး	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD),	• စွန့်ပစ်ရေ စွန့်ထုတ်သည့် နေရာ • ဟိန်းဇဲမြစ် (ရေစုပ်ယူမည့် စက်ရုံမှ မြစ်အထက်ပိုင်း), 14°38'24.10"N, 98° 1'14.86"E) • ဟိန်းဇဲမြစ် (ရေစုပ်ယူမည့် စက်ရုံမှ မြစ်အောက်ပိုင်း, 14°38'23.62"N, 98° 1'4.14"E)	Standard analytical method**	တစ်နှစ် (၂ကြိမ်)	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (4,000,000 MMK/time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
		Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As).	• မိကျောင်းအိုင်ချောင်း (ချောင်းအထက်ပိုင်း, 14°36'23.61"N, 98° 1'51.47"E) • မိကျောင်းအိုင်ချောင်း (ချောင်းအောက်ပိုင်း, 14°36'25.90"N, 98° 1'47.80"E)				
	မြေပေါ်ရေ အရည်အသွေး	ဟိန်းဇဲမြစ်၏ရေစီးဆင်းနှုန်းနှင့် စက်ရုံမှ ရေရယူနှုန်း	လုပ်ငန်းသုံးရေ ရယူမည့်စက်ရုံနေရာ၌	ရေရယူသည့် ပမာဏနှင့်ဟိန်းဇဲမြစ်၏ ရေစီးဆင်းနှုန်းအား စဉ်ဆက်မပြတ် စောင့်ကြည့်တိုင်းတာခြင်း။	စဉ်ဆက်မပြတ် တိုင်းတာခြင်း	EHS team	Included in operation and maintenance (O&M) cost

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
မြေအောက်ရေ အရည်အသွေး	မြေအောက်ရေ ညစ်ညမ်းမှု	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb), Mercury (Hg), Arsenic (As).	• လှည်းကုန်းရွာရှိ နေအိမ်တစ်ခု၌ (98°1'32.31"E, 14°36'16.11"N) • ရှင်ပုံရွာရှိ နေအိမ်တစ်ခု၌ (14°37'28.10"N, 98° 2'49.40"E) • ပြင်ကြီးရွာရှိ နေအိမ်တစ်ခု၌ (14°38'15.38"N, 98° 1'3.44"E) • မိကျောင်းအိုင်ရွာရှိ နေအိမ်တစ်ခု၌ (14°36'33.91"N, 98° 1'43.50"E)	Standard analytical method**	တစ်နှစ် (၁ ကြိမ်)	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော တတိယအဖွဲ့အစည်း	EPC Contractor Cost (2,400,000 MMK/time)
မြေဆီလွှာ အရည်အသွေး	မြေဆီလွှာနှင့် အနည်အနှစ်များ ညစ်ညမ်းစေခြင်း	pH, salinity, NH_4^+, total P, heavy metals, TSS	မတော်တဆ ယိုဖိတ်မှုဖြစ်ပွားသော နေရာများ နှင့် စွန့်ပစ်ပစ္စည်း သိုလှောင်ရာနေရာများ	Standard analytical methods**	မတော် တဆ ဖြစ်ပွားချိန်နှင့် တစ်နှစ် (၂ ကြိမ်)	စီမံကိန်းအဆိုပြုသူမှ ခန့်အပ်ထားသော	O&M Cost (1,000,000 / time)

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
						တတိယ အဖွဲ့အစည်း	
စွန့်ပစ်ပစ္စည်းများ	မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းမှု	စွန့်ပစ်ပစ္စည်းခွဲခြားသတ်မှတ်မှု၊ သယ်ယူပို့ဆောင်မှုနှင့် စွန့်ပစ် ထားရှိမှုများအား စောင့်ကြည့်တိုင်းတာခြင်း	စီမံကိန်းဆောင်ရွက်နေသော နေရာများနှင့် စွန့်ပစ်ထားရှိရာ နေရာများ၊	စီမံကိန်းအတွက် ရေးဆွဲထားသော စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုဆိုင်ရာ အစီအစဉ် အရ	စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုဆိုင်ရာ အစီအစဉ် အရ	EHS Team	Included in operation and maintenance (O&M) cost
	waste contractor များမှ စွန့်ပစ်ပစ္စည်းများ မသင့်တင့်စွာ စွန့်ပစ်ထားရှိမှုများ။	သင့်တင့်သော စာရွက်စာတမ်းများဖြင့် ထိန်းချုပ်၍ ခန့်အပ်ထားသော waste contractor များအား စောင့်ကြည့်စစ်ဆေးခြင်း	စီမံကိန်းလုပ်ငန်းခွင် အတွင်း Waste contractor များ၏ စာရွက်စာတမ်းများအား စစ်ဆေးခြင်း၊	တာဝန်ယူထားသော စာရွက်စာတမ်း အချက်အလက်များ	စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုဆိုင်ရာ အစီအစဉ်များ အတိုင်း။	EHS Team	Included in operation and maintenance (O&M) cost
လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး	မတော်တဆများ(သို့) လုပ်ငန်းဆောင်ရွက်စဉ်နှင့် ပြုပြင်ထိန်းသိမ်းရေး လုပ်ငန်းများကြောင့် ထိခိုက်မှုများ	လုပ်ငန်းခွင်အတွင်း အနာတရများ၊ အသေးစားထိခိုက်မှုများ၊ ရောဂါများနှင့် အန္တရာယ်ရှိသော အခြေအနေများ။	စီမံကိန်းဆောင်ရွက်နေသော နေရာများ။	စီမံကိန်းအတွက် ရေးဆွဲထားသော ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးဆိုင်ရာ အစီအစဉ်များအရ။	ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးဆိုင်ရာ အစီအစဉ်များ အတိုင်း။	EHS Team	Included in operation and maintenance (O&M) cost
အများပြည်သူ့ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး	ယာဉ်ကြောပိတ်ဆို့မှုများ ကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဘေးအန္တရာယ်များနှင့်	မတော်တဆများ၊ ထိခိုက်မှုများနှင့် တိုင်ကြားမှုများ	လမ်းအသုံးပြုမှု	ထိခိုက်မှုများ၊ မတော်တဆများနှင့် အများပြည်သူများ၏ တိုင်းကြားမှုများ	ဖြစ်ပေါ်လာသော အခြေအနေ အလျောက်။	EHS and/or Community Liaison Officer	Included in operation and maintenance

စီမံကိန်းအခြေအနေ/ သက်ရောက်နယ်ပယ်	သက်ရောက်နိုင်မှု	စောင့်ကြည့်တိုင်းတာရမည့် Parameters	တည်နေရာ	တိုင်းတာမှုများ	အကြိမ်နှုန်း	တာဝန်ယူမှု	ကုန်ကျစရိတ်
	အများပြည်သူများအား အနှောက်အယှက် ဖြစ်စေခြင်း။					of the Project Proponent	(O&M) cost
	စွန့်ထုတ်အရည်နှင့် အအေးခံရေများ စွန့်ပစ်ခြင်း။	မတော်တဆများ၊ ထိခိုက်မှုများနှင့် တိုင်ကြားမှုများ	ချိတ်ဆက်ထားသော လမ်းကြောင်းနေရာများ	ထိခိုက်မှုများ၊ မတော်တဆများနှင့် အများပြည်သူများ၏ တိုင်ကြားမှုများ	ဖြစ်ပေါ်လာသော အခြေအနေ အလျောက်။	EHS and/or Community Liaison Officer of the Project Proponent	Included in operation and maintenance (O&M) cost
	အများပြည်သူများ၏ စိုးရိမ်မှုသဘောထားများ	အများပြည်သူများ၏ တိုင်ကြားမှုများ	စီမံကိန်းလုပ်ငန်းဆောင်ရွက်ရာ အနီးဝန်းကျင်ရှိ အများပြည်သူများ	အများပြည်သူ့ သဘောထားခံယူပွဲများ ကျင်းပခြင်း။	စဉ်ဆက်မပြတ်။	Community Liaison Officer of the Project Proponent and Plant Manager	Included in operation and maintenance (O&M) cost
CSR လုပ်ငန်းစဉ်များ	ရပ်ရွာ ဖွံ့ဖြိုးတိုးတက်မှု	လုပ်ငန်းစဉ်များ၊ ပရိုဂရမ်များ နှင့်ကောင်းကျိုးခံစားခွင့် အရေအတွက်များ။	စီမံကိန်းလုပ်ငန်းဆောင်ရွက်ရာ အနီးတဝိုက်ရှိ ဒေသခံ အများပြည်သူများ။	ဆောင်ရွက်မှုများကြောင့် ဖြစ်ပေါ်လာသော အကျိုးဆက်များနှင့် ကောင်းကျိုးခံစားခွင့် အရေအတွက်များ။	အစီအစဉ်တကျသော် လည်းကောင်း၊ အခြေအနေ အရ သော်လည်းကောင်း။	Admin/ HR Manager and Plant Manager	CSR Budget (app 100,000 USD / year)

၁.၁၂.၃။ သင်ကြားမှု အစီအစဉ်

ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာစီမံခန့်ခွဲမှု အစီအစဉ်ကို အကောင်အထည် ဖော်ဆောင်ရွက်ရန်သင်တန်းများပေးခြင်းနှင့် ၄င်းတို့ပိုမိုတိုးတက်စေရန် EPC ကန်ထရိုက်တာမှ ကုမ္ပဏီနှင့် အကြံပေးလုပ်ငန်းများ ဆောင်ရွက်ရာတွင် သင့်တော်၍ အရည်အချင်းရှိသော ပညာရှင်များ ငှားရမ်းလုပ်ဆောင်ခြင်းများကို ဆောက်လုပ်ရေးလုပ်ငန်း စတင်ချိန်တွင် ဦးစားပေး လုပ်ဆောင်သွားပါမည်။ စီမံကိန်းအတွက် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်နှင့် အစီရင်ခံစာများကို သင့်တော်သည့် ကိုးကားချက်များနှင့် ဆောင်ရွက်ပါမည်။

စီမံကိန်းလည်ပတ်ခြင်းအဆင့်တွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုခြင်း သင်တန်းများပေးခြင်းနှင့် ထိုသင်တန်းများ ပိုမိုကောင်းမွန်စေရန် ကုမ္ပဏီမှ သင့်တော်ကောင်းမွန်သည့် ပညာရှင်များကို စီမံကိန်းလည်ပတ်ချိန်အစတွင် ဦးစားပေး၍ ငှားရမ်းပါမည်။ ယခုအကြောင်းအရာသည် ဆောက်လုပ်ရေးအဆင့်နှင့် အများဆုံးတူညီပါသည်။ နှစ်စဉ် စီမံကိန်းလည်ပတ်ချိန်နှင့် ဆောက်လုပ်ချိန်အတွင်း ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်တွင် သီးခြားသတ်မှတ်ချက်များ မပါရှိလျှင် အစီရင်ခံခြင်းနှင့် စစ်ဆေးခြင်းများကို တစ်နှစ်လျှင် နှစ်ကြိမ်ပြုလုပ်ပြီး ထိုအစီရင်ခံစာများကို သက်ဆိုင်ရာအာဏာပိုင်များ (MOEP, MONREC)နှင့် ချေးငွေထုတ်ပေးသူများသို့ တင်ပြသွားပါမည်။

၁.၁၃။ နိဂုံး

စီမံကိန်း၏ ပတ်ဂန်းကျင်ဆန်းစစ်မှုများအရ စီမံကိန်းသည် ပတ်ဝန်းကျင်ကို အဓိကမထိခိုက်စေသည်မှာသေချာပါသည်။ ထိခိုက်မှုအများစုသည် ယာယီ(သို့)ရေတိုဖြစ်ပြီး စီမံကိန်း၏ နည်းပညာဒီဇိုင်းများတွင်ပါရှိသော လျှော့ချရေးနည်းလမ်းများကို ထည့်သွင်းထားမှုအပေါ် အခြေခံ၍ အလွယ်တကူ ဖြေရှင်းနိုင်ပါသည်။

လေအရည်အသွေးစောင့်ကြည့်ခြင်း အခြေခံအချက်အလက်များမှ ရလဒ်များသည် လက်ရှိ အခြေအနေများကို အရည်အသွေးမကျဆင်းနိုင်သည့် လေထုဝန်းကျင်အဖြစ် သတ်မှတ်ထားပါသည်။ သို့သော်လည်း NO_x ထုတ်လွှတ်မှု ကို 25ppm ထိလျှော့ချရန် ခေါင်းတိုင်တွင် dry low NOx burners များကို တပ်ဆင်ထားပါမည်။ သာမန် ပေါင်းစပ်ဓာတ်အားထုတ်လုပ်ခြင်း သို့မဟုတ် ဓာတ်ငွေ့ဖြင့်ဓာတ်အားထုတ်လုပ်ခြင်းများ လည်ပတ်စဉ်တွင် သတ်မှတ်ထားသည့် air sensitive receivers (ASRs) ၏ခေါင်းတိုင်မှ ထိခိုက်မှုများသည် ထိခိုက်မှုမရှိဟု သတ်မှတ်ထားပါသည်။

မြေပေါ်ရေ၊ မြေအောက်ရေနှင့် မြေဆီလွှာများနှင့်ပတ်သတ်၍ စီမံကိန်း၏ ဟိန်းဇဲမြစ်အနီး ပတ်ဝန်းကျင်တွင် တည်ရှိမှုနှင့် စီမံကိန်းဧရိယာအတွင်းနှင့် ပတ်ဂန်းကျင်ရှိ မြေဆီလွှာအရင်းအမြစ်၊ မြေအောက်ရေ၊ မြေပေါ်ရေများကို ဒေသနေပြည်သူများမှ ၄င်းတို့၏ ကျန်းမာရေးနှင့် စားဝတ်နေရေးအတွက် မှီခိုနေရမှုတို့ကြောင့် စီမံကိန်းအတွက် အဆိုပါ ထိခိုက်မှုများ ဆန်းစစ်မှု သည် အလွန်အရေးပါသည်ကို မှတ်သားထားပါသည်။

ပတ်ဝန်းကျင်ဆိုင်ရာ၊ လူမှုရေးဆိုင်ရာနှင့် ကျန်းမာရေးဆိုင်ရာ ထိခိုက်နိုင်မှုများကို ခွဲခြားထားသော်လည်း လျှော့ချရေးနည်းလမ်းများ ဆောင်ရွက်ပြီးနောက် နောက်ဆက်တွဲ ထိခိုက်မှုမှာ အရေးပါမှု နည်းပါးနိုင်ပြီး ထိုထိခိုက်မှုကြာချိန်သည် ရေတိုဖြစ်ကြောင်း ဆန်းစစ်ချက်များတွင် တွေ့ရှိရပါသည်။ လျှော့ချရေးနည်းလမ်းများ ဆောင်ရွက်ခြင်းသို့ လျှော့ချရေးနည်းလမ်းများဖြင့် တိကျစွာ စစ်ဆေးခြင်းများပြုလုပ်ပါက ပတ်ဝန်းကျင်ဆိုင်ရာ၊ လူမှုရေးဆိုင်ရာနှင့် ကျန်းမာရေးဆိုင်ရာ သက်ရောက်ခံများအပေါ် နောက်ဆက်တွဲ ဆိုးကျိုးများသည် အလွန်နည်းပါးခြင်းသို့ မရှိဟု ကောင်းမွန်စွာ နားလည်ထားပါသည်။

ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာထိခိုက်မှုအစီအစဉ်တွင် ပါဝင်သော လျှော့ချရေးနည်းလမ်း များကို နိုင်ငံတကာအလေ့အထများဖြင့် ဆောင်ရွက်ထားပြီး ထိခိုက်မှုများကိုလည်း လက်ခံနိုင်သော အခြေအနေရောက်သည်အထိ စီစဉ်ထားပါသည်။

လူမှုရေးဆိုင်ရာ လေ့လာဆန်းစစ်ခြင်းတွင် ကနဦး သက်ဆိုင်သူများနှင့် ဆွေးနွေးညှိနှိုင်းပွဲတွင် အခြားသက်ဆိုင်သူများနှင့် ဒေသနေပြည်သူများမှ လိုအပ်သော ထောက်ပံ့မှုများကို စီမံကိန်းမှ ရရှိပြီးဖြစ်ကြောင်း သိရှိရပါသည်။ ဒေသအတွက် သင့်တင့်သော စွမ်းအင်ထောက်ပံ့မှုကြောင့် ဒေသ၏ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှုများ၊ အလုပ်အကိုင် အခွင့်အလမ်းများ (တိုက်ရိုက်နှင့် သွယ်ဝိုက်၍သော်လည်းကောင်း) ကဲ့သို့သော အခြားအကျိုးကျေးဇူးများ ရရှိနိုင်ကြောင်းနှင့် ဆိုးကျိုးများကိုလည်း လွယ်ကူစွာ လျှော့ချနိုင်ကြောင်း သက်ဆိုင်သူများဘက်မှ ဆွေးနွေးခဲ့ကြပါသည်။

ထိုထိခိုက်မှုများကို လျှော့ချရန်နှင့် စီမံခန့်ခွဲရန် အစီရင်ခံစာ အစိတ်အပိုင်းတစ်ခုအနေဖြင့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်တွင် ပြင်ဆင်ပြီး ထိခိုက်မှုများအားလုံးကို လက်ခံနိုင်သည့် အခြေအနေထိ လျှော့ချရန်နှင့် နည်းနိုင်သမျှနည်းရန် လျှော့ချမည့်နည်းလမ်း အစီအစဉ်များကိုလည်း ပြုလုပ်ပြီးဖြစ်ပါသည်။

ကောင်းမွန်သော ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်များကို ဆောင်ရွက်၍ ပတ်ဝန်းကျင်ထိခိုက်မှုများကို လက်ခံနိုင်သည့်အခြေအနေထိ လျှော့ချရာတွင် အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များနှင့် နိုင်ငံတကာ ငွေကြေးရန်ပုံငွေအဖွဲ့ ၏ လမ်းညွှန်ချက်များဖြင့် လိုက်နာဆောင်ရွက်သွားပါမည်။

CHAPTER 1 EXECUTIVE SUMMARY

1.1 Introduction

This Environmental and Social Impact Assessment (ESIA) report presents an assessment of the potential environmental and social impacts associated with the proposed 200MW Combined Cycle power plant (CCPP) and Project facilities in Kanbauk, Yebyu Township, Tanintharyi Region, Myanmar ('the Project').

This revised report has been prepared for Myanmar UPA Company Limited (hereinafter referred to as 'the Project Proponent' or 'MUPA') by E Guard Environmental Services Co., Ltd. and presents the objectives, methodology and outcomes of the ESIA study. E Guard Environmental Services Co., Ltd. has prepared this report according to the Third-Party Confirmation (Annex-B) by Environmental Conservation Department (ECD). The previous ESIA study was conducted by Environmental Resources Management (hereinafter referred to as 'ERM') supported by Sustainable Environment Myanmar (hereinafter referred to as 'SEM') and submitted to ECD on June, 2017.

1.2 Project Background And Overview

The project proponent has been approved by the Ministry of Electric Power (MOEP) (the predecessor of Ministry of Electricity and Energy (MOEE)) of the Government of Myanmar (GOM) as a private sector Independent Power Producer (IPP) to develop the Project in Kanbauk within the framework of a Memorandum of Agreement (MoA) signed in August 2014 and under a Power Purchase Agreement (PPA) signed in March 2016. The Project comprises of the following Project facilities:

- 200MW Combined Cycle Power Plant (CCPP);
- Water Intake Pumping Station including Water Treatment Facility;
- Water Intake Pipeline; and
- The Fuel Supply Infrastructure consisting of Gas Metering Station located within the MOGE Gas Receiving Station and Gas Supply Pipeline from Gas Metering to the Power Plant.

It should be noted that the existing gas pipeline connection from the offshore gas source(s) to MOGE Gas Receiving Station and the proposed overhead transmission line from the Project Site connecting to the 230kV Mawlamying- Ye- Dawei Transmission Line is outside the scope of this ESIA Study.

The technology of the Project is an efficient form of combined cycle power generation which was designed for high reliability and efficiency operation with lower environmental impact. The Project will operate on natural gas supplied by EPGE or other source like LNG, MUPA will perform the revised development plan for the project in accordance with the actual gas availability when confirmation of fuel supply quantity by EPGE.

The electrical capacity and electricity generated will be sold under a 30-year Power Purchase Agreement ("PPA"), as agreed with Electric Power Generation Enterprise (EPGE). The total Project cost is approximately US 300 million dollars.

1.3 Project Need

Parallel to growth in GDP, electricity demand in Myanmar has increased dramatically in recent years. ADB released a report on Myanmar's energy sector in October 2012 in which the future power demand was estimated to be doubling from 12,459 million kWh in 2012-2013 to 25,683 million kWh in 2018-2019 (ADB, 2012).

As of July 2013, Myanmar's power is predominantly generated from hydropower, gas and coal, representing over 70%, 22% and 3% of the total power generation respectively. [1] Out of the 3,735 MW of total installed capacity, approximately 835 MW is of gas-fired power generation. Due to the lack of water during dry season, hydropower generation has not been able to operate at full capacity and therefore electricity supply has been unstable during that time.

The Project is in line with the effort of Myanmar to reduce the country's reliance on hydropower by adding 1,740MW of gas-fired generation capacity in the coming years, which will increase the gas-fired capacity to over 50% of the total generation mix. [2]

1.4 The Project

The Project Sponsor is planning to develop a 200MW Combined Cycle Power Plant (CCPP) in Yebyu Township, Tanintharyi region in the Republic of the Union of Myanmar.

1.4.1 Project Location

The Project site is located approximately in Kanbauk Village, Yebyu Township, Dawei District in the Tanintharyi Region, the Republic of the Union of Myanmar as shown in Figure 1.1.

[1] MEPE (2013). http://www.ubifrance.com/medias/press/mepe_9_7_2013_29_31.pdf Accessed 8 June 2015.

[2] Sharma, Vikas (2013). An Overview of Electricity Market in Myanmar. slideshare.net/VikasSharma128/myanmar-electricity-industrydec2013 Accessed 8 June 2015

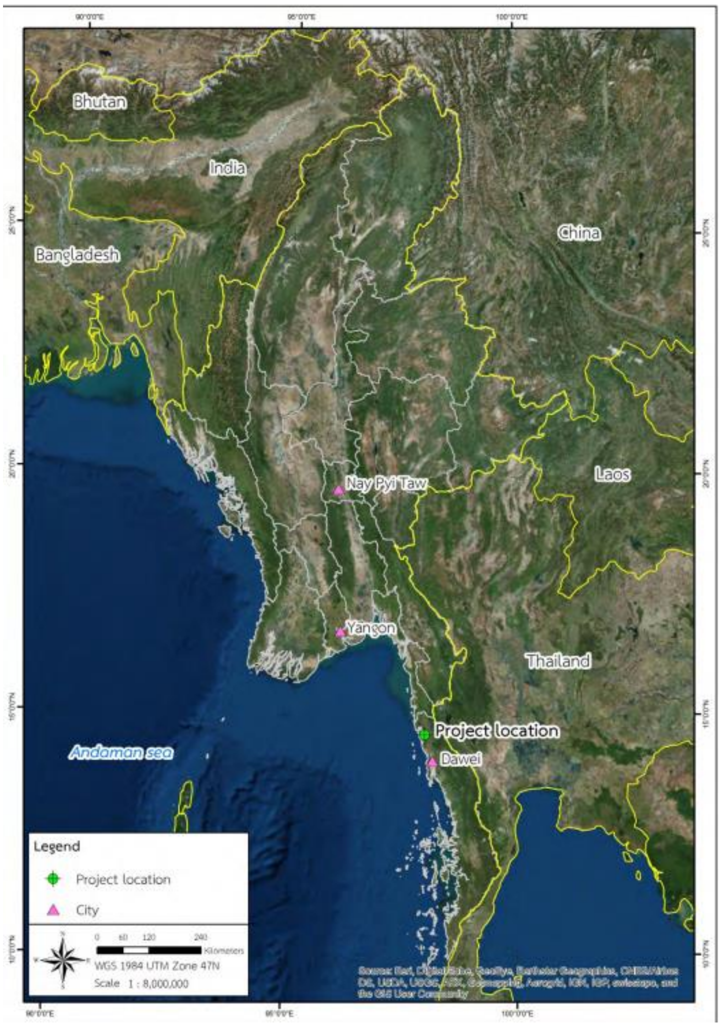


Figure 1. 1 Project Location

The Power Plant will be located on a brown field site, with a total of 9.47 hectares (ha). The land is currently owned by EPGE; however, the land has been allocated for this Project and the Land Lease Agreement between the Project Proponent and EPGE is being proceeded.

The following 10 villages are located in close proximity (5km radius from the Project site boundary):

- Mi Gyaung Auing village;
- Hle Gone village;
- Kanbauk village;
- On Bin Kwin village;
- Heinze village;
- Shin Byan village;
- Pet Taung village;
- Pyin Gyi village;
- Gan Gaw Taung; and
- Ye Ngan Zeik village.

The Heinze River is located approximately 3km north-west of the Project site boundary, where the Water Intake Facilities will be installed.

1.4.2 Project Facilities

The Project Facilities and Associated Facilities are described below. A total area of approximately 9.47 hectares (ha) is allocated for the Project facilities.

- 200MW Combined Cycle Power Plant comprising of the following main components:

- ❖ 3 sets of Gas Turbine (GT) units;
- ❖ 3 sets of Heat Recovery System Generator (HRSG);
- ❖ 1 steam turbines generating unit with associated auxiliary equipment;
- ❖ 230kV Switchyard area (located in adjacent to the existing 66kV Switchyard);
- ❖ Workshop/ warehouse and administrative building;
- ❖ Cooling Tower and Cooling Water System;
- ❖ Water Storage Tank; and
- ❖ Laydown Area.

- **Water Intake Pipeline** connecting the CCPP with the **Water Treatment Facility**, located on the embankment of the Heinze River, where the raw water will be withdrawn from the Heinze River, through the **Water Intake Pumping Station**. The Water Intake Pipeline will be approximately 3.3km in length and approximately 30cm in diameter.
- **The Fuel Supply Infrastructure** consisting of Gas Metering Station located within the MOGE Gas Receiving Station and Gas Supply Pipeline from Gas Metering Station to the Power Plant is owned by the Project Proponent. The Gas Supply Pipeline is approximately 2.6km in length, with 25cm diameter.

<u>200 MW Combine Cycle Power Plant (CCPP)</u>

The Power Plant is designed to operate continuously, in combined cycle mode. During normal combined cycle operation, the heat of exhaust gas will be admitted to the Heat Recovery Steam Generator (HRSG) where superheated steam will be produced which will drive the steam turbine to generate electrical power. The exhaust gas from the HRSG will be released from the main stack of the HRSG to the atmosphere. It is anticipated that the Power Plant will operate at full load for the majority of the time.

The HRSG is designed for dual pressures with reheat steam generation (High Pressure (HP) and Low Pressure (LP)) used to maximize energy transfer from the exhaust gas of the gas turbine. The HP steam generated by the HRSG will be fed to the HP steam turbine and the reheat and LP steam will be fed to the LP steam turbine.

The power output is net 200MW during combined cycle operation. The Power Plant will use natural gas or LNG.

<u>Cooling Water System</u>

The mechanical draft cooling tower cooling water systems is selected for this Project. The main cooling water system will provide cooling water to the steam turbine condenser by means of cooling water pumps installed in the cooling tower basin. The warm water from the condenser is returned to the multi-cell mechanical draft cooling tower, where it is cooled and collected in the cooling tower basin for return to cool the condenser.

<u>Raw Water System</u>

The water intake system includes the Water Intake Pumping Station, the Water Treatment Facility, the Water Intake Pipeline and the Water Storage Tank. The Water Intake Pumping Station and Water Treatment Facility will be installed at Pyin Gyi.

The raw water will be taken from Heinze River, using the Water Intake Pumping station at the flow rate of approximately 860 m3/hour. The raw water will be treated by the water treatment facility, Reverse Osmosis system, installed at the Heinze River bank.

The treated water will be delivered to the Project site, via a 30cm diameter Water Intake Pipeline, with a total length of approximately 3.3km and will be stored in the Water Storage Tank, located at the Project Site. The proposed Water Intake Pipeline will run from the Water

Treatment Facility to the Water Storage Tank located within the Project Site. The Water Intake Pipeline will be installed, along an existing road.

The capacity of raw water storage tank is approximately 30,000m^3, which can satisfy the water consumption of the plant for 3 days including the fire-fighting system.

Emission Controls

The Project will be equipped with the following equipment:

- Dry Low NOx burners will be installed to achieve low NOx emissions; and
- Both manual stack sampling facilities and Continuous Emissions Monitoring Systems (CEMS) including thermocouple and manual sampling ports will be installed with a CEMS which shall monitor the concentrations of NOx as specified in FIC EHSG and NEQ Guidelines for Thermal Power (Natural Gas Combustion Turbine > 50 MWth).

1.4.3 Associated Facilities

Currently, the existing MOGE Gas Receiving Station is located 1.7km to the north west of the Project site, off taking the natural gas from Yanada and Zawtika. The Gas Metering Station is located within the boundary of the MOGE Gas Receiving Station. The natural gas is transported to the Project Site via a 25cm diameter buried Gas Supply Pipeline, with a total length of approximately 2.6km.

1.4.4 Project Life Cycle Overview

For the purposes of this report, the Project is divided into 3 phases: Construction Phase, Operation Phase and Decommissioning Phase.

Construction Phase

Construction is expected to start in the mid of 2027 and be complete in the region of 30 months with commercial operation targeted at March 2030.

Construction activities of the Project will include: mobilization, site clearance, onshore construction of all Project components and commissioning. Heavy equipment such as bulldozers, excavators, dump trucks, compactors, etc. will be used at the Project Site.

The EPC Contractor will be appointed to undertake the engineering, procurement and construction activities of the Project. The EPC Contractor will be responsible for implementation of the mitigation, management measures and monitoring programme defined in this report under the Sponsor's supervision.

Operation Phase

The start of operation is anticipated for March 2030. The Project will be owned and operated by the Project Proponent. The Operation and Maintenance (O&M) of the Project will be undertaken by the Project Proponent with the support of a long-term service agreement (LTSA) for the GT and ST with the manufacturer and external expertise on each function to counterpart and provide the intensive in-house training during commission until 3 years after SCOD. The LTSA will cover the supply of spare parts, supervision and specialized technicians for inspections, major and minor overhauls.

O&M staff with relevant experience of operating similar plants and with adequate knowledge of comparable technology will be deployed prior to commercial operation date (COD) to commission and take over the Project from the EPC Contractor. Approximately 50 staff will work on the operational phase of the project.

Decommissioning Phase

It shall be noted that this Project will be developed on ‘Build-Operate-Transfer’ (BOT) basis. It is expected that by the end of Operation Phase, the Project will be transferred to the MOEP. However, for completion of this report, the Decommissioning Phase has been considered, based on general practice only.

The design lifespan of the power plant is estimated to be 30 years. The Project facilities will be designed with decommissioning in mind. In general, facilities and machinery will be designed so that they can be isolated and decommissioned in steps which are in reverse of the installation procedure or which are most convenient to do so. The decommissioning phase activities will therefore be similar to those associated with the excavation/foundation work, installation and civil construction phases.

1.5 ALTERNATIVE ANALYSIS

The main design criteria and project type were determined by MOEP to develop the competitive tender process and are therefore beyond the remit of this report.

However, the alternative analysis was conducted for the following aspects:

- Alternatives of the Power Generation Options;
- Alternatives of Configuration on Site; and
- Alternatives of Technological Options

1.6 ADMINISTRATIVE FRAMEWORK

The Project will conform to the legal and administrative requirements of the Republic of the Union of Myanmar. The Project will also conform to international treaties to which Myanmar is signatory, and to the International Finance Corporation (IFC) Performance Standards (IFC PS) (2012) and other associated guidelines.

1.6.1 Overview of Myanmar Legislation

The latest enacted Constitution (May 2008) provides information on governing laws and regulations in Myanmar. The Constitution takes precedence over any other national legislation or international agreements.

Myanmar is divided into twenty-one (21) main administrative subdivisions, which include:

- Seven states;
- Seven regions (Note that regions were previously referred to as “divisions”, prior to August 2010);
- Five self-administered zones;
- One self-administered division; and
- One union territory

States and regions are divided into districts. Districts consist of townships, which are composed of towns, wards and village-tracts. Village-tracts are groups of adjacent villages. The administrative structure of the states, regions and self-administering bodies is defined in the Constitution.

1.6.2 ESIA Requirements in Myanmar

Myanmar adopted regulatory requirements for ESIA studies on the 29th December 2015. Laws related to ESIA requirements are as follows:

- Environmental Policy, 1994, Myanmar Agenda 21, 1997, and National Sustainable Development Strategy, 2009;
- The Environmental Conservation Law, 2012;
- Environmental Conservation Rules (2013);
- Foreign Investment Law, 2012, Foreign Investment Rules, 2013, and
- Notifications for Investment, 2013;
- Environmental Impact Assessment Procedures (2015); and
- Myanmar National Environmental Quality (Emission) (NEQ) Guidelines (2015).

1.6.3 International Standards and Applicable Guidelines

In addition to national legislation, the Project will be undertaken to comply with a range of international standards, including the World Bank Group Safeguard Policies and the IFC Performance Standards (IFC PS). These standards are set to complement and reinforce national legislation and ensure the Project is conducted under best practices in a way that minimizes risks, impacts and ensures compliance and fair practices. The international performance standards and guidelines provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

The applicable guidelines and standards for the Project are as follows:

- The IFC's Performance Standards (IFC's PSs) (2012);
- IFC/World Bank Group (WBG) EHS Guidelines and WBG EHS Guidelines for Thermal Power (2007 and 2008);
- IFC's Stakeholder engagement handbook and other relevant Good Practice Notes;
- IFC's Handbook for Preparing a Resettlement Action Plan (if applicable)
- Kyoto Protocol to the UNFCC on Climate Change (1997);
- United Nations Convention on Biological Diversity (1992);
- Basel Convention (1989);
- Ramsar Convention on Wetland (1971); and
- International Union for Conservation of Nature and Natural Resources, Red List of Threatened Species (1964).

1.7 Impact Assessment Methodology

The ESIA methodology follows the overall approach illustrated in Figure 1.2. The ESIA has been undertaken following a systematic process that evaluates the potential impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment; identifies preliminary measures that the Project will take to avoid, minimize/reduce, mitigate, offset or compensate for potential adverse impacts; and identifies measures to enhance potential positive impacts where practicable.

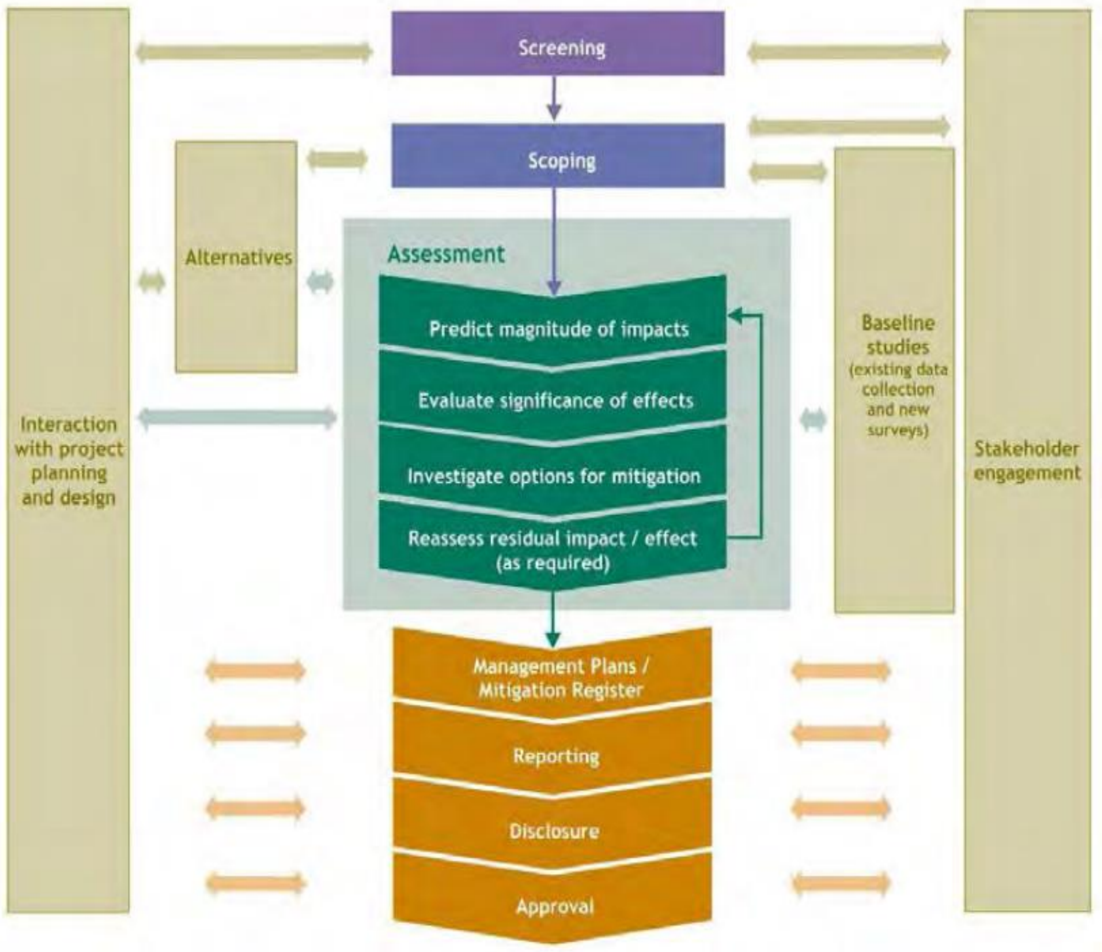


Figure 1. 2 Overall Impact Assessment Process

The stages of the ESIA process are described below.

<u>Screening</u>

At the initial stage of the ESIA, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilizing a high-level description of the Project and its associated facilities.

<u>Scoping</u>

During the scoping study, potential interactions between the Project, environmental and human resources/receptors were identified, and prioritized in terms of their potential to cause impacts of concern. A scoping report was submitted to ECD in December 2016 by ERM.

<u>Project Description</u>

In order to set out the scope of the Project features and activities, with particular reference to the aspects which have the potential to impact the environment, a Project Description has been prepared.

<u>Baseline Conditions</u>

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social / socio-economic and cultural conditions that would be expected to prevail in the absence of the Project is presented. The baseline includes information on all receptors and resources that were identified as having the potential to be significantly affected by the proposed Project.

Stakeholder Engagement

An effective ESIA Process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be considered in the prediction and evaluation of impacts.

Impact Assessment

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. The principal ESIA steps are summarized in Figure 1.3 and comprise:

- **Impact prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;
- **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts; and
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

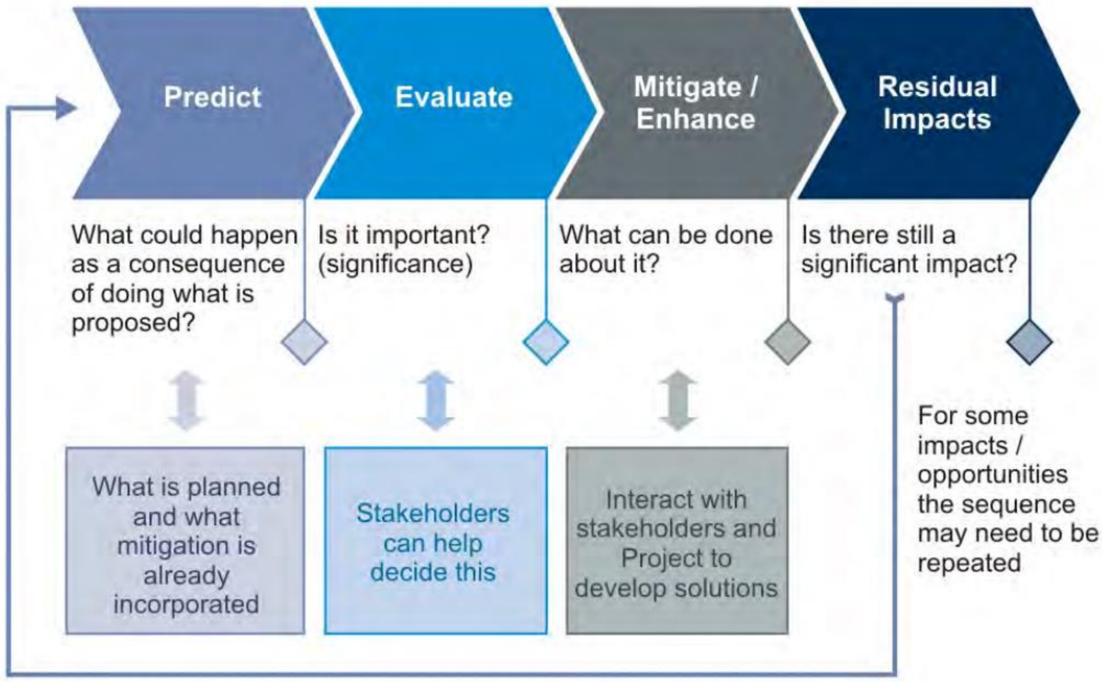


Figure 1. 3 Impact Assessment Process

Identification of Mitigation and Enhancement Measures

Once the significance of a potential impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this ESIA, E Guard has adopted the following Mitigation Hierarchy:

- Anticipate and Avoid
- Minimize or Reduce
- Mitigate

- Compensate or Offset

Management, Monitoring and Audit

The final stage in the ESIA Process is definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

The Environmental and Social Management Plan (ESMP) has been developed as part of the ESIA report. The ESMP generally refers to the Project specific plan which will set out how the requirements, management and mitigation measures, and any other commitments will be implemented, managed and monitored. It will lay out information such as the responsible parties for implementing the Project commitment, any monitoring requirements and associated standards or thresholds, the timing of monitoring, check methods and corrective actions, and any training requirements.

1.8 Description Of The Environment

The biophysical environmental baseline conditions within the Project Study Area are based on secondary data from published sources as well as primary data collected to fill data gaps.

The Study Area refers to the area that needs to be studied in order to adequately understand and describe the baseline conditions likely to be affected by the Project. This area varies according to the potential impacts on a resource or receptor (influenced by spatial and temporal dimensions). For the purpose of this study, a circular area of 5Km in diameter around the proposed CCPP project site has been considered alongside a 500 meters area each side of the Water Intake Pipeline. When necessary, data have also been collected outside of this area if a potential impact from the Project was expected.

The baseline studies were carried out through field trip during both the rainy and the dry season where teams of specialists were deployed on site to collect data on the biophysical environment. The social, socio-economic and cultural baseline study was conducted in parallel of the Public Participation Engagement in November 2016.

1.8.1 Climate and Meteorology

Most of Myanmar belongs to the tropical region. The climate of Myanmar is roughly divided into three (3) seasons: Summer, Rainy Season, and Winter Season. Summer months are from March to Mid-May; the rain falls from Mid-May to the end of October and the Winter Season starts in November up to the end of February.

Most rainfall is received at the Project site from May to October, with June, July and August being the most consistently wet months in comparison to the rest of the year.

Mean wind speeds tend to fluctuate throughout the year, with two distinct peaks and troughs. Easterly and south easterly winds dominate. The prevailing wind direction will mean receptors to the West and North West of the Project site will be impacted.

1.8.2 Ambient Air Quality

Ambient air quality monitoring was undertaken at 3 selected baseline air sampling locations, located in the vicinity of the Project Site. Ambient air quality monitoring was undertaken at each of the selected monitoring sites using two (2) approaches so as to capture both short-term and long-term trends in ambient air quality in both the dry and wet season. Monitoring was undertaken using the Haz-Scanner for a 72-hour period at each monitoring location in both the dry and wet season and have been used as indicative of the short term (24-hour) trend in ambient air quality in the study area. Monitoring was also undertaken using the diffusion tube methodology for a continuous three (3) week period at each monitoring location in both the dry and wet season. This information has been used as indicative of long term (annual) concentrations of both NO_X and NO_2.

The results from the monitoring conducted in the area indicate that ambient concentrations of NO_X and NO_2 are below the relevant air quality standards; however ambient concentrations of SO_2, $PM_{2.5}$ and PM_{10} are found to exceed the relevant air quality standards.

1.8.3 Noise

Baseline noise monitoring was conducted at 3 existing noise sensitive receivers (NSRs) located near the Project Site. Hourly A-weighted equivalent continuous sound pressure levels (LAeq, 1 hour) were recorded continuously over 72 hours at each location during both weekday and weekend. At each location, daytime and night-time LAeq were calculated by averaging the hourly sound pressure levels measured between 07:00 and 22:00 hours and between 22:00 to 07:00 hours, respectively.

The averaged background noise levels at three locations during daytime and night-time periods were higher than the NEQEG. The background noise levels are typical of a general rural environment and dominant noise sources were traffic along access roads and community activities around stations. The background noise levels exceeded both the noise limits set out in NEQ and IFC General EHS guideline values during daytime and night-time periods. In accordance with the NEQ and IFC Guidelines, noise impacts should not result in a maximum increase in background levels of 3dB(A) at the nearest receptor.

1.8.4 Surface Water Quality

The Project lies in Tanintharyi Region, which consists of several rivers and small streams originating from the mountains along the eastern border region.

The main river within the Project area is Heinze River. The Heinze River is located approximately 3km north-west of the Project site boundary. The river becomes brackish during the dry season. The catchment area in Kanbauk is approximately 37 km^2. Most part of this river is under tidal influence. It flows into the Andaman Sea through a funnel-shaped estuary. The estuary and creeks are navigable by small craft and are fringed by mangrove forest. There are number of villages located on its banks, therefore, the river is currently used for fisheries, navigation and marine logistic purposes.

The results were compared to EPA's recommended aquatic life and human health criteria and National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation. **During wet season**, results indicate that Arsenic and Cyanide levels were compliant with the criteria at all monitoring locations. Concentrations of Iron (1.160 mg/l) at SW4 was found to exceed the USEPA CCC criteria of 1.0mg/l.

Although the Lead Concentration (4.30×10^{-3} mg/l) was found to exceed the USEPA CCC criteria of 0.0025mg/l, the concentration of Lead (4.30×10^{-3} mg/l) at SW4 was complaint with the standard of National Surface Water Quality Standard (0.01 mg/l). Therefore, it can be regarded as an acceptable value in Myanmar.

In comparison with the National Surface Water Quality Standard (8 mg/l) for Chemical Oxygen Demand (COD), the result of COD for SW4 was compliant with the criteria and the results of

SW1 (85.0 mg/l), SW2 (101 mg/l), SW3 (12.6 mg/l), SW5 (9.4 mg/l) and SW6 (9.4 mg/l) were exceed to the standard.

In Biochemical Oxygen Demand (BOD), the SW1 (5.9 mg/l) and SW4 (4.00 mg/l), SW5 (7.60 mg/l) and SW6 (4.40 mg/l) were exceed the standard of National Surface Water Quality (3 mg/l) and the results of other locations were compliant with the standard.

The results for total dissolved solids indicated high concentrations at SW1 (10,998mg/l), SW2 (9,858mg/l) and SW3 (414mg/l). This is likely due to the dissolved salt in the brackish water.

During dry season, arsenic was found at levels above the EPA Criteria (chronic) and National Surface Water Quality Standard (0.05mg/l) at all locations including SW1(0.10mg/l), SW2(0.25mg/l) and SW3(0.25mg/l). This is likely due to arsenic content in the nearby soils being carried by runoff, as high arsenic levels were also found in soil samples (see Section 5.3.5).

The results of cyanide, Iron, Lead, turbidity, salinity, total Suspended Solids, conductivity, flow rate, water dept and water temperature were compliant with the EPA standards and National Surface Water Quality Standard respectively.

The results of Chemical Oxygen Demand (COD) at SW1 (20.4mg/l) and SW2 (20.4mg/l) were above the level of National Surface Water Quality Standard (8mg/l) and the result of Biochemical Oxygen Demand (BOD) at SW1 (5.6mg/l) was exceed the standard of National Surface Water Quality Standard (3mg/l). All the other locations were compliant with the standards for COD and BOD. In addition, results indicated high concentrations of total dissolved solids (TDS) at all stations, as well as very high conductivity. This is again likely due to the dissolved salt in the brackish water. At SW6(2.46mg/l), Dissolved Oxygen (DO) value was exceeded the criteria of National surface Water Quality Standard (>5 mg/l).

Total Coliform Bacteria levels were also found to be higher than during the wet season survey. The presence of total coliform bacteria indicates that there is at least some existing faecal contamination of the river. Sources of total coliform include sewage waste from humans and fecal matter from warm-blooded animals such as livestock, both of which could either be directly discharged into the river or carried in runoff during rainfall.

1.8.5 Soils

Soils in the Study Area are classified primarily as Gleysol Soils. The soils are composed of Saline Muddy Soil Mangroves. This soil has high salt and water, low oxygen and high hydrogen sulphide contents. It contains a high proportion of humus (Macnae, 1968). The best growth and development of mangroves takes place on alluvial and muddy soils, which are generally formed by the deposition of water-borne soil particles. Mangrove soils are mostly anoxic except for the surface layer in which roots spread (Rag, 1987). Soil samples were collected from two (2) sample points in the study area on the 26th September 2016 and tested for heavy metal content. Top soil was collected from 10 - 30 cm in depth and sub soil from 2.7 - 3.0 m in depth.

The results indicate that concentrations of arsenic at both sampling sites were in exceedance of the USEPA screening criteria. The measured concentrations of all other heavy metals were below the USEPA RSL for resident soil.

1.8.6 Groundwater

Groundwater samples were collected from three (3) household wells in riparian communities located within 1 km of the Project site on the 26th September 2016. The results indicate that heavy metal levels are compliant with the US EPA National Primary Drinking Water

Regulations and WHO standard at all monitoring locations. The pH was found to be lower than the US EPA Standards which agrees with the previous groundwater results from the survey done by TEAM Consulting in 2013.

1.8.7 Landscape and Visual

The proposed CCPP will be located on a vacant brown field site. It is on rolling terrain with the highest ground level area at the central northeast side (ground level: 28 m above mean sea level (MSL)), the northern tip of land at 12-17 m MSL and lower ground level at the southern and eastern side at 7.5 m MSL. Some land along the northern section of the site is lower than 5 m MSL. This Project site is surrounded by agricultural land and old rubber plantations and the main Heinze River is approximately 3km north-west of the CCPP site boundary. To the north of the site boundary is a paved road and agricultural area, to the south a tributary of the Heinze River and some agricultural land and to the east a paved road, habitation, agricultural area and a monastery. To the west there is an existing dirt road and the closest village houses within the villages of Mi Gyaung Auing and Hle Gon.

The proposed Water Intake Pumping Station and Treatment facility is located on the Heinze River on the border with Pyin Gyi Village. The location is on a small inlet surrounded by mudflats and mangrove habitat.

The longstanding residents of the villages have a high level of association with the landscape, particularly the surrounding agricultural land. All agricultural land is accessible to these people, and it is highly likely that they place great value on this landscape due to the high contribution it makes to livelihoods in the area. There are also a number of local pagodas and worshipping sites in the area. Visitors to these sites will classically confer a high value to the landscape and visual context of these sites and are considered to have high sensitivity.

1.8.8 Terrestrial and Aquatic Biodiversity

The Project Study Area resides within the lowland evergreen and semi-evergreen rain forests of the western side of Arakan Yoma and Tenasserim ranges along the west coast of Myanmar. According to the World-Wide Fund for Nature (WWF) Wild finder database, it is located in the Ecoregion known as the Myanmar Coastal Rain Forests.

This Ecoregion is within a tropical wet climate and receives monsoonal rainfalls during April to October. The remaining periods of the year tend to be dry. The habitats contained in the Ecoregion vary from tropical rainforests to lowland forest and mangroves along the coastal areas. The Ecoregion’s position means that it acts as a corridor between the Sundaic, Indochinese, and Indian sub-regions.

The Ecoregion has low endemism but contains a broad mix of flora and fauna. Protected Areas are not well represented in the Ecoregion with around 4% contained within a Protected Area.

Coastal areas of the Ecoregion are currently in a degraded state with large tracts of land cleared for agriculture. Land around the port cities of Dawei and Myeik is particularly degraded.

In Myanmar, Key Biodiversity Areas (KBAs) fall in different land management categories including protected areas, public protected forests, community-conserved forests, community forests, reserve forests and other resource and land use areas. Therefore, they accommodate different management systems such as government, private, community-led and joint management. Within the last decade, KBAs were reviewed and updated in order to identify and prioritize investment opportunities for biodiversity conservation in Myanmar.

A total of 132 KBAs were identified for Myanmar and prioritized based on Species-based Vulnerability and Site-based Vulnerability. A total of three KBAs were identified under

Alliance for Zero Extinction (AZE), one as a Ramsar site, 53 important bird areas, and six ASEAN Heritage Parks.

The Project Area is located 18km SW from the Tanintharyi National Park which is an Important Bird Area (IBA) and was assessed in 2004. The National Park is 259,000 ha in size. The Project Area is also 30km NE from the Moscos Kyun Archipelago Wildlife Sanctuary which also an IBA. The Project area is not located within a KBA. The Project Area is located near to two Protected Areas being the Tanintharyi National Park (18km SW) and the Moscos Kyun Archipelago Wildlife Sanctuary (30km NE). The Project Area is not located within a Protected Area.

ERM's sub-contractor undertook site surveys in both dry and wet seasons. These surveys were conducted to determine the location of any priority biodiversity values within the Project Area and Area of Influence. These priority values focused on Critical Habitat triggers as well as species of conservation significance. The surveys consisted of a desktop assessment to identify species and habitats to be prioritized for survey; identification of sampling locations (including local villager interviews); field surveys targeting major flora and fauna groups; and taxonomy and mapping of flora and fauna records identified. Habitat assessments were also undertaken to inform Natural Habitat and Modified Habitat mapping as required by IFC PS6.

1.9 Description Of The Socio-Economic Baseline

Myanmar is divided into a number of States and Regions (sometimes also referred to as Divisions), which are further divided into Townships for governance purposes. The Project site is located in the Yebyu Township in the Tanintharyi region.

Receptors that may be impacted or influenced by the Project due to their proximity to the Project site and/ or Project associated facilities includes:

- Mi Gyaung Auing village. The village is located directly next to the Project site. The village is also located along the road that connects the Project site to Kanbauk;
- Hle Gone village. The village is located approximately 0.6 km south west of the Project site;
- Kanbauk village. The village is located approximately 2.1 km south west of the Project site;
- Shin Byan village. The village is located approximately 2.5 km north east of the Project site;
- Pyin Gyi village. The village is located approximately 3.3 km north west of the Project site and next to the Water Intake Pumping facility;
- Gan Gaw Taung village. The village is located approximately 3.3 km south east of the Project site;
- Pet Taung village. The village is located approximately 4.5 km south west of the Project Site;
- On Bin Kwin village. The village is located approximately 4.5 km north west of the Project Site;
- Ya Ngan village. The village is located approximately 3.9 km north east of the Project Site;

A desktop review of publicly available information was conducted, and primary data was collected through a visit to the study area. Primary data were collected through a variety of methods so that the data could be triangulated. This included:

- Key informant interviews with village leaders.

- Focus groups with key sectors within each of the villages.
- Household surveys (total of 300 household surveys).

1.9.1 Demographic Profile

As of January 2017, it was estimated that the population of Myanmar was approximately 57 million. The population in the Tanintharyi Region was estimated to be 1.4 million, divided into 3 districts and 16 townships in 2014.

As of 2016, it was estimated that 65.7% of the population lives in rural areas, while 34.3% of the population resides in urban areas. For the Tanintharyi region, the percentage of people living in rural area was approximately 75%. Yebyu Township has a population of approximately 100,760 people, most of whom (approximately 96%) live in rural areas.

The largest ethnic group in Myanmar is the Burmans, which make up more than half of the population (68%). This is followed by Shan (9%), Karen (7%), Rakhine (4%), Chinese (3%), Indian (2%), Mon (2%) and other (5%).

In terms of the villages located in the Project area, the largest village is Kanbauk, with a population of approximately 9,976 people, while the smallest village is Phet Taung, with a population of approximately 125 people. The villages in terms of ethnicity, language and religion, reflect the broader Myanmar population – i.e. are Buddhist Burmans that speak Myanmar, but Kanbauk also house a Hindu temple and a Mosque.

1.9.2 Community Health

The life expectancy in Myanmar is 64 years of age for men and 68 years of age for women. The leading causes of morbidity are largely associated with communicable diseases and pregnancy/ child birth. In terms of mortality, again the leading causes are largely associated with communicable diseases i.e. human immunodeficiency virus (HIV)/ acquired immune deficiency syndrome (AIDS).

The prevalence of communicable diseases can be exacerbated by availability of and access to clean drinking water and sanitation facilities. According to the Ministry of Health, in 2012, Myanmar had 987 public hospitals with a total of 54,503 beds. In addition to existing health facilities, the use of traditional medicine is widespread and forms an integral part of the country's health services.

In the study area, based on interview with public health officer, communicable and non-communicable diseases are present. Leading causes of morbidity appear to be hypertension, diabetes, acute respiratory infection (ARI), stroke and common fever linked to influenza are observed as most occurring diseases. Pregnancy and/ or child birth is not considered by health officers as being a health issue in the study area with a maternal mortality rate of 0.2 per 1000 birth and infant mortality rate of 0.18 per 1000 birth, similar to the number at the regional level.

Malaria, hypertension, liver diseases and accident (traffic) were all mentioned as the most usual cause of mortality in the study area. There has been a reduction of death due to malaria in the recent years while the number of fatalities related to traffic accident has been increasing.

1.9.3 Economy and Livelihood

In 2015, Myanmar's gross domestic product (GDP) was estimated to be $62.6 billion. The per capita GDP was approximately $1,160 - one of the lowest in Southeast Asia and lower than the previous year.

Myanmar is in a transition from a centrally directed economy to a market-oriented economy. This has been supported by a reform program launched by the government in 2011. The key sectors of the economy include agriculture, forestry and fishing.

Agriculture

Traditionally, Myanmar has been reliant on the agriculture sector (and to a lesser extent forestry and fishing). Approximately half of all agricultural land in Myanmar is devoted to cereal crops, such as rice. Other agricultural products include beans, sesame, groundnuts, sugarcane, and hardwood. The agricultural sector is the primary employer in the Project area.

The crops cultivated in Yebyu Township are paddy, sesame, crane and corn. In addition, rubber, oil palm, betel and coconut are cultivated as long-term plantation. The main cash crops are rubber, betel, palm, cashew, jack fruit, rambutan, cane and durian. Other crops are pineapple and pepper. Cashew and betel nuts are sold at Dawei Market. Most of the household also own an orchard but few own a paddy rice field.

In addition to crops, livestock rearing is another source of income in Myanmar. A variety of animals are raised, including duck, cattle, water buffalo, goats, sheep, chickens, and pigs. In 2014/2015, duck was the most commonly raised livestock, with 18.3 million, followed by cattle and chicken.

In the Tanintharyi Region, the most commonly raised livestock is duck, followed by chicken. Villagers raise a variety of livestock, including pig, goat, duck, buffalo, sheep and poultry. However, more households are involved in crop production, than livestock rearing and even more in fishing.

In many instances the livestock are reared for personal consumption and in limited occasion, sold to the market. Both men and women are involved in the rearing of livestock. This includes fodder collection, dung cake preparation, milking and selling of milk or taking it to cooperatives, and vaccination and other veterinary services.

Forestry

Approximately 48% of Myanmar was covered by forest in 2011, but According to the FAO, between 2010-2015, Myanmar lost 3.2 million hectares of forests, about 10.8 per cent of its forest cover. In 2011, the forestry sector contributed approximately 0.5% to GDP, and employed approximately 36,000 people but the government has agreed a temporary national logging ban between August 2016 and March 2017, closing the forests for one complete logging season.

According to the land Record Department, the majority of the Yebyu Township is covered by forest land with 527,883 acres of forest reserves. Gurjan, Karen wood, dropping fig, Shiral, Dog fruit, Kalod, Burmese ironwood are the species the most commonly observed.

There is no forest reserve in the villages located in the study area and no villages have declared being involved in the forestry activity. The collection of forest products on the other hand is widely developed for household consumption in particular to collect wood for cooking. Villagers in the study area use wood for cooking. The wood is collected from areas close to the villages – e.g. nearby agricultural properties.

Fisheries

The fishing industry contributes approximately 8% to GDP. The industry is separated into three components – inland fisheries, marine fisheries and aquaculture. The marine sector makes up approximately 52% of the industry, followed by inland fisheries (27%) and aquaculture (20%).

Even though fishing is popular in some villages in the study area, it is generally not the primary livelihood in the study area. Fishing is significant especially in Pyin Gyi, Mi Gyaung Auing and Oh Pin Kwin and mainly takes place in Heinze river. The types of boats used in fishing are usually 5 meters long and the motor capacity is 5/6 hp. The boats' carrying capacity is about 300 kilos. Gillnetting, Drift Netting, Hook and Line, Hand and Crab trap are widely used for fishing in the studied area.

1.9.4 Community Infrastructure and Public Services

The limited access to and the poor state of existing infrastructure and services have been identified as impediments to development in Myanmar. This includes the provision of basic health and education services, as well as other infrastructure such as roads, telecommunications, drinking water and waste management (World Bank 2015).

Access to Electricity

In terms of lighting, a range of sources are available. The most commonly used are electricity, candle, and batteries.

The access to electricity is likely to change in the future given the investment that the Myanmar government is making in the power sector. A number of new power plants are being developed in order to provide an increasing number of people with electricity.

Most of the household in the study area have access to the electricity. Among these almost half of them get 24 hours service. Some villages only get electricity for 3 hours while the norm seems to be 10 hours per day. However, electricity shortage occurs frequently especially in the peak time during summer. For domestic energy, most of the household use gas and charcoal. People can purchase gas at Kanbauk and for charcoal they can buy the charcoal within the village which is imported from Min Thar Village.

Transportation

A variety of transport methods are used in Myanmar, including roads, rail, air and water. In some areas the various modes of transport are well developed, while in other areas they are quite limited.

Within the Project area, the main transportation mode is motorbike. Moreover, there are shuttle buses not only to other villages but also to Dawei. Most of the respondents travel to other villages almost every day. The roads in the study area are well maintained except the road between Kanbauk and Pet Taung.

Waste Management

In Myanmar, it is anticipated that approximately 0.45 kilograms of waste is produced per capita per day. This includes organic waste, commercial waste and paper and plastic waste. It is estimated that nearly 65% of the waste generated is organic waste. This is attributed to the size of the agricultural sector, as the agricultural sector largely generates organic waste.

In the study area, wastewater is largely directed back into the ground or into the nearest stream. Solid waste disposal is the responsibility of each household. Specific disposal areas exist in Kanbauk, Hle Gone and Mi Chaung Aing but there is no collective system or collect organized. Burning within the compound, dump in waste dump site or discharge into the nearest stream are common practice.

1.9.5 Cultural Heritage

Desktop study supplemented by field survey conducted identified no known archaeological resources; or ancient above ground resources but several items of living heritage sites within the cultural heritage study area. All the identified items are pagoda complexes and monasteries as well as churches and a mosque. Most of these items are located within or in close proximity to human settlements. No tangible cultural heritage resources were identified within the project's footprint (i.e. the CCPP site boundary and proposed water intake facilities and pipeline).

A range of national festivals and ceremonies (i.e. intangible cultural heritage) are held throughout Myanmar. Examples include the Water Festival and Myanmar New Year. Pagoda complexes and monasteries are often at the center of these festivals and ceremonies.

1.10 Stakeholder Engagement

Project stakeholders have been engaged at a number of points during development of the ESIA. The focus of the engagement activities has been to:

- Introduce the Project and provide ongoing updates as the design of the Project is further refined;
- Provide an overview of the likely impacts and proposed management measures and corresponding monitoring activities;
- Gather stakeholder insights and input, including feedback on the identified impacts, proposed management measures and monitoring activities; and
- Respond to key issues raised by stakeholders

Stakeholders were encouraged to ask questions and raise concerns throughout the engagement process. A range of issues and concerns were raised by stakeholders. Key issues included:

- Employment. Most of the villages indicated that they would like to benefit from the employment opportunities that will be created by the Project;
- Availability and quality of surface and ground water. Stakeholders expressed concern that Project activities (e.g. discharge of waste water, use of water from the Heinze River) may impact the quality of water and/ or reduce the amount of water available for use by local villagers;
- Access to electricity. Many of the Project area villages do not have access to reliable electricity. There is a keen interest from villagers to be address this issue through the Project, including regarding lower prices;
- Monitoring of the management plans and engagement taken by the Project Sponsor. Many villagers enquired about the responsibilities in term of monitoring of the Management Plans by the company or the ECD.
- CSR Programme. In all the villages, stakeholders expressed interest in MUPA's CSR programme in the area.
- Baseline. Some stakeholders requested to have access to the data collected during the baseline, in particular for surface water quality.

The issues and concerns captured during the stakeholder engagement activities have been incorporated into development of the ESIA. The information has been used to inform the impact identification and assessment process as well as the identification of management measures and monitoring activities.

Engagement will continue to occur throughout construction and operation of the Project and the comments received during Public Participation for the presentation of the draft study will be followed-up by MUPA, in particular regarding grievance redressal process.

1.11 Key Environmental And Social Impact Assessment

All construction and operation activities that were likely to cause environmental and social impacts were identified, and evaluated to assess their magnitude, duration, and potential receptors.

1.11.1 Construction Phase

The activities which have the potential to cause impacts on surrounding environment and receptors during the construction phase are identified as:

- Site preparation;
- Transportation of construction material and machinery for the power plant by road/ rail and heavy machinery/ equipment by barges up to temporary jetty location;
- Wastewater discharges and runoff, including contaminated surface water runoff, and increased erosion and sedimentation from excavation and foundation works; Inappropriate waste storage and disposal; and
- Pressure on local water supplies due to Project's water intake requirements.
- Dredging of water channel up to the temporary jetty depending on available water depth during the heavy lift transportation;
- Construction of the main buildings and infrastructure at the power plant and the water intake facilities including the pumping station, the water treatment facility and the water intake pipeline;
- Excavation of equipment foundations and installation of power plant components;
- Laydown areas for temporary use during construction phase;
- Storage and handling of hazardous materials, waste and wastewater; and
- Accommodation and transportation for the construction workforce and the Sponsor personnel.
- Vehicle movements over unpaved surfaces within construction areas and on unpaved roads;
- Earthworks including site clearance, site formation and levelling involving excavation and spoil dumping;
- Concrete batching;
- Construction of the main buildings and infrastructure at the power plant and the water intake facilities including the pumping station, the water treatment facility and the water intake pipeline; and
- Air emissions from construction vehicles and non-road machinery within the Construction site boundaries and on access roads.

Air Quality

The construction of the Project has the potential to generate dust and particulate matter (Total Suspended Particulate (TSP), PM10 and PM2.5) to air as a result of material transfer, soil movements, stockpiling materials and the use of construction vehicles on unmade access roads. Fugitive dust and particulate matter (PM) have the potential to cause health impacts on air sensitive receivers in the vicinity of construction activities if not managed accordingly.

Dust emissions from the Project site may also result in nuisance issues when depositing onto surfaces, for example, property, vehicles and washing. In addition, dust deposition can affect sensitive vegetation due to the soiling of leaves hindering photosynthesis and the blockage of leaf pores.

With implementation of the recommended control measures (namely, dust suppression measures and good site practices at the construction worksites), the magnitude of the air quality impact is considered to be **minor**.

Greenhouse Gas

During construction, the Project will involve Scope 1, Scope 2, and Scope 3 emissions as follows;

- Scope 1 direct emission mainly from mobile combustion from heavy machinery (e.g. excavators, bulldozers, cranes, etc.) and vehicles using diesel.
- Scope 2 indirect emission from purchased electricity.
- Scope 3 indirect emissions from transmission loss.

Based on the calculated GHG emissions, the emissions from the construction phase are estimated to be 3,079 tons CO_2e (Scope 1, Scope 2, and Scope 3). This is considered insignificant emissions according to IFC. GHG emissions are global pollutants. The concentration of GHG in the atmosphere beyond the level of naturally occurring concentrations could result in more heat being held within the atmosphere. Although overall the atmosphere is sensitive to impacts from GHG emissions, the local atmosphere is not expected to be any more or less sensitive to potential impacts to GHG.

Surface Water Quality

During the construction phase, potential water quality impacts may arise from wastewater discharge and runoff, inappropriate waste storage and disposal, and Project water use.

Potential impacts to surface water quality are expected to be long-term and localized in nature, and can be controlled with the implementation of good construction practices and adequate wastewater treatment systems on-site. Therefore, the residual impact is considered to be **minor**.

Noise

The construction activities of particular importance for potential noise impacts are: Site preparation, pile driving and foundation works, installation of equipment and construction of the infrastructure such as internal access roads, storm water drains and security fence.

The predicted noise levels at the two identified representative NSRs do not comply with the NEQ and IFC General EHS Guidelines during daytime period. Noise mitigation measures are considered necessary to mitigate the noise impact due to construction of the Project. With the implementation of mitigation measures (such as the use of noise barriers) the impact due to the construction of the Project is considered to be a **negligible** significance at the nearest receptors.

Landscape and Visual

Visual impacts from earthworks, light emissions, disturbance and physical presence of new facilities will be local to the confines of the Project Sites although some light emissions will be visible further away and any facilities higher than current fencing surrounding of the CCPP site will become more visible as they rise above it. Based on the implementation of the proposed mitigation measures, the significance of these impacts is considered to be a **minor to moderate** Negative Impact post mitigation.

Soil and Groundwater

During construction phase, the following impacts to soil and groundwater may occur:

- Loss of soil structure, quantity and quality due to improper management during site clearance activities;
- Soil and groundwater contamination due to improper construction waste storage and disposal;
- Soil and groundwater contamination due to improper discharge of waste water discharges and runoff; and
- Soil and groundwater contamination due to potential accidental leaks and spills.

Construction of the Project will be carried out by the EPC Contractor appointed by the Sponsor. The EPC Contractor will handle, store and dispose of all waste in accordance with applicable guidelines to prevent soil and ground water contamination. With other mitigation measures such as proper storage of chemicals and fuel, drip or spill trays for spills and leaks, site specific emergency response plan for soil clean –up and training by contractors, demarcating routes for heavy vehicle movement, retaining top soil for reuse, the impact to soil and groundwater would be mostly **negligible**.

Waste

During the construction phase, a range of waste materials will be generated either due to the daily activities of the construction workforce (e.g. generation of putrescible waste) as well as a range of general construction waste such as concrete, steel pipes, plastic pipes, steel plates, structural steel and wooden crates during the civil works phase of construction. Whilst most of these are likely to be non-hazardous, some of these may be hazardous include used paint, engine oils, hydraulic fluids, spent solvents, spent batteries etc.

Improper waste management may result in indirect impacts to community and work health and safety due to contamination of drinking water or food; accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters; and soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored. Implementation of proper mitigation measures including waste management plan (both non-hazardous and hazardous) will minimize the impacts. With implementation of the mitigation measures, the residual impact is expected to be **negligible**.

Terrestrial and Aquatic Biodiversity

Construction activities such as clearance of vegetation disturbance and displacement of species, mortality from machinery strike, and introduction of invasive species have the potential to impact the local and downstream biodiversity as well as impacts to priority biodiversity values.

Mitigation measures can be implemented to manage the disturbance during construction such that biodiversity values are **not significantly impacted** or impacts are reduced by the application of the mitigation hierarchy.

Community Health and Safety

The community health and safety impacts, as those associated with changes in environmental conditions, increased prevalence of diseases and heavy traffic movement are assessed as moderate. Impacts due to construction workers camp, laydown areas and logistics on the community health and safety will be temporary and can be considered as **moderate**.

Social Impacts

In terms of overall social impact, the construction phase in one hand will generate employment, benefit local enterprises, while on the flipside will cause labor influx, cause some displacement/disruption of communities, and will have noise and dust impacts to some extent. Mitigation measures include maximizing local procurement and employment to reduce and manage influx, labor management measures ensuring no local resources are indiscriminately used by the Project, developing resettlement and livelihood restoration plan, developing compensation plan, consultation with stakeholders, review of land acquisition/procurement, health interventions etc. The residual impact is expected to remain. However, it is considered to be **negligible**.

Cultural Heritage

There are no known archaeological or ancient above ground resources in the area; but a number of items of living heritage sites were identified within the cultural heritage study area.

No significant intangible cultural heritage was identified and no adverse impact is anticipated through interview with villagers and stakeholder's meeting. Religious buildings, in particular the Monastery located in Pyin Gyi may be impacted by construction activities of the Water Intake Facilities, in particular the pipeline laying activities. With the appropriate mitigation measures described in this report, the impact can be considered **negligible**.

1.11.2 Operation Phase

Air Quality

The key emission sources associated with the operation of the Project are stack emissions from the combustion of natural gas during plant start up, normal combined cycle operation; and from the combustion of diesel from the backup generator during emergency conditions.

The main substances of concern for a gas-fired combined cycle power plant and diesel generators include oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matters (PM) including respirable suspended particulates (PM_{10}) and fine suspended particulates ($PM_{2.5}$) [3].

Whilst emissions of SO2, PM_{10} and $PM_{2.5}$ are likely from the combustion of natural gas, they are expected to be minimal provided that the combustion process is efficient and the hydrogen sulfide (H_2S) content of the gas remains low. Thus, impacts on air quality from Project operations are considered **negligible**.

Greenhouse Gas

During operation phase, electricity for the Power Plant will be supplied by the Plant itself, so there would be no Scope 2 emissions to consider. Scope 1 emissions of GHG from the plant operation will mainly come from the gas turbine generators.

The emissions from Power Plant are calculated to be 1,570,642.28 tons of CO_2eq or 1.57 million tons CO2eq per annum. Compared to Myanmar's GHG emissions of 357.02 million tons CO_2eq in 2010, the total GHG releases from the Project is approximately 0.44%. The estimated GHG emissions from the Power Plant during operation will exceed the threshold that defines significant emitters of GHGs by the ADB SPS and EP III (100,000 tons CO2e per year) and IFC PS3 (25,000 tons CO2e per year). Therefore, the Project is required to implement

[3] PM_{10}: shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM_{10}, EN 12341, with a 50 %efficiency cut-off at 10 µm aerodynamic diameter;
$PM_{2.5}$: shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of $PM_{2.5}$, EN 12341, with a 50 %efficiency cut-off at 10 µm aerodynamic diameter. Definition from the European Union Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

measures for GHG reduction, and report annual GHG emissions as per the applicable reference framework.

The Project employs the most effective GHG reduction measure and mitigation measures have been put in place to monitor the GHG emission. As there will be no reduction in the impact level, the post-mitigation impact significance is considered a **moderate** Negative Impact.

<u>Surface Water Quality</u>

During the operation phase, potential surface water impacts may arise from domestic wastewater discharge, inappropriate waste storage and disposal, pressure on local water supplies due to Project’s water intake requirements, and impacts to surface water hydrology from increased impervious surfaces.

As the wastewater generated at various areas of the plant will be collected and treated at the wastewater treatment plant, meeting the discharge standards of the Myanmar NEQ and World Bank/ EHS guidelines, the impact is considered to be **minor**.

<u>Noise</u>

The sources of noise associated with the operation of the power plant are expected to include the heat recovery steam generators (HRSG), gas turbines, steam turbine and cooling tower.

The predicted operational noise levels at NSR1 exceed both the NEQ and IFC General EHS Guidelines during daytime and night-time periods, meanwhile, the predicted noise levels at NSR2 exceed noise criteria during night-time period. Noise mitigation measures are considered necessary to mitigate the noise impact due the operation of the Project. With the implementation of mitigation measures (such as the use of noise barriers) the impact due to operation of the Project is considered to be a **negligible** significance at the nearest receptors.

<u>Landscape and Visual</u>

The long-term presence of the Project is anticipated to have impacts upon both the landscape and visual amenity. For the CCPP plant there is just one stack, reaching up to 50m. While this is high, there is only one such tall structure that will be visible to a farther distance than the main CCPP Plant itself. The majority of the plant is considered to be no more than two-storey buildings with some taller facilities up to a maximum of 10m high. Overall, the bulk of the CCPP Plant is considered of medium scale within this rural context.

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **minor to moderate** Negative Impact post mitigation.

<u>Soil and Groundwater</u>

During the operation phase, potential soil and groundwater impacts may arise from:

- Loss of soil due to increased erosion potential during operations;
- Soil and groundwater contamination due to potential leaks, spills and leaks;
- Soil and groundwater contamination due to improper construction waste storage and disposal; and
- Soil and groundwater contamination due to improper discharge of waste water discharges and run-off.

It is noted that soil and groundwater contamination due to improper waste storage and disposal would be the result of contaminated surface water run-off being discharged from waste storage and disposal areas. Therefore, the impacts and mitigation measures are also discussed in surface water quality and waste management sections. With the implementation of good site practices and controls, the residual impacts are considered to be **negligible**.

Waste

The impacts on surface water, soil and groundwater contamination from generation of hazardous and non-hazardous wastes are assessed as **moderate**. The operations of the proposed Project would result in generation of various types of non-hazardous and hazardous wastes from office and canteens; gas turbine; laboratories; compressors; lube oil systems; DG sets; and power house and workshop area.

The solid waste generated during the operation phase will be collected and segregated for recycle and non-recycle waste (i.e. paper, plastic). Project will use incineration on site and compost. There will also be minimal other waste such as wood crates from maintenance activities which will be provided to the local community as fire wood.

MUPA will handle, store and dispose of all waste in accordance with applicable guidelines.

Further mitigation measures as the development of a waste management plan and periodic audits will be maintained. With implementation of the recommended mitigation measures, residual impact significance would be **minor**.

Terrestrial and Aquatic Biodiversity

Operational activities that have potential to disturb native fauna include the use of night lighting at infrastructure and facility locations. In addition, mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during transmission line maintenance vegetation clearing activities. However, the impact significance is considered to be **negligible to minor**. There are also no residual impacts to biodiversity values identified that require be offsetting or compensating.

Community Health and Safety

An increase in the transmission of communicable diseases may occur as the result of the introduction of workers into the area, creation of vector habitat, and/ or the presence of commercial sex workers.

Given the existing management measures, the local extent and scale of the impact, the impact was assessed as **moderate and negative**. The impact would have been assessed as minor, however, the duration (and consequence) of the impact was identified as potentially long-term – i.e. long-term health issues and in some cases death.

The Project will increase the number of vehicles using local roads and waterways through the transport of workers, goods, materials and machinery to and from the Project site, in particular during the construction phase. Due to the existing management measures, the local extent and scale of the impact, the impact was assessed as **moderate and negative** during construction, while **minor and negative** during operation. The impact would have been assessed as minor, however, the duration (and consequence) of the impact was identified as potentially long-term – i.e. the outcome of a traffic accident can have long-term implications.

Social Impacts

Some of the social impacts predicted due to the operations of the Project are Employment Generation and In-Migration of Skilled workforce resulting in increased opportunities for local business which will have a **positive impact** on local stakeholders.

During construction, the workforce will reach 600 workers. Although the company will try to source workforce from local villages, when possible, it is anticipated that a number of workers will come from other areas. The introduction of projects such as the one proposed may induce the arrival of unskilled workers (indirectly related to the Project) and opportunistic job-seekers into the Project SAoI. Influx in the SAoI could also place additional pressure on existing infrastructure and services.

The impact of influx is widespread and the entire community in the Project SAoI could be affected. Vulnerable community stakeholders and public infrastructures and services could be particularly impacted as well as users of the road between Kanbauk and Pyin Gyi. The impact of the Project pre-mitigation on community health is considered a **moderate** negative Impact and **negligible** after mitigation.

1.12 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

1.12.1 Mitigation Measures

Many of the mitigation measures suggested during the construction phase of the Project associated with good construction and housekeeping practices and are included in the Environmental and Social Management Plan (ESMP).

Mitigation measures for the operation phase (such as those for air emissions and noise generation) of the Project are part of the design and will be incorporated into the Project design specifications.

The construction phase of the Project is anticipated to be 30 months, whereas the operation phase of the Project is 30 years, as per the Power Purchase Agreement.

A summary of mitigation measures identified for the construction and operation phases of the Project is presented in the ESMP. This also identifies lead responsibility for implementing of the mitigation measures and its verification along with reporting requirements and sources of funds for such implementation.

The project proponent and sub-contractors will ensure that the mitigation measures stated in the ESMP are implemented throughout the life span of the Project.

Table 1. 1 Summary of Environmental Management Plan

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
A	***Site Preparation and Construction Phase***							
1.1	Air Quality	Construction activities	Impact to air quality due to dust emissions	• Where movement of friable material occurs, localized and activity specific dampening should be used, vehicles transporting dusty materials should be covered and Wind breaks should be erected to reduce localized emissions of dust. • Where unpaved roads are utilized by vehicles, water suppression at a rate of two (2) liters/m^2/hr. should be used where rainfall of less than two (2) mm in the last hour has occurred or surface binding agents should be used to more permanently reduce dust generation, where vehicles are to use that road in the next hour during the dry season period. • Wheel washing should be used prior to entry onto a sealed road section to avoid tracking dirt onto sealed roads and generating dust. • Stockpiling of material, for example, rocks, sand and soils should be minimized. Machinery and dust causing activities should be located as far away from air sensitive receivers as possible.	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost
1.2	Air Quality	Operation phase	Impact to air quality due to NOx emissions	• Emergency diesel generators will be designed, operated and maintained in line with the IFC General EHS Guidelines for Air Emissions and Ambient Air Quality and will be situated as far as reasonably practicable from air sensitive receivers in the study area where the emission concentration of feasible NOx shall not exceed and should be reduced. • Continuous emission monitoring and real-time measurement of NOx.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
1.3	Air Quality	Monitoring	Impact to air quality due to dust and NOx, SO2	• Monitoring of PM_{10} should be undertaken using hand-held monitors to confirm the effectiveness of the site controls during the site walkovers. • Any impacts to air quality during the construction phase should	Appointed EPC Contractor	Designated EHS team on site	Monthly monitoring report to the	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
			and PM emissions	be investigated, the cause determined and actions taken to reduce those emissions in a timely manner. • The main stack (33T/78RH-100GT) will be fitted with continuous emission monitoring capable of real-time measurement of NOx and transmitted to the operator control room. • Meteorological monitoring should be performed at one location, unaffected by site buildings etc. to inform use of mitigation on site during construction period.			Project Proponent	
2.1	Greenhouse Gas	Construction activities including Operation of heavy machinery and transport vehicles	GHG emissions	• Implement the same mitigation measures to minimize impacts to Air Quality. • Develop and implement preventive vehicle maintenance plan for machines, and engines to ensure combustion efficiency.	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost
2.2	Greenhouse Gas	Monitoring	GHG emissions	• Conduct annual pollutant release inventory and the GHGs emission shall be reported as CO_2eq unit. • Where feasible, arrange emissions offsets (including the Kyoto Protocol's flexible mechanisms and the voluntary carbon market), including reforestation, afforestation.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Annual internal reporting	Project proponent Cost
3.1	Surface Water Quality	Wastewater Discharges and Runoff	Impacts to surface water due to wastewater discharges and runoff, inappropriate waste storage and	• For the construction workforce, project shall give trainings and implement adequate sanitary facilities to use and for the waste disposal in designed area. • Wheel cleaning facilities, exposed soil surfaces, sand bag barriers, mulching, and re-vegetation, protect temporary trafficked areas on-site with coarse stone ballast or equivalent, open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
			disposal, and water use during construction phase	rainstorms. • Regularly, and particularly following rainstorms, install, inspect and maintain drainage systems, erosion control and silt removal facilities to ensure proper and efficient operation at all times to treat surface run-off from bunded areas and Liquid effluents from construction activities under the rate of applicable IFC guideline. • Oil-contaminated water, if any, will be collected and handled by local licensed wastewater sub- contractors (if available, to be determined at a later stage) and should pass through oil/water separators prior to discharge to the stormwater system. • Implement construction materials inventory management system to minimize over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period. • Segregate hazardous and non-hazardous waste are being provided with appropriate containers by the type of wastes (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odor nuisance). • Dispose of waste by appropriate contractors. • Install onsite wastewater treatment facilities or processes such as filtration, flocculation or biochemical treatment before discharge.				
3.2	Surface Water Quality	Operation phase	Impacts to surface water due to Wastewater Discharges and runoff, and inappropriate waste storage and disposal	• Conduct monitoring of temperature at the cooling water discharge point at a frequency of once every 7 days and Implement discharge system shutdown in event that discharge temperature of effluent exceeds standard. • Separated oil will be disposed of as part of oily wastes and handled as a hazardous waste stream. The treated de-oiled water will be discharged with the plant wastewater. The Project will study the possibility to transfer to cooling water basin and used as part of cooling water stream during detailed engineering. • The sewage and liquid effluents from the entire plant area will	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project Proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				be collected and treated in a sewage treatment plant (STP) in accordance to the applicable WB/IFC EHS Guidelines for Thermal Power Plant (2008). No untreated sewage will be directly discharged into the Heinze River or surrounding the site, or disposed of on land, for the duration of the project life cycle. • In order to monitor STP performance, continuous evaluation and monitoring of discharge parameters will be undertaken at the outlet point of STP. • Segregate hazardous and non-hazardous waste are being provided with appropriate containers by the type of wastes (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odor nuisance) • Store waste systematically to allow inspection between containers to monitor leaks or spills and keep away from direct sunlight, wind and rain. • Dispose of waste by appropriate contractors.				
3.3	Surface Water Quality	Operation Phase	Pressure on local water supply due to Project's water intake requirements and increased impervious surfaces	• The Project commits to comply with following WB/IFC EHS Guideline measures or equivalent of them that are pertinent to river water intake systems. • Ensure that drainage channel has enough capacity to accommodate the increased rainfall runoff from the Project's impervious surface.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project Proponent Cost
3.4	Surface Water Quality	Monitoring of surface water quality	Impacts to surface water due to wastewater discharges and runoff, inappropriate waste storage and disposal, and water	• As detailed in the ESMP chapter, monitoring for surface water during the construction phase should consist of half-yearly monitoring up and downstream of the pumping station in the Heinze River, using standard analytical methods.	EPC Contractor through 3rd Party Environmental Consultant	On site Project Management team and designated EHS team	Monitoring report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
			use					
3.5	Surface Water Quality	Monitoring of surface water quality	Impacts to surface water due to wastewater discharges and runoff, inappropriate waste storage and disposal, and water use	• As detailed in the ESMP chapter, monitoring for surface water during the operation phase should consist of the following: ○ Temperature monitoring at cooling water discharge point, once a week, using standard analytical methods. ○ Quarterly monitoring at wastewater discharge point, using standard analytical methods.	Project Proponent or LTSA through 3rd Party Environmental Consultant	On site Project Management team and designated EHS team	Monthly internal reporting	Project Proponent Cost
4.1	Noise	Overall construction activities inc. heavy machinery operations for construction works	Increase in ambient noise levels	• The use of noise barriers will be an effective means to mitigate the noise impact arising from the construction works. ○ Noise barriers should be installed at the site boundary (facing the villages) and high enough which completely hides the noise sources from the NSR. ○ The noise barrier material should have a superficial surface density of at least $7kg/m^{-2}$ and have no openings or gaps. • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components. • Shut down or throttled down between work periods for machines and construction plant items (e.g. trucks) that may be in intermittent use. • Reduce the number of equipment operating simultaneously and locate noisy plant (such as hydraulic hammer and lorry mounted concrete pump) as far away from receptor as practicable; • Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost
4.2	Noise	Operation phase	Increase in ambient noise levels	Other than implementation of noise barriers and installation of silencers, good site practices are recommended to be implemented by the EPC contractor to minimize the potential noise impacts during the operation phase, including:	Project Proponent or LTSA	On site Project Management team and designated	Monthly internal reporting	Project proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Selecting equipment with lower SWLs. • Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas. • Re-locating and siting permanent noise sources to less sensitive areas to take advantage of distance and shielding. • Installing vibration isolation for mechanical equipment. • Installing acoustic enclosures for equipment casing radiating noise and apply sound insulation. • Taking advantage of the natural topography as a noise buffer during facility design. • Reducing noise of ground operations at the source or through the use of sound barriers and deflectors.		EHS team		
4.3	Noise	Monitoring	Increase in ambient noise levels	• Monthly noise monitoring should be conducted at the representative NSRs by the EPC contractor to check noise levels and compliance at the NSRs throughout the construction phase. • Noise commissioning test should be conducted for the operation plant items by the EPC contractor prior to the operation of the Project to ensure compliance with the relevant noise criteria at the representative NSRs.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

5.1	Landscape and Visual	Construction activities	Visual impacts due to construction activities and the construction of project infrastructure	• For temporary earthworks areas, including outside the Project site, minimize clearing of vegetation as far as practicable.
				• Good construction practice, including hoarding of construction site(s)
				• Landscape extensive areas within the proposed site with a variety of planting
				• Manage lighting of construction site(s) and any flare testing activity to consider minimization of light pollution/ light spill
				  ○ e.g. minimize test flaring activity and conduct during the day
				  ○ e.g. Use shielding, directional alignment and window coverings (e.g. at worker accommodation) that minimize external visibility of indoor lighting
				  ○ e.g. Minimize lighting use and light intensity to as low as reasonably practicable.
					Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
5.2	Landscape and Visual	Operation phase	Visual impacts during operations due to the physical presence of new facilities, light emissions (including any flaring) and disturbance.	• Careful design to contain light to areas that need illumination and prevent light spill/ glare e.g. consider: ○ Shielding, directional alignment and window coverings that minimize external visibility of indoor lighting. ○ Minimize lighting use and light intensity to as low as reasonably practicable. • Careful design to improve aesthetics e.g. consider: ○ Texture of building material to blend with landscape/sky. ○ Paint/ Treat large components (e.g. flare stack, offices, storage buildings, stacks) to blend in with the landscape/sky. ○ Establishing viewing corridors between buildings to maintain view through the site/ to key views such as pagodas etc. • Ensure trees/ shrubs are planted along the boundary of the site to act as screening. • Maintain all facilities in good repair and ensure all soft landscaping within the site is well maintained. Replace any soft landscaping if not in good health.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
5.3	Landscape and Visual	Monitoring	Visual impacts from construction activities and operation of the Project	• General site inspections during construction. • Preparation of a landscape plan and Lighting Management Plans for construction activities and for operation of the CCPP Plant including Water supply site and facilities.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
5.4	Landscape and Visual	Monitoring	Visual impacts from construction activities and operation of the Project	• Preparation of Lighting Management Plan for operation of the CCPP Plant. • Ensure the Water Supply facilities are included in Lighting Management Plan prepared for the whole Project.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
6.1	Waste	Disposal of	Impacts due to improper disposal	• No vegetation is to be disposed of by burning under any circumstances. • Generally, biomass such as trees, shrubs and grass are utilized by	Appointed EPC Contractor	On site Project Management	Report to the Project	EPC Contractor

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
		Removed Biomass	of removed biomass	the local community for a variety of purposes. • MUPA will engage with the local community to ensure that they are provided with priority access to all of the biomass. In order to ensure public safety and limit access to the site, MUPA will first clear of the biomass and store it in a designated area where the local community are easily able to access it. • Any biomass not taken by the local community biomass is to be appropriately stored (or immediately mulched) for later use within site stabilization and rehabilitation activities.		team	Proponent during site clearance	Cost
6.2	Waste	Solid Waste Generation, Storage and Disposal during construction	Impacts to community and worker health and safety due to contamination of drinking water or food Accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters Soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored.	• All waste collection and storage measures as detailed within Chapter 9 and Chapter 12 (Surface Water, Soil and Groundwater) will be implemented. • Prior to construction commencing, MUPA is to engage with local authorities and other stakeholders to determine the capacity of the local waste management network to absorb the new waste streams during construction. • A waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the construction phase for all of the waste streams identified. • Education of all workers on site shall be undertaken to avoid, reduce and reuse wastes generated. • Waste disposal facilities shall be sited and signposted throughout the construction site. • Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing IFC requirements and Monitor. • The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
6.3	Waste	Solid	Impacts to	• All waste collection and storage measures as detailed within Chapter 9 and Chapter 12 (Surface Water, Soil and Groundwater)	Project	On site Project	Monthly	Project

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
		Waste Generation, Storage and Disposal during operation	community and worker health and safety due to contamination of drinking water or food Accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters Soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored.	will be implemented. • An operation waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the operation phase for all of the waste streams identified. • Education of all employees on site shall be undertaken to avoid, reduce and reuse wastes generated. • Waste disposal facilities shall be sited and signposted throughout the site. • Waste clean-up measures are to be undertaken on at least a fortnightly basis to collect any waste. All waste collected should be managed and disposed of in accordance with the accepted best practice for waste collection and disposal. • Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing NEQ and IFC requirements and Monitor. • The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.	Proponent or LTSA	Management team and designated EHS team	internal reporting	Proponent Cost
6.4	Waste	Monitoring	Impacts of solid waste generation, storage and disposal upon the existing waste management network during construction, operation and maintenance	As specified in the ESMP, monitoring of waste during both the construction and operation phases should consist of the following: • Monitoring of waste segregation, transportation and disposal practices in the Project activity areas and disposal location, as to be defined in a Waste Management Plan to be prepared specifically for the Project. • Monitoring of appointed waste contractors using chain-of custody documentation, as to be defined in a Waste Management Plan to be prepared specifically for the Project.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent	EPC Contract or Cost during Construction; The Project Proponent (Operator

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
								) Cost during Operation
7.1	Soil Quality	Construction activities	Impacts to soil due to topsoil loss	• Delineation of clearance boundaries to limit the areas and scheduling activities (if possible) to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Revegetation areas with temporary land use, conducting progressive rehabilitation. • Demarcate routes for movement of heavy vehicles to minimize disturbance of exposed soils and compaction of sub-surface layers. • Reuse topsoil as much as possible within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins. And • Stockpiles to be separated into topsoil and sub-soil and be located at least 50m from any surface water source or groundwater well and be located in areas surrounded by natural wind barriers to minimize the potential for wind erosion. • Topsoil heights are to be restricted in height to 2m above ground level to minimize wind erosion, and they are only to be partially compacted on the upper layer in order to promote aeration, maintain soil vertical structures, reduce runoff and encourage infiltration.	Appointed EPC Contractor	On site Project Management team	Route plans and top soil management inventory submitted to EHS and Project Management team	EPC Contractor Cost
7.2	Soil and sediment Quality	Operation phase	Impacts to soil due to loss of soil due to increased erosion potential	• Ensure that drainage channel have enough capacity to accommodate the increased rainfall runoff from the Project's impervious surfaces	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
7.3	Soil and sediment Quality	Monitoring	Impacts to soil due to loss of soil due to increased erosion potential	As detailed in the ESMP chapter, monitoring for soil during the operation phase should consist of half-yearly monitoring at locations of accidental spillage, waste storage areas, using standard analytical methods.	Project Proponent or LTSA	On site Project Management team and designated	Half yearly internal reporting	Project Proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• No groundwater monitoring is anticipated to be required during the operation phase.		EHS team		
8.1	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Loss of habitat	• Strict rules against clearing vegetation will be imposed on all Project staff, workers, and all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws. • The Project Proponent shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning restrictions related to unauthorized clearing of vegetation, as well as the punishment. • Use of the access road should be restricted to construction and operation vehicles only. • Checkpoints should be used to manage access and inspect vehicles for timber and forest products taken from the Project Area.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.2	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Disturbance to fauna behaviors	• Operational vehicles will be maintained in accordance with industry standard to minimize unnecessary noise generation. • Traffic signs will be maintained on all roads depicting speed limits. • For operational areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible. And • Commitment will be made to raise awareness of the operator work force regarding flora and fauna values and decide for restriction of hunting and poaching.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.3	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Impacts to species of conservation significance	• Management measures for the population of *Sonneratia griffithii* are to be outlined in a Biodiversity Action Plan; • Individuals of *Sonneratia griffithii* are to be marked in the Project Area and avoided during construction and operation; • During construction, monthly inspections are to occur of the intertidal zone for any impacts from construction activities on individuals of *Sonneratia griffithii*. Where impacts are detected, measures must be undertaken to rectify the source of the impacts.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
8.4	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Degradation of habitat	• For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilize disturbed soil surfaces. • Oil, chemical and solid waste, construction and domestic waste will be stored, and handled and disposed of by appropriate waste management contractors to avoid attracting native and alien species to the construction and camp areas. • Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to limit noise and dust generation.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.5	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Mortality of resident species through vehicle/ machinery strike as well as hunting/ poaching	• Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to minimize potential for fauna strike. • Commitment will be made to raise awareness of values of important species and habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection by staff. • Access restriction should be applied to Project facilities for non-construction and operation vehicles. • Hunting wild animals, Fishing and using of illegal fishing gear anywhere along the stream will be strictly prohibited for all staff.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
9.1	Occupational Health and Safety	General construction activities	Health and safety of construction workforce	The Project will develop and implement an Occupational Health and Safety Management Plan (OHSMP) in line with good industry practice and corporate policies. • The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilization, construction sequence and safety arrangements. • A Permit to Enter system will be established to ensure that only authorized persons gain entry to the site. • Competent and adequately resourced sub-contractors will be used where construction activities are to be sub-contracted. • All persons working on site will be provided information about	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				risks on Site and arrangements to discuss health and safety with the Contractor. • Personal Protective Equipment (PPE) shall be worn at all times on the Site. Non-slip or studded boots will be worn to minimize the risk of slips. • All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded. • All scaffolding will be erected and inspected in conformity with the Factories Act (1951) and the appropriate records maintained by the Contractor. • When there is a risk of drowning, lifebelts shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, safety hoops or cages for height in excess of two meters and that rescue personnel are present when work is proceeding (near the temporary jetty site) and will be properly maintained and thoroughly examined at least once a month, and after every occasion on which it has been used. • Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate a Leq of more than 85 dB(A). When hearing protection is used, arrangements will be made to ensure the wearers can be warned of other hazards. • The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations. • The EPC contractor will comply with the IFC Performance Standard 2 Requirement 1: Environment for labor and working conditions. • Develop and monitor an internal standard to guide labour practices and apply this to supply chain to ensure that no child and/or forced labour will be employed by the EPC contractor and its sub- contractors.				

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
9.2	Occupational Health and Safety	Monitoring and review of accidents/ incidents due to construction activities; workers' health		• Yearly review of training log to confirm all employee are trained on the company H&S standard; • Monitoring and review of accidents/ incidents due to construction activities; workers' health by daily monitoring and monthly review of near-misses, incidents, occupational diseases, dangerous occurrences, accidents at project activity areas and construction workers camp, as per construction phase Health and Safety Plan, which will be prepared by the EPC contractor. • Development of the Occupational health and safety monitoring and surveillance programme.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
10.1	Community Health	Influx of construction workers	Increased prevalence of disease	• In partnership with local health officials, government authorities and relevant NGOs, MUPA will undertake information, education and communication campaigns around hygiene, sanitation, safe sexual practices and transmission of STIs and HIV/AIDS for all workers on the transmission routes and common symptoms of communicable diseases which can be control by developing a complementary occupational health and safety plan and prevent by the pre-employment screening process to minimize the transmission of communicable diseases. This will help reduce the potential for the workforce to subsequently introduce the disease in their home village/ community. • Ensure there is access to free condoms (including female condoms) at the worker camp to promote safe sexual practices. This can help reduce the potential for workers to unknowingly transmit communicable diseases. • Establish amenities at the camp to help minimize the interaction between the workforces (particularly temporary construction workers) and local villagers. This includes recreation facilities and health care infrastructure. • In collaboration with the local and regional Government, local emergency providers and local health care facilities, MUPA will develop and implement Emergency Prevention, Preparedness and Response Plans (EPPRPs) to cover all incidents presenting	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				risks to public safety and the affected communities in proximity to the Project Sites and the environment. • Develop and implement a Workforce Code of Conduct. The Workforce Code of Conduct will be adhered to by all Contractors, sub-contractors and MUPA employees. Any employee or Contractor found in violation of the Code shall face disciplinary hearing which may result in dismissal. Include in the code specific measures that target anti-social behaviors, such as becoming involved with commercial sex workers.				
11.1	Community Safety and Security	Construction activities, construction material transportation	Community disturbance and potential safety hazard due to road traffic	• Develop and implement a traffic management plan. The plan should set out measures to minimize the risks associated with transporting materials, goods, and workers to and from site. This includes: ○ fatigue management ○ Forbidding non-Project passenger transport, reckless driving and cellular telephone use whilst driving. ○ Forbidding alcohol and drug use (including Bettel). ○ Forbidding stopping at any location except MUPA controlled compounds. And ○ General safe driving practices including vehicle speeds. • Ensure all employees complete training prior to driving any Project vehicles. The content of the training should be tailored to the employee's role. • Develop and implement waste management plan. The plan should set out procedures for appropriately managing and disposing of hazardous materials and other forms of waste. • Develop and implement a Road Safety Awareness Campaign. MUPA will implement a road safety awareness campaign in the Project SAoI to improve community knowledge of the dangers of industrial road traffic and safe behaviors in and around roads for security personnel and monitor implementation of the training over time (to minimize any potential use of excessive force). This programme will be implemented with a suitable and experienced local partner or NGO and in partnership with the	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				local government. Such a program may be targeted at schools to help disseminate road safety information to children who may be particularly vulnerable to vehicle traffic. • MUPA will establish a livestock compensation framework that defines the process and rates for compensation for livestock that are injured or killed in Road traffic accidents. The Project Stakeholder Engagement Programme will include engagement activities with potentially affected communities to discuss and agree this framework. • MUPA will implement a stakeholder engagement, consultation and information disclosure process prior to use of the proposed road connection during construction. This will allow stakeholders to understand the upcoming increases in vehicle traffic, the plans for vehicle movements and driving policies, and to provide feedback on construction / transportation plans. • MUPA will establish an Emergency Response Plan (ERP) for the Project SAoI that details the agreed protocols, process, engagement and investigation processes for various relevant potential emergencies (Road Traffic Accidents - RTAs, spillage etc.). The ERP will include management and monitoring requirements as well Key Performance Indicators (KPIs) related to emergencies and emergency response. • Develop and communicate to local community the Grievance mechanism to report grievance from local population and employee regarding the Project activities.				
11.2	Community Safety and Security	Construction activities	Impacts on local infrastructure	Provide appropriate amenities at the workforce accommodation camp – e.g. recreational opportunities. This will help reduce the need for workers to utilize local infrastructure and services. • MUPA will ensure that company medical services have sufficient capacity and capability to treat a reasonable number of workers at the same time. • MUPA will engage with local authorities and public service	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				providers to discuss specific influx impact calming measures and to develop a Project in-migration plan. • MUPA will conduct a traffic survey on the Pyin Gyi to Kanbauk road and develop the design of the road and to minimize the impact experienced by road users as a result of the Project. • Develop and implement a social investment/ corporate social responsibility plan/ program in consultation with local stakeholders. As part of the plan, MUPA should explore opportunities to enhance community infrastructure and services. And • Develop and implement a community health management plan and an occupational health and safety plan in consultation with relevant stakeholders (e.g. local health practitioners). These plans will ensure that appropriate and adequate health care services are provided on site and at the accommodation camp to address/ manage worker illnesses and injuries.				
12.1	Employment and Economy	Construction, operation and decommissioning	Employment Opportunities and opportunities for local business	In order to maximize the benefits from this impact for the local population, wherever possible, the workforce will be sourced from areas close to the Project after a training and selection process and thereafter at a regional or national level. Given that levels of educational achievement and formal employment experience in relevant sectors is low within the SAoI. The Project will develop a Sourcing, Procurement and Recruitment Management Plan which will be developed for this Project with the aim to promote benefits to locals from recruitment and procurement activities for the Project (including information, training, and engagement). A key element of this will be to promote equal opportunity and non-discrimination throughout the recruitment and procurement process.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent and monthly internal reporting during operation and decommissioning	EPC Contract or Cost during Construction; The Project Proponent (Operator) Cost during Operation

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
13.1	Cultural Heritage	Construction, operation and decommissioning	Impact on cultural heritage buildings and access to Monastery.	• The EPC contractor will develop the construction planning for the water intake pipeline in discussion with the monastery in Pyin Gyi in order to make sure that the pipeline laying activities near the monastery do not take place during special religious activities.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent and monthly internal reporting during operation and decommissioning	EPC Contract or Cost during Construction; The Project Proponent (Operator) Cost during Operation

1.12.2 Monitoring Programme

Key roles and responsibilities of the Sponsor and the appointed EPC contractor have been defined for implementation and monitoring of environmental and social impacts. For environmental monitoring, physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator will be prepared for all phases of the Project which gives parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

Table 1. 2 Summary of Environmental Monitoring Plan

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Site Preparation and Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas and construction workers camp	Visual inspection of all active work areas	Daily	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Air Quality	Ambient Air Pollution	1-hour and 24- hour averaged NO_2 and SO_2 24-hour averaged $PM_{2.5}$, PM_{10}	1. (AQM1: 14º 35’ 39.20” N, 98º 01’ 30.00” E, Hle Kon Ward, Kanbauk Village) (Baseline AQ Measurement) 2. (AQM2: 14 º 36’ 15.43” N, 98 º 01’ 40.05” E, Migyaung Aing Ward, Kanbauk Village) (Baseline AQ Measurement) 3. (AQM3, 14 º 37’ 28.10” N, 98 º 02’ 49.40” E, Shinpyan Village, Ye Pyu Township) (Baseline AQ Measurement)	24-hour measured by EPAS-Haz Scanner	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (6,000,000 MMK/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			4. Construction Site of Proposed Project (14°36'40.25"N, 98° 1'51.41"E) 5. Construction Area of Water Intake Facility (14°38'18.15"N, 98° 1'14.27"E) 6. Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)				
Noise Level	Increase in ambient noise levels*	Noise levels in Leq, Leq day, Leq night and hourly Leq	1. (AQM1: 14º 35' 39.20" N, 98º 01' 30.00" E, Hle Kon Ward, Kanbauk Village) (Baseline AQ Measurement) 2. (AQM2: 14 º 36' 15.43" N, 98 º 01' 40.05" E, Migyaung Aing Ward, Kanbauk Village) (Baseline AQ Measurement) 3. (AQM3, 14 º 37' 28.10" N, 98 º 02' 49.40" E, Shinpyan Village, Ye Pyu Township) (Baseline AQ Measurement) 4. Construction Site of Proposed Project (14°36'40.25"N, 98° 1'51.41"E)	24-hour measured by Digital Sound Level Meter	Quarterly	Third Party hired by the Project Proponent	EPC Contractor Cost (300,000 MMK / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			5. Construction Area of Water Intake Facility (14°38'18.15"N, 98° 1'14.27"E) 6. Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)				
	Workers Health*	Noise levels in Leq	Identified location within the construction area	24-hour measured by Digital Sound Level Meter	Monthly	EPC Contractor	EPC Contractor Cost (included in Capex cost)
Soil	Contamination of soil*	pH, salinity, NH_4, total P, heavy metals	1. Construction site or laydown area or spill area 2. Baseline Soil Condition Construction Site of Proposed Project S1: (14°36'45.00"N, 98° 1'51.65"E)	Standard analytical methods**	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	Third Party hired by the Project Proponent	EPC Contractor Cost (2,000,000 MMK / time)
Surface Water	Contamination of surface water*	pH, Electrical Conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium	1. Heinze Chaung River (upstream of the pumping station, 14°38'24.10"N, 98° 1'14.86"E) 2. Heinze Chaung River (Downstream of the pumping station 14°38'23.62"N, 98° 1'4.14"E) 3. Mi Gyaung Aing Chaung (upstream, 14°36'23.61"N, 98° 1'51.47"E) 4. Mi Gyaung Aing Chaung (downstream,	Standard analytical methods**	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (3,500,000/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		(Cd), Mercury (Hg); Arsenic (As).	14°36'25.90"N, 98° 1'47.80"E)				
Ground Water	Ground Water Pollution	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb), Mercury (Hg), Arsenic (As).	1. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N) 2. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 3. One village house at Pyin Gyi (14°38'15.38"N, 98° 1'3.44"E) 4. One village house at Mee Kyaung Aing (14°36'33.91"N, 98° 1'43.50"E)	Standard analytical method**	Once a year	Third Party hired by the Project Proponent	EPC Contractor Cost (2,400,000 MMK/time)
Sedimentation	Sediment Contamination*	pH, salinity, NH_4^+, total P, heavy metals, TSS	1. Locations, to be defined on a case-by-case basis. 2. Construction Area of Water Intake Facility (14°38'18.15"N, 98° 1'14.27"E) 3. Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)	Standard analytical methods**	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals Frequency to be defined on a case-by-case basis.	Third Party hired by the Project Proponent	EPC Contractor Cost (3,600,000MMK/ time)
Occupational Health and Safety	Accidents or incidents due to construction	Near-misses,	Project activity areas and construction workers camp	As defined in construction phase Health & Safety	As defined in H&S Plan	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
	activities, workers' health	incidents, occupational diseases, dangerous occurrences		Plan to be prepared by EPC contractor			
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Access Road connecting site	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Public concerns	Complaints from community	Neighboring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Project Company	EPC Contractor Cost (included in Capex cost)
Operation Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	Plant EHS Team	Included in operation and maintenance (O&M) cost
Air Emissions	Stack emissions*	NOx, SOx	Main stack and by-pass stack	CEMS Annual stack emission test: following USEPA method or equivalent	Continuous and Annually	Plant EHS Team	Installation included in EPC Cost Monitoring and maintenance in O&M cost (10,000 USD / time)
Air Emissions	Ambient air quality*	1-hour and 24- hour averaged NO2 and SO2 24-hour averaged PM, PM10 and PM2.5	1. Project Site (14°36'40.25"N, 98° 1'51.41"E) 2. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N) 3. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 4. One village house at Pyin Gyi	Method published by International Organization for Standardization, or USEPA or European Committee for Standardization or equivalent	Twice a year	Third Party hired by the Project Proponent	6,000,000 MMK/time

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			(14°38'15.38"N, 98° 1'3.44"E) 5. One village house at Mee Kyaung Aing (14°36'33.91"N, 98° 1'43.50"E)				
GHG Emissions	Climate change	GHG generation	Plant control room	Natural gas consumption Pollutant release inventory	Annually	Plant EHS Team	Included in operation and maintenance (O&M) cost for disclosure
Noise	Increase in ambient noise levels*	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified NSRs within 500 m from the Project boundary	24-hour measured by Digital Sound Level Meter	Quarterly	Power Plant's EHS team	Included in operation and maintenance (O&M) cost
	Workers Health*	Noise levels in Leq	1. Identified location within the plant area 2. Water Intake Facility near Pyin Gyi Village (14°38'18.15"N, 98° 1'14.27"E)	24-hour measured by Digital Sound Level Meter	Monthly	Power Plant's EHS team	
Surface Water	Surface Water Quality*	Temperature	At wastewater discharge point	Standard analytical method**	Once a week	Power Plant's EHS team	Included in operation and maintenance (O&M) cost
	Surface Water Quality*	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended	1. At wastewater discharge point 2. Heinze Chaung River (upstream of the pumping station, 14°38'24.10"N, 98° 1'14.86"E) 3. Heinze Chaung River (Downstream of the pumping station 14°38'23.62"N, 98° 1'4.14"E)	Standard analytical method**	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (4,000,000 MMK/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As).	4. Mi Gyaung Aing Chaung (upstream, 14°36'23.61"N, 98° 1'51.47"E) 5. Mi Gyaung Aing Chaung (downstream, 14°36'25.90"N, 98° 1'47.80"E)				
	Surface Water Quantity	Intake Flow Rate Flow Rate of Heinze River	At water intake location	Continuous monitoring of water intake quantities and flow rates in the Heinze River.	Continuous	Plant EHS team	Included in operation and maintenance (O&M) cost
Ground Water	Ground Water Pollution	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb),Mercury (Hg), Arsenic (As).	1. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N) 2. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 3. One village house at Pyin Gyi (14°38'15.38"N, 98° 1'3.44"E) 4. One village house at Mee Kyaung Aing (14°36'33.91"N, 98° 1'43.50"E)	Standard analytical method**	Once a year	Third Party hired by the Project Proponent	EPC Contractor Cost (2,400,000 MMK/time)
Soil	Soil and Sediment Contamination*	pH, salinity, NH_4^+, total P, heavy metals, TSS	Accidental spillage area and waste storage area	Standard analytical methods**	On occurrence for accidental spill and	Third Party hired by the Project Proponent	O&M Cost (1,000,000 / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
					Half Yearly		
Waste	Soil and Groundwater contamination	Monitoring of waste segregation, transportation and disposal	Project activity areas, disposal site.	As to be defined in the Waste Management Plan to be prepared for the Project	As defined in Waste Management Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
	Inappropriate waste disposal by waste contractor	Monitoring of appointed waste contractors using chain-of custody documentation	Project site Waste contractor documentation	Chain of custody documentation	As defined in Waste Management Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
Occupational Health and Safety	Accidents or incidents due to operation and maintenance activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As to be defined in the H&S Plan to be prepared for the Project	As defined in H&S Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Access Road	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of the Project Proponent	Included in operation and maintenance (O&M) cost
	Discharge of effluent and cooling water	Accidents, incidents and complaints	Adjoining Channel	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of the Project Proponent	Included in operation and maintenance (O&M) cost
	Public concerns	Complaints from community	Neighboring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Community Liaison Officer of the Project Proponent and Plant Manager	Included in operation and maintenance (O&M) cost
CSR Activities	Community Development	Activities/ Programs and No. of beneficiaries	Local communities around the Project activity areas	No. of beneficiaries and outcome of the activities	Periodic and need based	Admin/ HR Manager and Plant Manager	CSR Budget (app 100,000 USD / year)

1.12.3 Training Programme

Prior to commencement of construction activities at site, a suitably qualified in-house/ external expert will be appointed by the EPC contractor in consultation with the Sponsor to develop and deliver a training programme on implementation of the ESMP. Environmental and social monitoring programme and reporting will be implemented in line with the applicable reference framework for the Project.

Prior to the commencement of the Plant operation, a suitably qualified in-house/ external environmental expert will be engaged by the Sponsor to develop and deliver a training programme on operation phase environmental monitoring and reporting. The topics will be mostly same as that during the construction phase. The reporting and verification will be semi-annual during construction phase and annual during operation phase (unless specify otherwise in the ESMP) and the reports will be submitted to the relevant authorities (i.e. MOEP, MONREC, etc.) and the Lenders.

1.13 CONCLUSIONS

The environmental assessment of the Project ascertains that the Project is unlikely to cause any major environmental impacts. Many of the impacts are localized and short-term or temporary in nature and can be readily addressed based on the built-in mitigation measures in the engineering design of the Project.

It is to be noted that the results from baseline air quality monitoring shows that the existing conditions are considered as non-degraded air shed. Nevertheless, the built-in dry low NOx burners will be installed in order to reduce NOx emission at stack to below 25ppm at all times. Therefore, the impacts from the stack emissions at identified air sensitive receivers (ASRs), during normal combined cycle operation or simple cycle operation, is considered negligible.

With regards to impacts to surface water, groundwater, and soil, it is noted that the assessment of such impacts for this Project is highly important due to the Project's vicinity to the Heinze River, as well as the reliance of the local population on surface water, groundwater, and soil resources within the Project area and surroundings for their health and livelihood.

Although a number of potential environmental, social and health impacts were identified, the assessments found that impacts are typically short term in duration have minor residual significance after implementation of mitigation measures. The potential for impacts is well understood with little or no evidence of adverse consequences on the majority of environmental, social or health receptors provided that adequate in-place controls and/or mitigation measures are implemented. The suggested mitigation measures in the ESMP are well established amongst international practice, and proven to be effective in managing any impacts that might occur to acceptable levels.

In terms of social aspect, the results from initial stakeholder engagement indicate that the Project has received favorable support from local people and other stakeholders. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region, potential employment (direct and indirect) and that the negative impacts can be easily mitigated.

In addition, the ESMP has been prepared as part of this report to manage and mitigate such impacts, a range of measures have been developed to reduce the overall impacts to acceptable levels and as low as reasonably practicable.

The effective implementation of the ESMP and adherence with the Myanmar NEQ, and IFC guidelines will assist in minimizing the environmental impacts to acceptable levels.

CHAPTER 2 CONTEXT OF THE PROJECT

2.1 Project Background And Overview

Myanmar UPA Company Limited ('MUPA' or 'the Project Sponsor' or 'the Project Proponent') intends to develop a 200MW Combined Cycle Power Plant (CCPP) to supply power to the Republic Union of Myanmar through a Power Purchase Agreement (PPA) with the Ministry of Electric Power (MOEP) in Kanbauk, Tanin Tharyi Region, Myanmar ('the Project').

As per the New Environmental Impact Assessment (EIA) Procedure and the National Environmental Quality (Emission) (NEQ) Guidelines have been promulgated on 29th December 2015, it is understood that proposed Project requires the Scoping Study and the EIA Study (also referred to as 'Environmental and Social Impact Assessment (ESIA) Study') to be conducted and submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC) to order to obtain an Environmental Compliance Certificate (ECC).

It is important to note that the earliest Environmental and Social Impact Assessment (ESIA) study was conducted by TEAM Consulting Engineering and Management Co., Ltd. ('TEAM') in October 2014. Subsequently, the study underwent review by the Environmental Conservation Department (ECD) of MONREC, and comments were provided to the Project Proponent (MUPA) during the ECD Review Meeting held on July 21, 2016.

Environmental Resources Management ('ERM') was subsequently appointed by MUPA to upgrade and revise the ESIA Study for the Project, ensuring compliance with the EIA procedure of 2015 and addressing the feedback from the review meeting. As part of this process, the Scoping Study, prepared by ERM, was submitted to the ECD on December 27, 2016. The first revised ESIA report was then submitted to the ECD in June 2017.

On January 31, 2019, the ECD provided comments with required references (Annex A) for further revisions to the ESIA study. Currently, MUPA has appointed E Guard Environmental Services Co., Ltd. to upgrade the ESIA study based on third-party confirmation by the ECD (Annex B). Consequently, the E Guard Environmental Services Co., Ltd. has prepared this 2nd revised ESIA report.

2.1.1 Purposes and Objectives of this ESIA Report

This Environmental and Social Impact Assessment (ESIA) Report presents an assessment of the potential environmental and social impacts associated with the proposed 200MW Combined Cycle Power Plant (CCPP) and Project facilities in Kanbauk, Tanin Tharyi Region, Myanmar ('the Project').

The specific objectives of this ESIA report are as follows:

- To satisfy the New EIA Procedure (2015) including other relevant requirements/ guidelines and to address and accommodate comments provided by ECD during the Review meeting in July 2016;
- Facilitate an understanding of the elements of the existing baseline conditions that are relevant to resources/receptors that could be potentially impacted by the Project;
- Identify the aspects of the Project that could potentially result in significant environmental and social impacts on resources/receptors;
- Document how stakeholders have been engaged during the ESIA Process, and how stakeholder feedback has been considered in the ESIA study;

- Predict and evaluate the significance of the potential environmental and social impacts of the Project;
- Identify the aspects of the Project that need to be managed, and recommend appropriate and justified mitigation and enhancement measures;
- Determine the significance of residual impacts, considering the implementation of mitigation measures; and
- Generate plans for the management and monitoring of impacts, including plans for ongoing stakeholder engagement.

2.1.2 Project Need

Parallel to growth in GDP, electricity demand in Myanmar has increased dramatically in recent years. ADB released a report on Myanmar's energy sector in October 2012 in which the future power demand was estimated to be doubling from 12,459 million kWh in 2012-2013 to 25,683 million kWh in 2018-2019 (ADB, 2012).

As at July 2013, Myanmar's power is predominantly generated from hydropower, gas and coal, representing over 70%, 22% and 3% of the total power generation respectively. [4] Out of the 3,735 MW of total installed capacity, approximately 835 MW is of gas-fired power generation. Due to the lack of water during dry season, hydropower generation has not been able to operate at full capacity and therefore electricity supply has been unstable during that time.

To reduce the country's reliance on hydropower, MOEE in its five-year plan (2011/2012 to 2015-2016) has set an ambitious target to add 1,740MW of gas-fired generation capacity by 2015-2016, which will increase the gas-fired capacity to over 50% of the total generation mix. [5]

In addition, given that the additional gas supply will become available from the Yadana Gas Supply pipeline, the proposed development of a combined cycle power plant in Kanbauk, Tanin Tharyi Region, Myanmar will contribute towards a power security for adding capacity required to cover the shortfall in Myanmar.

2.1.3 Project Name

200MW Combined Cycle Power Plant of Myanmar UPA Company Limited (MUPA 200MW CCPP)

2.1.4 Project Sponsor / Project Proponent

Myanmar UPA Company Limited, a subsidiary of United Power of Asia Public Company Limited (UPA), is the main Project Proponent for the proposed Project.

UPA is a holding company that strives toward corporate growth and sustainable development through worldwide investment. Founded in 2000, UPA Group currently owns 8 subsidiaries with 3 core businesses, investing in power, real estate, and information and communication technologies industries.

For the Power Business, the main power projects have been invested, developed, and operated under Andaman Power and Utility Company limited (APU), 93% shares owned by UPA, while the alternative energy projects have been studied and assessed through UPA Solar, UPA Green Energy, and UPA Power Group, whether they are feasible for further investment.

[4] MEPE (2013). http://www.ubifrance.com/medias/press/mepe_9_7_2013_29_31.pdf Accessed 8 June 2015.

[5] Sharma, Vikas (2013). An Overvoew of Electricity Market in Myanmar slideshare.net/VikasSharma128/myanmar-electricity-industrydec2013 Accessed 8 June 2015

APU has signed a Power Purchase Agreement of 6-20MW with Tanin Tharyi Region Government, to supply the power to Dawei District. The gas engines power plant, located in Kanbauk (Phase 1), already started its operation and provided the electricity to Dawei District and nearby area since June 17th, 2015.

The UPA Group has total assets of over 94.2 million USD (3,295.78 million Baht, 1 USD = 35 Baht) and employs more than 100 employees, and listed on the main board of the Stock Exchange of Thailand. UPA Group's key facts are highlighted in Table 2.1.

Table 2. 1 Key Facts of UPA Group

Key Facts	Descriptions
Year of Incorporation	Founded in 2000, converted into Public Company in 2009, listed in 2010
Listing	The Stock Exchange of Thailand (mai: market for alternative investment)
Market Capitalization	129.6 million USD or 4,535.60 million Baht (As of 6 Sep 2016, 1 USD = 35 Baht)
Shareholders	Mr. Upakit Pachariyangkun – 25.04 % BSI SA – 16.04 %
Number of Employees	16 Employees for UPA and around 100 employees for whole UPA Group
FY2015 Turnover	3.8 million USD or 132.57 million Baht
FY2015 Net Profit	-11.5 million USD or -402.41 million Baht (1 USD = 35 Baht
Key Business	Power, Real Estate, and IT Businesses
Global Presence	Thailand and Myanmar

Source: (UPA, 2016)

Table 2. 2 Contact Person Information

Contact Name	Daw Khine Wint Mon
Address	No.5995, Loikaw Street, Ortharathiri Township, Naypyitaw, Myanmar
Telephone	092011012
Email Address	mupaygnoffice 2017@ gmail.com

2.1.5 Environmental, Social and Health Experts

The previous ESIA study was conducted by Environmental Resources Management (ERM) and sub-consultant, Sustainable Environment Myanmar Co., Ltd (SEM) from July 2016 to June 2017.

This report, the revised ESIA report, has been prepared by E Guard Environmental Services Co., Ltd. to revise and upgrade the comments with references issued by ECD on 31st January, 2019 (Annex-A).

Table 2.5 describes the key personnel who involved in the preparation of this 2nd revised ESIA study.

Table 2. 3 E Guard's Key Personnel involved in Preparation of the Revised Report of ESIA Study

Members of EIA preparation			
Team Leader of the team			
Sr.	**Name (Sur name, Given name)**	**Registration / License No. by ECD**	**Area of expertise**
1.	Daw Yu Wai Yan Thein Tan	EIA-C 009/2023	1. Air Pollution Prevention and Control 2. Water Pollution Prevention, Control, Monitoring and Prediction of Impacts 3. Risk Assessment and Management 4. Solid Waste and Hazardous Waste Management
Members of the team (except the team leader)			
Sr.	**Name (Sur name, Given name)**	**Registration / License No. by ECD** **(if registered)**	**Area of expertise**
2.	U Aye Thiha	EIA-C 005/2023	1. Health (Impact Studies and Analysis) 2. Meteorology, Air Quality Assessment and Forecast 3. Air Pollution Monitoring
3.	U Soe Min	EIA-C 031/2023	1. Hydrology, Surface Water and Ground Water Conservation
4.	U Aung Myint Myat	EIA-C 008/2023	1. Noise and Vibration
5.	Daw Thein Mwe Khin	EIA-C 006/2923	1. Ecology and Biodiversity 2. Social Study and Analysis
6.	Daw Htet Shwe Sin Aung	EIA-AC 002/2023	1. Ecosystem and Biodiversity
7.	Daw Shwe Ya Min Bo	EIA-AC 008/2023	1. Ecosystem and Biodiversity
8.	U Nyein Chan Aung	EIA-AC 004/2023	1. General Environmental Management
9.	Daw May Thu Win	EIA-AC 003/2023	1. Legal Study and Analysis
10.	U Aung Si Thu Thein	EIA-AC 006/2023	1. Land Use
11.	U Myint Aung	EIA-AC 011/2023	1. Geological Assessment
12.	U Kyaw Soe Moe	EIA-AC 088/2024	1. GIS Mapping 2. Noise and Vibration (Supporting Staff)
13.	Daw Chan Myae Hnin	Supporting Staff	1. Electrical Engineer

2.2 STRUCTURE OF THIS ESIA REPORT

Following the Executive Summary presented as Chapter 1 and this Chapter, the remainder of this ESIA Report is presented as follows:

- Chapter 3 presents an overview of the environmental and social policy, legal and institutional framework related to the proposed Project;
- Chapter 4 provides details on the Project description and alternatives considered;
- Chapter 5 provides a description of the surrounding environment;
- Chapter 6 provides a description of the existing socio-economic environment;
- Chapter 7 presents the Impact Assessment Methodology used for this study;
- Chapter 8 to chapter 17 present the key potential environmental and social impacts and potential mitigation measures;
- Chapter 18 presents the Cumulative Impact Assessment (CIA);
- Chapter 19 provides the Environmental and Social Management Plan (ESMP);
- Chapter 20 highlights the stakeholder identification, stakeholder engagement activities, including Project disclosure and results from Public Consultation meetings;
- Chapter 21 provides conclusions and recommendations;
- Chapter 22 present the Statement of Commitment; and

The supported documents are forming part of Annexes, as follows:

- Annex A: ECD Comment Reply Table
- Annex B: Third Party Confirmation Letter
- Annex C: Land Lease Agreement and Power Purchase Agreement
- Annex D: Checklist of invasive species
- Annex E: Tools used for social baseline
- Annex F: Press Release
- Annex G: Presentation material
- Annex H: Photo of Engagement
- Annex I: Minutes of the meetings
- Annex J: Draft Emergency Response Plan
- Annex K: Consultant License and CVs for ESIA study Team
- Annex L: Baseline Study Results by TEAM Consulting

CHAPTER 3 POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 INSTITUTIONAL FRAMEWORK

Every citizen has the duty to assist the Union carrying out the environmental conservation under sub-section (b) of section 390 of **The Constitution of the Republic of the Union of Myanmar (2008).**

The project proponent commits to adhere to the following project-related laws, rules, regulations, procedures, guidelines, and periodic notifications issued by relevant governmental departments.

For this project, the following laws are related to Environment-

- National Environmental Policy of Myanmar (2019)
- The Environmental Conservation Law (2012)
- The Environmental Conservation Rules (2014)
- The Environmental Impact Assessment Procedure (2015)
- National Environmental Quality (Emission) Guidelines (2015)

For Investment and Insurance,

- The Myanmar Investment Law (2016) (Amendment 2019)
- The Myanmar Investment Rules (2017) (Amendment 2018)
- The Myanmar Insurance Law (1993)

For Health,

- Prevention of Hazard from Chemical and Related Substances Law (2013)
- The Public Health Law (1972)
- The Prevention and Control of Communicable Diseases Law (2011)
- The Control of Smoking and Consumption of Tobacco Product Law (2006)

For occupational health and safety is,

- The Occupational Health and Safety Law (2019)

Other necessary laws for this project-

- The Vehicle Safety and Motor Vehicle Management Law (2020)
- The Vehicle Safety and Motor Vehicle Management Rules (2022)
- The Electricity Law (2014)
- The Export and Import Law (2012)
- Natural Disaster Management Law (2013)
- The Myanmar Fire Brigade Law (2015)
- The Myanmar Engineering Council Law (2013) (Amendment 2022)
- The Industrial Explosive Materials Law (2018)
- The Explosive Substances Act (1908)
- The Boiler Law (2015)
- Private Industrial Enterprise Law (1990)
- The Myanmar Companies Law (2017)

- The Farm Land Law (2012)
- The Management of Vacant, Fallow and Virgin Land Law (2012)

Implementation of this project, the following laws are required for labors-

- The Labor Organization Law (2011)
- The Settlement of Labor Disputes Law (2012) (Amendment 2019)
- The Employment and Skill Development Law (2013) (Amendment 2019)
- The Minimum Wage Law (2013)
- The Payment of Wages Law (2016)
- Workmen's Compensation Act (1923)
- The Leaves and Holidays Act (1951) (Amendment 2014)
- The Social Security Law (2012) (Amendment 2014)

The following Laws are applicable for this project-

- The Conservation of Water Resources and Rivers Law (2006) (Amendment 2017)
- The Conservation of Water Resources Rivers Rules (2013) (Amendment 2015)
- Underground Water Act (1930)
- The Forest Law (2018)
- The Conservation of Biodiversity and Protected Areas Law (2018)
- The Ethnic Rights Protection Law (2015)
- The Ethnic Rights Protection Rules (2019) (Amendment 2020)
- The Protection and Preservation of Cultural Heritage Regions Law (2019)
- The Protection and Preservation of Antique Objects Law (2015)
- The Protection and Preservation of Ancient Monuments Law (2015)

For Petroleum,

- The Petroleum and Product of Petroleum Law (2017)
- The Petroleum Rules (1937)

3.2 LEGAL COMMITMENT OF RELATED LAWS AND POLICIES FOR THIS PROJECT

The project proponent, Myanmar Lighting (IPP) Co., Ltd. must follow the following laws and regulations throughout the project lifespan.

1) The Constitution of the Republic of the Union of Myanmar (2008)

- The Union shall protect and conserve natural environment under section-45 of said law.
- Every citizen has the duty to assist the Union carrying out the environmental conservation under sub-section (b) of section 390 of said law.

2) National Environmental Policy of Myanmar (2019)

- **Mission:** To achieve a clean environment, with healthy and functioning ecosystems, that ensures inclusive development and wellbeing for all people in Myanmar.
- **Vision:** To establish national environmental policy principles for guiding environmental protection and sustainable development and for mainstreaming environmental considerations into all policies, laws, regulations, plans, strategies, programs and projects in Myanmar.

3) **The Environmental Conservation Law (2012)**

Objectives: To construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.

- The project proponent has to pay the compensation for damages if the project will cause injuries to environment under sub-section (o) of section 7 of said law.
- The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards under section 14 of said law.
- The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment under section 15 of said law.
- The project proponent has to allow relevant governmental organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not under section-24 of said law.
- The project proponent has to comply with the terms and conditions included in prior permission under section 25 of said law.
- The project proponent has to abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure under section 29 of said law.

4) **The Environmental Conservation Rules (2014)**

- The project proponent has to avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public under sub-rule (a) of rule 69 of said law.
- The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem under sub-rule (b) of rule 69 of said law.

5) **The Environmental Impact Assessment Procedure (2015)**

- The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner under sub-paragraph (a) of paragraph 102 of said law.
- The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project under sub-paragraph (b) of paragraph 102 of said law.
- The project proponent has to fully implement all commitments of project and conditions included in EMP. Moreover, the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions under paragraph 103 of said law.

- The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under paragraph 104 of said law.
- The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time under paragraph 105 of said law.
- The project proponent has to continuously monitor all adverse impacts in the pre-construction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure under paragraph 106 of said law.
- The project proponent has to submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it under paragraph 107 of said law.
- The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP under paragraph 108 of said law.
- The project proponent has to prepare the monitoring report under paragraph 109 of said law.
- The project proponent has to show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover, has to give the copy of this report, by email or other way which way agreed with the asked person, to any asked person or organization under paragraph 110 of said law.
- The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project and other work-place related to this project in any time under paragraph 113 of said law.
- The project proponent has to allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it under paragraph 115 of said law.
- The project proponent has to allow inspector to inspect the contractor and sub-contractor who implement on behalf of project under paragraph 117 of said law.

6) National Environmental Quality (Emission) Guidelines (2015)

Objectives: The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.

7) The Myanmar Investment Law (2016) (Amendment 2019)

Objectives: To ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law.

- The project proponent has to register the land lease contract at Registration of Deeds Office in accordance with the Registration of Deeds Law under sub-section (d) of section 50 of said law.
- The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise under sub-section (b) of section 51 of said law.
- The project proponent has to appoint the nationalities only in normal work without expertise under sub-section (c) of section 51 of said law.
- The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law under sub-section (d) of section 51 of said law.
- The project proponent has to comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social under sub-section (g) of section 65 of said law.
- The project proponent has to close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees under sub-section (i) of section 65 of said law.
- The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period under sub-section (j) of section 65 of said law.
- The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work under sub-section (k) of section 65 of said law.
- The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, and directives under sub-section (l) of section 65 of said law.
- The project proponent has to abide by labor laws under sub-section (m) of section 65 of said law.
- The project proponent has to pay the compensation, to the injured person for damages if damage to environment or socio-economy is occurred by misuse of project under sub-section (o) of section 65 of said law.
- The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project under sub-section (p) of section 65 of said law.
- The project proponent has to obtain the permission of MIC before EIA process and report back this process to Myanmar Investment Commission under sub-section (q) of section 65 of said law.
- The project proponent has to ensure the prescribed insurance by rules under section 73 of said law.

8) The Myanmar Investment Rules (2017) (Amendment 2018)

- The project proponent has to comply with the conditions of the permit issued by MIC and applicable laws when making the investment under rule 202 of said law.

- The project proponent has to fully assist while negotiating with the authority for settling the grievance of the local community which has been affected due to investment under rule 203 of said law.
- The project proponent has to submit the passport, expertise evidence or document of degree and profile to the MIC office for approval if decide to appoint a foreigner as a senior management, technician expert or consultant according to sub-section (a) of section 51 of Myanmar Investment Law under rule 206 of said law.

The project proponent has to ensure the relevant insurance out of the following types of the insurance at any insurance business entitled to carry ort insurance business within the Union based on the nature of the business: under rule 212 of said law.

- Property and Business Interruption Insurance;
- Engineering Insurance;
- Professional Liability Insurance;
- Bodily Injury Insurance;
- Marine Insurance; or
- Workmen Compensation Insurance;
- Life Insurance;
- Fire Insurance.

9) The Myanmar Insurance Law (1993)

Objectives: The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanmar Insurance.

- If the project proponent uses the owned vehicles the project owner has to ensure the insurance for injured person under section 15 of said law.
- The project proponent has to ensure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public under section 16 of said law.

10) Prevention of Hazard from Chemical and Related Substances Law (2013)

Objectives: To ensure to use the hazardous chemical and related substances safely and safety for the employees. Moreover, safety in carrying the hazardous chemical and related substances and storage place of it. If it is needed to train how to use the safety dresses which provided to the employees with free of charges. Insure to compensate for injury to person or damage to environment. The project has to be inspected for safety use of hazardous chemical and related substances before starting the project.

- The project proponent has to be inspected for the safety and resistance of the machinery and equipment by the respective Supervisory Board and Board of Inspection before starting the business under sub section (a) of section 15 of said law.
- The project proponent has to assign the employees, who will serve with the hazardous chemical and substances, to attend the trainings on prevention of hazardous chemical and substances in local or abroad under sub section (b) of section 15 of said law.
- The project proponent has to abide by the conditions included in the license under sub section (a) of section 16 of said law.

- The project proponent has to abide by and assign to the employees who serve in this work to abide by the instructions for safety in using the hazardous chemical and related substances under sub section (b) of section 16 of said law.
- The project proponent has to arrange the enough safety equipment in the work-place and provide the safety dresses to the employees who serve in this work with free of charge under sub-section (c) of section 16 of said law.
- The project proponent has to train, in work-place my arrangement, the know-how to use the occupational safety equipment, personal protection equipment and safety dresses systemically in the work-place under sub section (d) of section 16 of said law.
- The project proponent has to allow the receptive Supervisory Board and Board of Inspection to inspect whether the hazard may be injured to health of human or animal or damaged to environment under sub section (e) of section 16 of said law.
- The project proponent has to assign the healthy employees who have obtained the recommendation that is fit for this work after taken medical check- up and keep systematically the medical records of employees under sub section (f) of section 16 of said law.
- The project proponent has to inform the copy of storage permission for hazardous chemical and related substances to the relevant township administrative office under sub section (g) of section 16 of said law.
- The project proponent has to obtain the approval with instructions of relevant fire force before starting the work if the project will use the fire hazard substances or explosive substances sub section (h) of section 16 of said law.
- The project proponent has to transport only the limited amount of the chemical and related substance in accord with the prescribed stipulations in local transportation under sub section (i) of section 16 of said law.
- The project proponent has to insure, in accord with the stipulations, to pay the compensation if the project cause injury to person or animals or damage to environment under section 17 of said law.
- The project owner has to abide by the conditions included in the registration certificate. Moreover, will abide by the orders and directives issued by the Central Supervisory Board from time to time under section 22 of said law.
- The project proponent has to classify the level of hazard to protect it in advance according to the properties of chemical and related substances under sub section (a) of section 27 of said law.
- The project proponent has to provide the safety equipment, personal protection equipment to protect and reduce the accident and assign to attend the training to use the equipment systematically under sub section (c) of section 27 of said law.

11) The Public Health Law (1972)

Objectives: To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department.

- The project proponent has to abide by any instruction or stipulation for public health under section 3 of said law.

- The project proponent has to allow any inspection, anytime, anywhere, if necessary, under section 5 of said law.

12) The Prevention and Control of Communicable Diseases Law (1995) (Amendment 2011)

Objectives: To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.

The project proponent has to build the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage under clause (9) of sub section (a) of section 3 of said law.

The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health under section 4 of said law.

The project proponent has to inform promptly to the nearest health department or hospital if the following are occurred: under section 9 of said law.

- Mass death of animals included in birds or chicken;
- Mass death of mouse;
- Suspense of occurring of communicable disease or occurring of communicable disease;
- Occurring of communicable disease which must be informed.

The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect by health officer under section 11 of said law.

13) The Control of Smoking and Consumption of Tobacco Product Law (2006)

Objectives: To ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking.

- The project proponent has to keep the caption and mark referring that is non- smoking area in the project area under sub section (a) of section 9 of said law.
- The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations under sub section (b) of section 9 of said law.
- The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area under sub section (c) of section 9 of said law.
- The project proponent has to allow the inspection of supervisory body in the power plant area sub section (d) of section 9 of said law.

14) The Occupational Health and Safety Law (2019)

Objectives: To effectively implement measures related to safety and health in every industry and to set occupational safety and health standards.

- The project proponent has to provide adequate and relevant personal protective equipment to workers free of charge and make them wear it during work so as not to expose workers to any serious occupational diseases or hazards under sub section (e) of section 26 of said law.
- The project proponent has to arrange and display occupational safety and health instructions, warning signs, notices, posters, and signboards under sub section (l) of section 26 of said law.

- The worker shall wear or use at all times any protective clothes, equipment and tools provided by the employer for the purpose of safety and health under sub section (a) of section 30 of said law.
- The worker shall proper and systematic use any equipment and tools, machines, any parts of the machines, vehicles, electricity and other substances being used at the workplace under sub section (d) of section 30 of said law.
- The worker shall take reasonable care for the safety and health of himself/ herself and of other persons who may be affected by his/ her acts or omissions at work under sub section (e) of section 30 of said law.

15) The Vehicle Safety and Motor Vehicle Management Law (2020)

Objectives: When the construction period and if necessary, in operation and production period for the all vehicles.

- The project proponent has to comply with the restrictions and restrictions on the use of domestic vehicles by the Ministry of Transport and Communications with the approval of the Union Government under sub section (a) of section 9 of said law.
- The project proponent has to comply with safety, environmental regulation, standards and regulations regarding the initial registration of vehicles issued by the Ministry under sub section (c) of section 12 of said law.
- The project proponent has to drive at the speed limit set by the Road Transport Directorate to ensure the safe movement of vehicles on public roads under sub section (r) of section 14 of said law.
- The project proponent has to maintain the vehicles in accordance with the standards set by the Department so that it can be driven safely under sub section (a) of section 18 of said law.
- The project proponent has not to carry or transport hazardous materials in public places in accordance with the regulations under sub section (g) of section 81 of said law.

16) The Vehicle Safety and Motor Vehicle Management Rules (2022)

- The project proponent has to comply with the Commercial Vehicle Regulations in Chapter (9) and the Motor Vehicle Traffic Regulations in Chapter (10).

17) The Electricity Law (2014)

- Objectives: To ensure the compliance with the conditions of permission for productions of electricity, abiding by any stipulation, implementing with the best practices and paying compensation in line with above law. It stipulated the following obligations of the project proponent.
- The project proponent has to implement the project with the best practices to reduce the damages on the environment, health and socio-economy, also will pay compensation for the damages and will pay the fund for environmental conservation under sub section (b) of section 10 of said law.
- The project proponent has to take the certificate of electric safety, issued by the chief-inspector, before the commencement of power generation under section 18 of said law.

- The project proponent has to be liable for damages to any person or enterprise by failure to abide by the quality standards or rules, regulation, by-law, order and directive issued under said law under sub section (a) of section 21 of said law.
- The project proponent has to be liable for damages to any person or enterprise by negligence of project owner under sub section (a) of section 22 of said law.
- The project proponent has to comply with the permission for electric searching and generation under sub section (a) and (b) of section 26 of said law.
- The project proponent has to inform promptly to chief-inspector and head officer of related office while occurring of accident in electricity generation under section 27 of said law.
- The project proponent has to comply with the standards, rules and procedure. Moreover, will allow the inspection by respected governmental department and organization if it is necessary under section 40 of said law.
- The project proponent has to pay the compensation to anyone who is injured or caused to death in electric shock or fire caused by the negligence or omitting of the project owner or representative of project owner under section 68 of said law.

18) The Export and Import Law (2022)

The purpose of this law is to ensure the legal import and export. The project proponent has to abide by the conditions contained in the permission for import if boilers or other machineries are imported, under the provisions mentioned in Section 7.

19) Natural Disaster Management Law (2013)

Objectives: To implement natural disaster management programs and to coordinate with national and international organizations in carrying out natural disaster management activities; to conserve and restore the environment affected by natural disaster and to provide health, education, social and livelihood programs in order to bring about better living conditions for victims;

- The project proponent has to perform preparatory and preventive measures for natural disaster risks reduction before the natural disaster strikes under sub section (a)(i) of section 13 of said law.
- The project proponent has to undertake rehabilitation and reconstruction activities for improving better living standard after the natural disaster strikes and conservation of the environment that has been affected by natural disaster under sub section (a)(iii) of section 13 of said law.
- The project proponent has to carry out better improvement on early warning system of natural disaster under sub section (b) of section 14 of said law.
- The project proponent has to carry out together with the measures of natural disaster risk reduction in development plans of the State under sub section (d) of section 14 of said law.
- Whoever if the natural disaster causes or is likely to be caused by any negligent act without examination or by willful action which is known that a disaster is likely to strike, shall be punished with imprisonment for a term not exceeding three years and may also be liable to fine under section 25 of said law.

- Whoever interferes, prevents, prohibits, assaults or coerces the department, organization or person assigned by this law to perform any natural disaster management shall, on conviction, be punished with imprisonment for a term not exceeding two years or with fine or with both under section 26 of said law.
- Whoever violates any prohibition contained in rules, notifications and orders issued under this law shall, on conviction, be punished with imprisonment for a term not exceeding one year or with fine or with both under section 29 of said law.
- Whoever willful failure to comply with any of the directives of the department, organization or person assigned by this law to perform any natural disaster management shall, on conviction, be punished with imprisonment for a term not exceeding one year or with fine or with both under sub section (a) of section 30 of said law.

20) The Myanmar Fire Brigade Law (2015)

Objectives: To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law.

- The project proponent has to institute the specific fire services under sub section (a) of section 25 of said law.
- The project owner has to provide materials and apparatuses for fire precaution and prevention under sub section (b) of section 25 of said law.

21) The Myanmar Engineering Council Law (2013) (Amendment 2022)

Objectives; To ensure the safety in technical and engineering work in the project. This law focuses the following;

- The project proponent has to ensure the employees who are engineers abide to the provisions of Myanmar Engineering Council law, prohibitions included in the rules, order and directive issued under said law, conditions included in the registration certificate issued by the Myanmar engineering council, under section 34 of said law.
- The project proponent has to appoint the employees, who obtained the registration certificate issued by the Myanmar Engineering Council, in the technical and engineering work, under section 37 of said law.

22) The Industrial Explosive Materials Law (2018)

Objectives;

(a) To manufacture, import, transfer, store and use industrial explosive materials systematically;
(b) To be safe and secure at work places where dynamite and related substances are used;
(c) To supervise manufacture and use of industrial explosive materials systematically.

The project proponent has not refused inspection of the Chief Inspector or and inspector under section 8 of said law.

The project proponent, in an unlicensed magazine, has to

- Accept to store industrial explosive materials;

- Deliver to store industrial explosive materials under section 16 of said law.

The project has to-

- Store industrial explosive materials only in the licensed magazine;
- Take necessary preventive measures in accord with the specifications to avoid harm in transport, manufacture, use or possession of industrial explosive materials
- The project proponent has not refused inspection of the Chief Inspector or and inspector under section 18 of said law.

The project proponent has to-

- Import, transport, store, manufacture, use, possess or transfer industrial explosive materials without permission in accordance with this law;
- Destroy industrial explosive materials without approval of the Executive Committee of Defence Service Council
- Fail to act in accordance with the rules, regulations, by-laws, notifications, orders and directives issued under section 19 of said law.

The project proponent has to

- Accept to store industrial explosive materials more than the limited amount mentioned in the licence issued by the Ministry;
- Fail to inform the nearest police station immediately and to report the Chief Inspector timely if anything mentioned in sub-section (c) of section 15 occurs due to industrial explosive materials;
- Continue to store industrial explosive materials without renewal after expiration of the licence under section 21 of said law.

23) The Explosive Substances Act (1908)

- The project proponent has to comply with the following points in Sections - 3/ 4/ 5
    - Punishment for causing explosion likely to endanger life or property (Section 3)
    - Punishment for attempt to cause explosion, or for making or keeping explosive with intent to endanger life or property (Section 4)
    - Punishment for making or possessing explosives under suspicious circumstances (Section 5)

24) The Boiler Law (2015)

The purpose~~;~~ of this law is to ensure the legal registration and safety in utilization of of boilers. It sets out the following obligations of the project proponent:

- To register the boiler, under section 5, 6, 7 and12;
- To apply to obtain the certificate to the relevant inspector in accord with the specified manner, under sub-section (a) of section 12;
- Submit application for using of the boiler at more than allowable pressure to the relevant inspector, under sub-section (a) of section 14 of said law (even though the certificate has been already issued);

- To submit the application for altering, repairing or renewing any steam-pipe, feed-pipe or any mounting or other fitting attached to such steam-pipe, feed-pipe or any mouthing or other fitting attached to the boiler to the relevant inspector under sub-section (a) of section 14 of said law. (Even though the certificate has been already issued).
- To submit the certificate when requested by the relevant government department or organization as may be necessary, under section 15;
- To promptly inform to relevant inspector if any accident is occurred, under section 18;
- Not to use the boiler higher than allowable pressure under sub-section (a) of section 19;
- Not to repair and alter or force to repair and alter the safety value to exceed allowable pressure, under sub-section (b) of section 19 of said law and has to not do any act contained in sub-section (b) without permission, under sub-section (c) of section19;
- To engrave the register - number on the boiler in accord with the specified manner, under section 21;
- To carry out with the person who has the boiler repairer certificate on the receipt of notice to repair, alter, add or renew any boiler, steam-pipe, feed-pipe or any mounting or other fitting attached to such boiler, steam-pipe and feed-pipe, under sub-section (a) of section 24;
- Not to assign any person to charge the boiler used in the work except the person who operates and maintains the boiler, under sub-section (b) of section 24;
- To import the boiler which is consistent with Myanmar standards or international standards, under section 26;
- To ensure that boiler attendant has to comply with the terms and conditions contained in boiler attendant certificate, under sub-section (b) of section 29 of said law and boiler attendant has not to use the boiler at more than allowable pressure, under section 31; and
- To allow the inspector to inspect the boiler, under section 40.

25) Private Industrial Enterprise Law (1990)

To ensure the compliance with conditions in registration certificate. This law focuses as follows;

- The project proponent has to register for production of cement, under section 4 of said law.
- The duties and powers of the Supervisory Body are as follows-
  a) supervising to ensure the compliance by the entrepreneurs in the conducting of the industrial enterprises in accordance with the basic principles
  b) giving opinion for the determination of industrial areas and for the granting of lease of land for the private industrial enterprises under sub – section (d) and (f) of said law.
- The project proponent has to abide by the conditions in registration certificate, under sub-section (b) of section 13 of said law.
- The project proponent has to allow inspection by Directorate or Supervisory Body, under sub-section (e) of section 13 of said law.

- The project proponent has to abide by the orders and directives issued by the Ministry and Directorate, under sub- section (f) of section 13 of said law.
- The project proponent has to abide by all existing laws, under sub-section (g) of section 13 of said law.
- The project proponent has to hire the experts and technicians from foreign country with the permission of Ministry, under sub-section (a) of section 15 of said law.
- The project proponent has to close the enterprise in accordance with stipulated ways with the permission of Directorate, under sub-section (b) of section 15 of said law.
- The project proponent commits to-

  a) in distributing and selling the goods he has produced has not sell without a trade mark:
  b) has not violate any provision of section 13:
  c) has not fail to comply with any order or decision passed by the Minister and the Director General: under section 27 of said law.

26) The Myanmar Companie Law (2017)

Essential Requirements of Companies are as follows,

A company registered under the Myanmar Companies Law shall have the following facts: under section-4, sub-section (a) of said law.

- a name;
- a constitution
- at least one share in issue (provided that a company limited by guarantee need not have a share capital)
- at least one member
- subject to sub-section (vi), at least one director who shall be ordinarily resident in the Union;
- if the company is a public company, at least three directions, one of whom shall be a Myanmar citizen who is ordinarily resident in the Union; and
- a registered office address in the Union, under section-4, sub-section (a), sub-section i, ii, iii, iv, v, vi and vii of said law.

Capacity and powers of companies are as follows,

A company: under section-5, sub-section (a) of said law.

- will be a legal entity in its own right separate from its members having full rights, powers, and privileges and continuing in existence until it is removed from the register: under section-5, sub-section (a), sub-section (i) of said law.
- subject to this law and any other law, has both with other and outside the Union full legal capacity to carry on any business or activity, do any act, or enter into any transaction, including the power to: under section-5, sub-section (a), sub-section (ii) of said law.

- issue shares, debentures or securities which convert into shares in the company; under sub-section (ii), sub-section (aa) of said law.
- grant options to subscribe for shares or debentures in the company: under sub-section (ii), sub-section (bb) of said law.
- grant a security interest over any of its property: under sub-section (ii), sub-section (cc) of said law.
- distribute any of the company's property among the members, in kind or otherwise, under sub-section (ii), sub-section (dd) of said law.
- The constitution of a company may contain a provision relating to the capacity, rights, powers, or privileges of the company only if the capacity of the company or those rights, powers and privileges are restricted, under section-5, sub-section (b) of said law.
- A company may act as a holding company of another company and incorporate and hold shares in any number of subsidiaries, under section-5, sub-section (c)of said law.

27) The Farm Land Law (2012)

Purpose: To ensure the right to use the farm land and sufficient compensation for acquisition of the farm land. This law focuses the following matters;

- The project owner has to abide by the decision of relevant Ministry with the coordination with the Central Administrative Body of the Farmland for paying the compensation if it is needed acquisition farm land, under section 26 of said law.
- The project proponent has to obtain the permission of the Central Administrative Body of Farmland for the land use change from paddy field land to other land use under sub-section (a) of section 30.
- The project proponent has to obtain the permission of the Yangon Region Government with the recommendation of Yangon Region Administrative Body of Farmland for the land use change from farm land other than paddy field land to other land use under sub-section (b) of section 30.

28) The Management of Vacant, Fallow and Virgin Land Law (2012)

Purpose: To ensure the project land is clearly get as the project land.

- The project proponent will ensure to get permitted areas for the project land by the Central Administrative Body on Vacant, Virgin and Fallow Land under sub – section (d) of section 10 of said law.
- The project proponent will promise to return the land if any antique object is found in the project area under sub – section (a) of section 19 of said law.
- The project proponent will promise to return the land if any resource is found in the project under sub-section (d) of section 19 of said law.

29) The Labor Organization Law (2011)

Objectives: To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labor organizations systematically and independently.

- The project owner has to allow the labor organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labor laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached under section 17 of said law.
- The project proponent has to allow the demand for the re-appointment of worker who is dismissed by the employer without the conformity with the labor laws under section 18 of said law.
- The project proponent has to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker under section 19 of said law.
- The project proponent has to allow the labor organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee’s rights or interest contained in the labor laws under section 20 of said law.
- The project proponent has to allow the labor organization to participate in solving the collective bargains of the employees in accord with the labor laws under section 21 of said law.
- The project proponent has to allow the labor organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation, by-law and directive of relevant Chief Labor Organization under section 22 of said law.

30) The Settlement of Labor Dispute Law (2012) (Amendment 2019)

Objectives: To ensure negotiation and discussion between employees and project proponent, abiding the decision of Tribunal.

- The project proponent has to not absent to negotiation within the stipulated time for complaint under section 38 of said law.
- The project proponent has to not change the existing stipulations for employees within conducting period before tribunal under section 39 of said law.
- The project proponent has to not close the work without negotiation, discussion on dispute in accord with this law, decision by tribunal under section 40 of said law.
- The project proponent has to pay the compensation decided by Tribunal if violates any act or any omission to damage the interest of labor by reducing of product without efficient cause under section 51 of said law.

31) The Employment and Skill Development Law (2013) (Amendment 2019)

Objectives: To ensure the job security and to develop the employee’s skill with the fund of project owner.

- The project proponent has to appoint employees with the contract under section 5 of said law.
- The project proponent has to carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed under section 14 of said law.

- The project proponent has to monthly pay to the fund, which is fund for development of skill of employees, not less below 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level under sub section (a) of section 30 of said law.
- The project proponent has to promise not to deduct from the payment of employees for above mentioned fund under sub section (b) of section 30 of said law.

32) The Minimum Wage Law (2013)

Objectives: To ensure the project owner pay the wages not less than prescribed wages and notify obviously these wages in work place, moreover to be inspected.

- The project proponent has to notify the prescribed wages obviously in work place under sub section (a) of section 13 of said law.
- The project proponent has to correctly record the lists, schedules, documents and wages and report these to the relevant department and give if these are asked while inspecting, in accord with the stipulations under sub section (b)(c)(d) of section 13 of said law.
- The project proponent has to allow to be inspected by the inspector under sub section (d) and (e) of section 13 and section 18 of said law.
- The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work under sub section (f) of section 13 of said law.
- The project proponent has to allow holidays without deducting from the wages if one of parents or one of family dies under sub section (g) of section 13 of said law.

33) Payment of Wages Law (2016)

Objectives: To ensure the way of payment and avoiding delay payment to the employees.

- The project proponent has to pay the wages under section 3 and 4 of said law.
- The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster under section 5 of said law.
- The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages under section 7 to 13 in chapter (3) of said law.
- The project proponent has to pay the overtime fees, prescribed by law, to the employees who work over working hours under section 14 of said law.

34) Workmen's Compensation Act (1923)

Objectives: To ensure the compensations to injured employee while implementing in line with the above law and to pay the prescribed compensations in various kinds of injury.

- The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case under section 13 of said law.

35) The Leaves and Holiday Act (1951) (Amendment 2014)

Objectives: The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves.

- The project proponent has to allow the leaves and holidays in line with the law.

36) The Social Security Law (2012) (Amendment 2014)

Objectives: The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed fund.

- The project proponent has to register to the respected social security office under sub section (a) of section 11 of said law.
- The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15 under section 15 of said law.
- The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees. Moreover, the project owner will pay the cost for paying the above-mentioned fund only myself under sub section (b) of section 18 of said law.
- The project proponent has to pay the fund for accidence sub section (b) of section 48 of said law.
- The project proponent has to make correctly and submit the list and record provided in section 75 to respected social security office under section 75 of said law.

37) The Conservation of Water Resources and Rivers Law (2006) (Amendment 2017)

Objectives: The project proponent will avoid the disposal of stipulated materials into river-creek.

- The project proponent has to avoid any act to damage to the river, any creek and water resource under sub section (a) of section 8 of said law.
- The project proponent has to avoid disposing the fuel, chemicals, toxic substances, other substances and explosive substances from the bank to the river under sub section (a) of section 11 of said law.
- The project proponent has to avoid disposing any material, which may damage or change the water way, from the bank to the river under section 19 of said law.
- The project proponent has to avoid constructing the toilets, which are not suitable, at the bank under sub section (a) of section 21 of said law.
- The project proponent has to avoid digging the well or lake and digging the soil without permission of the Directorate under sub section (b) of section 21 of said law.
- The project proponent has to avoid putting the heavy materials in the bank without permission of the Directorate under section 22 of said law.
- The project proponent has to avoid the violation of conditions stipulated by the Directorate for prevention of water pollution under sub section (b) of section 24 of said law.

38) The Conservation of Water Resources and Rivers Rules (2013) (Amendment 2015)

Objectives; To ensure the project scope and project period are submitted to the department and the permission is given before commencing the construction of the project. This law focuses as follows;

- If the project proponent has to build a river-crossing bridge or stream-crossing bridge alongside within the stream territory, river bank territory and strand territory as necessity, present the project scope and project period to the Ministry of Transport and request the agreement contract, in line with the section (20) of said law.
- After reviewing the request form in accordance with section 20 and if there is no possible impact on conservation of water resources and rivers, the Ministry of Transport shall define the regulations and give the permission of constructing stream-crossing bridges and river-crossing bridges, in line with the section (21) of said law.
- If the permission is given according with section 21, the project proponent has to submit the project scope and monitoring service charges to the department for the construction of the river-crossing bridges and stream-crossing bridges, in line with the section (22) of said law.

39) Underground Water Act (1930)

Objectives: to ensure to obtain the license before sinking the underground water and to abide by the conditions in license.

- The project owner will obtain the license granted by the water officer for sinking the underground water before sinking water under section 3 of said law.
- The project proponent has to abide by the conditions prescribed by rules under sub section (a) of section 6 of said law.

40) The Forest Law (2018)

Objectives: to ensure in carrying out the project with the permission of Ministry of Natural Resources and Environmental Conservation if the project land is forest land or forest covered land. This law focuses as follow;

- The project proponent has to obtain the permission of Ministry of Natural Resources and Environmental Conservation before starting the work if the project land is forest land or forest covered under sub- section (a) of section 12

41) The Conservation of Biodiversity and Protected Areas Law (2018)

Objectives: to ensure abiding by the prohibitions and stipulations to protect biodiversity and protected area

- The project proponent has to avoid entering the prohibited area located in protected area without permission under sub-section (a) of section35 of said law.
- The project proponent has to avoid digging on the land or carrying out any activity in protected area under sub-section (c) of section35 of said law.
- The project proponent has to avoid extracting, collecting or destroying in any manner, any kind of wild or cultivated plant in protected area under sub-section (d) of section35 of said law.
- The project proponent has to avoid polluting soil, water and air, damaging a water-course or poisoning water, electrification, using chemical or explosive materials in protected area under sub-section (a) of section39 of said law.
- The project proponent has to avoid possessing or disposing of toxic objectives or mineral wastes in protected area under sub-section (b) of section39 of said law.

42) The Ethnic Rights Protection Law (2015)

Objectives: To ensure to disclose to residents' ethnic nationalities about the project fully, moreover to ensure to cooperate with them. This law focuses the following matters;

- The project proponent has to disclose all about the project fully to the residents who are national races.
- The project proponent has to cooperate with the residents who are national races according to section 5 of said law.

43) The Ethnic Rights Protection Rules (2019) (Amendment 2020)

- The project proponent has to compliance with rule 20 shall be reported to the Ministry in full and submitted to the ministry before the project commences under sub-section (a) of section 21 of said law.
- After the implementation of the project, the plan must be submitted to the ministry under sub-section (b) of section 21 of said law.

44) The Protection and Preservation of Cultural Heritage Regions Law (2019)

Objectives: To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.

- The project proponent has to apply to get the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area under section 13 of said law.
- The project proponent promises not to build the building which is not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area under section 22 of said law.

45) The Protection and Preservation of Antique Objects Law (2015)

Objectives: To ensure the protection of ancient monument and information about it if it was in the project area. This law focuses as follow;

- The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.

46) The Protection and Preservation of Ancient Monuments Law (2015)

Objectives: To ensure the protection of ancient monument and information about it if it was in the project area. This law focuses as follows;

- The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water under section 12 of said law.
- The project proponent has to obtain the prior permission of Department of Ancient Research Museum if the project area is in the prescribed area of ancient monument under section 15 of said law.
- The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent disposes the chemical and solid waste in the Ancient Monument area under sub section (f) of section 20 of said law.

47) The Petroleum and Petroleum Product Law (2017)

Objectives; This law is holding license for import and storage of petroleum and petroleum products, and the holder's compliance with the license terms. This law is applicable to the project because of the transportation and storage of fuel in all project phases. The obligations of the project proponent are;

- To transport the fuel by the vehicle or vessel which is licensed by the Ministry of Transportation and Communication under sub-section (a) of section 9;
- To abide by the procedures and conditions specified by the Ministry of Transportation and Communication under sub-section (e) of section 9;
- To transport after obtaining the transportation license issued by the Ministry of Natural Resource and Environmental Conservation under sub-section (b) of section 10;
- To allow inspection by the Ministry of Natural Resource and Environmental Conservation under sub-section (d) of section 10;
- To store the fuel in the tank which is licensed by the Ministry of Natural Resource and Environmental Conservation under sub-section (a) of section 10; and
- To show the sign of danger on the tank or container of fuel under section 11.

48) The Petroleum Rules (1937)

The purpose~~:~~ of the Rules is to ensure the project owner's compliance with the stipulations for transportation of oil. The project proponent has to abide by the provisions of chapter (3) for transportation as well as the provisions of chapter (4) for storage.

3.3 Applicating of International and Domestic Guidelines

The ultimate EIA report will be prepared based on the Myanmar Environmental Impact Assessment Procedure (2015) and International best practice and guidelines. Specifically, the environmental impact assessment for this "230 MW Combine Cycle Power Plant (Mawlamyine)" shall be conducted following not only the National Environmental Guidelines but also International Guidelines and Practices such as WHO standards, IFC performance indicators. The international guidelines are as follows;

a) Environmental Health and Safety Guidelines for Hazardous Materials Management, 2007
b) Environmental Health and Safety Guidelines for General Environmental, Health and Safety Guidelines, 2007
c) Environmental Health and Safety Guidelines for Occupational, Health and Safety, 2007
d) Environmental Health and Safety Guidelines for Thermal Power Plants

In addition, IFC performance standard (PS) represent the policy and performance-based framework and requirements for the ESIA and sustainable social and environmental management for the project. Whereas the World Bank Group's EHS Guidelines provide guidance on general and industry best practice as well as recommended numerical limits for air emissions to the atmosphere, noise, liquid and solid wastes, hazardous waste, occupational health and safety, and other aspects of industrial facilities and other types of development project. The IFC performance standard (PS) includes:

- PS 1 Assessment and Management of Environmental and Social Risks and Impacts

- PS 2 Labor and Working Conditions
- PS 3 Resource Efficiency and Pollution Prevention
- PS 4 Community Health, Safety and Security
- PS 5 Land Acquisition and Involuntary Resettlement
- PS 6 Biodiversity Conservation and Sustainable Management of Natural Resources
- PS 7 Indigenous Peoples
- PS 8 Cultural Heritage

Table 3. 1 International Conventions of relevance to Project

Legislation	Relevance to the Project	Ratification Status (in Myanmar)
Environmental		
Vienna Convention for the Protection of the Ozone Layer 1988 and Montreal Protocol on Substances that Deplete the Ozone Layer 1989	Not relevant to the Project as the Project will not use any ozone depleting substances.	Accession 16th Sep 1998 (Vienna) & Accession 24th Nov 1993 (Montreal)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	The Project may generate hazardous wastes.	Entered into force 6th April 2015
United Nations Framework Convention on Climate Change 1992 (UNFCCC) and Kyoto Protocol 1997	The project will form part of Myanmar's total emissions output.	Entered in for 23rd Feb 1995 (UNFCCC) and 16th Feb 2005 (Kyoto Protocol)
United Nations Agenda 21	Not relevant to Project. Relevant to the government.	Since 1997
Ramsar Convention	To halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain.	Since 1975
Convention on Migratory species of Wild Animals was found that there is no relevant to this project.		
Convention on International Trade in Endangered Species of Wild Fauna and Flora Convention (CITES)	To ensure international trade of wild animal and plant species does not threaten their survival	Washington DC 1973 and amended in Bonn, Germany 1979
Convention on Biological Diversity	To develop national strategies for the conservation and sustainable use of biological diversity.	Rio de Janeiro 1992

Legislation	Relevance to the Project	Ratification Status (in Myanmar)
United Nations Framework Convention on Climate Change	To curb and stabilize greenhouse-causing emissions in the atmosphere.	New York 1992
The Convention Concerning the Protection of the World Cultural and Natural Heritage	To conserve not only the world heritage sites situated on its territory, but also to protect its national heritage.	Paris 1972
Kyoto Protocol to the Convention on Climate Change	To limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.	Kyoto 1997

CHAPTER 4 PROJECT DESCRIPTION

4.1 PROJECT BACKGROUND

Myanmar UPA Company Limited ('MUPA' or 'the Project Sponsor' or 'the Project Proponent') is planning to develop a 200MW Combined Cycle Power Plant (CCPP) to supply power to the Republic of the Union of Myanmar through a Power Purchase Agreement (PPA) with the Ministry of Electric Power (MOEP) (the predecessor of Ministry of Electricity and Energy (MOEE)). (Described in Annex-C)

The Project Proponent has signed the Memorandum of Understanding (MOU) and the Memorandum of Agreement (MOA) with the Government of Myanmar in August 2013 and August 2014 respectively. In addition, the Power Purchase Agreement (PPA) has been signed between the Project Proponent and MOEE in March 2016.

This Chapter provides a description of the proposed 200MW Combined Cycle Power Plant, including the facilities, equipment required and the associated activities to be undertaken throughout the Project cycle, including construction, operation and decommissioning phases. This Chapter also provides an analysis of alternatives to the Project in *Section 4.5.*

The proposed Project will be located in Kanbauk Village, Yebyu Township, Dawei District in Tanintharyi Region, Myanmar. The Project comprises of the following Project facilities:

- 200MW Combined Cycle Power Plant (CCPP);
- Water Intake Pumping Station including Water Treatment Facility;
- Water Intake Pipeline; and
- The Fuel Supply Infrastructure consisting of Gas Metering Station located within the MOGE Gas Receiving Station and Gas Supply Pipeline from Gas Metering to the Power Plant.

It should be noted that the existing gas pipeline connection from the offshore gas source(s) to MOGE Gas Receiving Station and the proposed overhead transmission line from the Project Site connecting to the Sub-Station is outside the scope of this ESIA Study.

However, the Gas Metering station (located within the MOGE Gas Receiving Station boundary) and the Gas Supply Pipeline from the Gas Metering Station to the Project Site have been considered.

The technology of the project is an efficient form of combined cycle power generation which was designed for high reliability and efficiency operation with lower environmental impact. The project will operate on natural gas supplied by EPGE or other source like LNG, MUPA will perform the revised development plan for the Project in accordance with the actual gas availability when confirmation of Fuel supply quantity by EPGE.

The electrical capacity and electricity generated will be sold under a 30-year Power Purchase Agreement ("PPA"), as agreed with Electric Power Generation Enterprise (EPGE). The total Project cost is approximately US 300 million dollars. The contractual structure of the Project is shown in Figure 4.1.

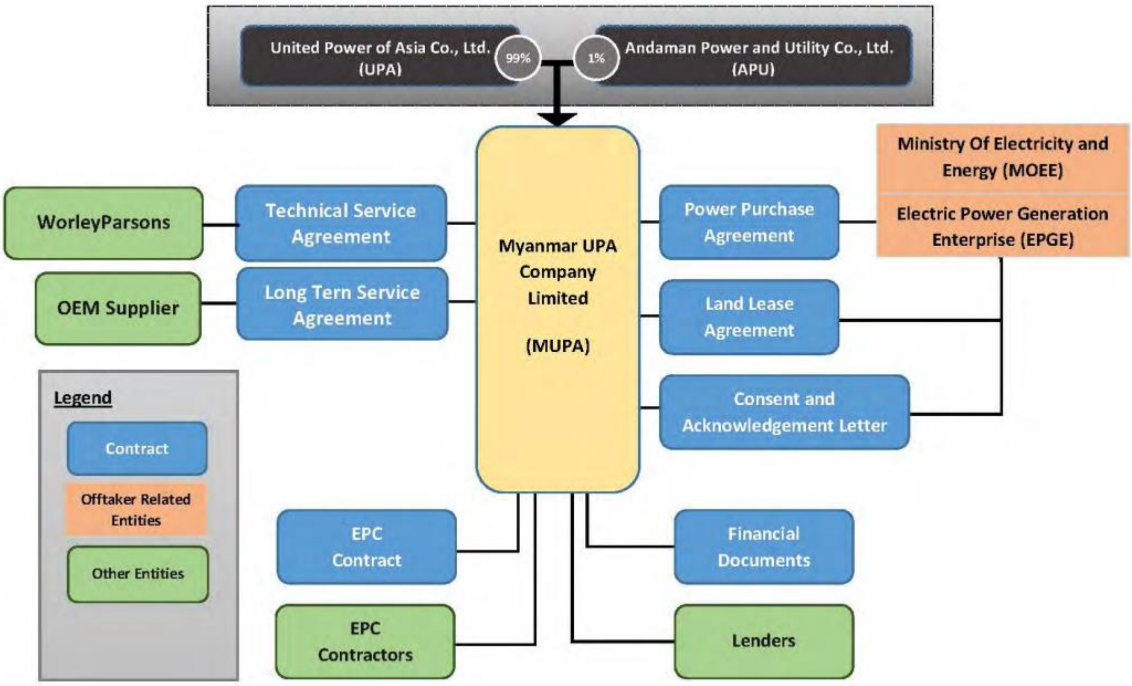


Figure 4. 1 Contractual Structure of the project

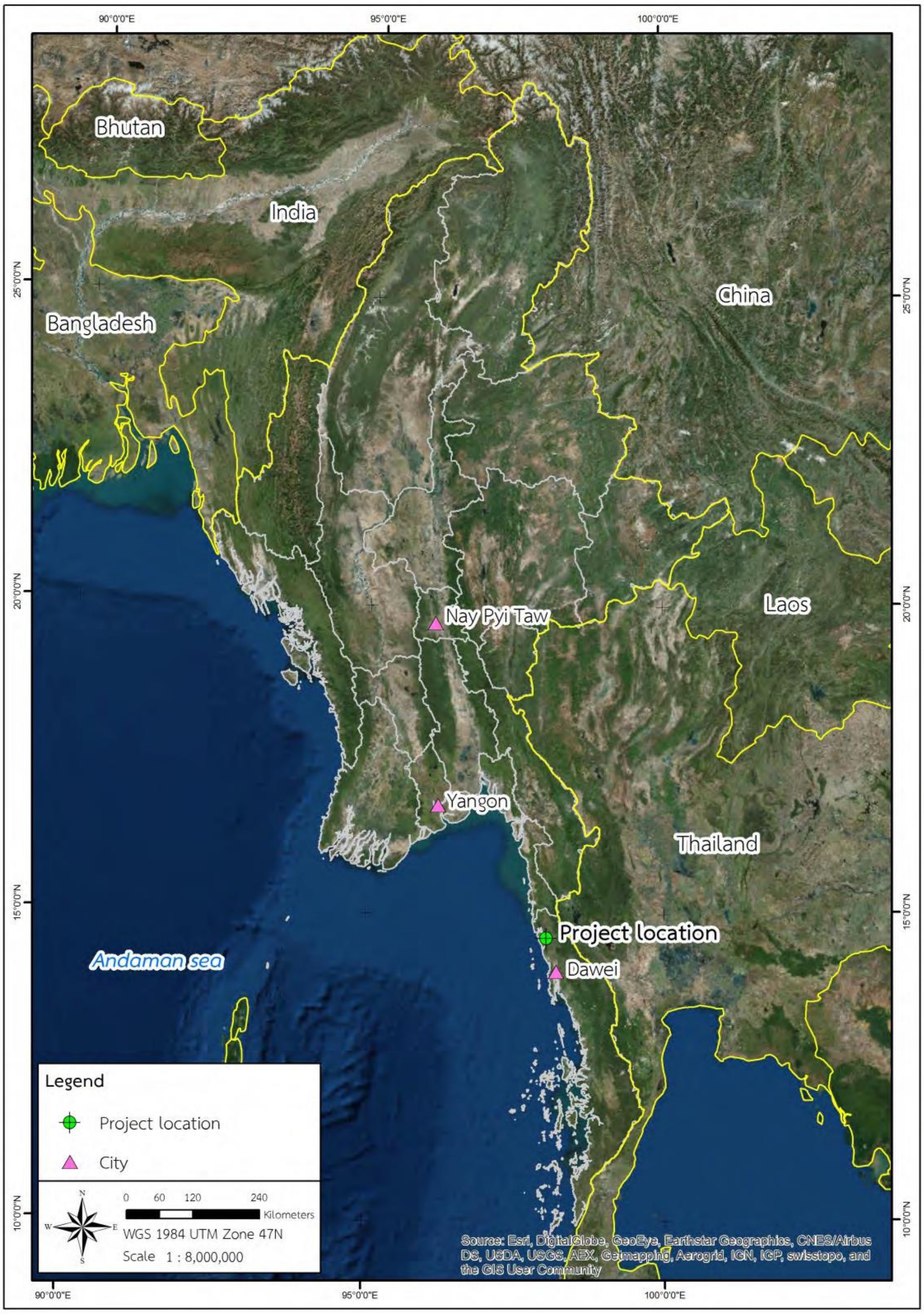
4.2 Project Location

The Project site is located in Kanbauk Village, Yebyu Township, Dawei District in the Tanintharyi Region, the Union Republic of Myanmar as shown in Figure 4.2 and Figure 4.3.

The Power Plant will be located on a brown field site, with a total of 9.47 hectares (ha). The land is currently owned by EPGE; however, the land has been allocated for this Project. Land Lease Agreement between the Project Proponent and EPGE is being proceeded (Annex C).

It shall be noted that the Project Proponent has previously signed a Power Purchase Agreement with Tanintharyi Region Government to supply 6-20MW electricity to Dawei District. The gas engines rental project carried out during June 17^{th} 2015 to June 2017 at the same Project boundary, and provided electricity to Dawei District and nearby area.

The Project site is largely surrounded by flat agricultural land with four (4) nearby villages. The closest villages to the Project site are Mi Gyaung Auing, Hle Gon and Pyin Gyi, which have a population of 600, 1,378 and 350 people, respectively. The Kanbauk village is located approximately 1.8km south of the Project site, with a total population of approximately 9,976 people.



Source: MUPA, 2016 (modified by ERM)

Figure 4. 2 Project Location within Myanmar

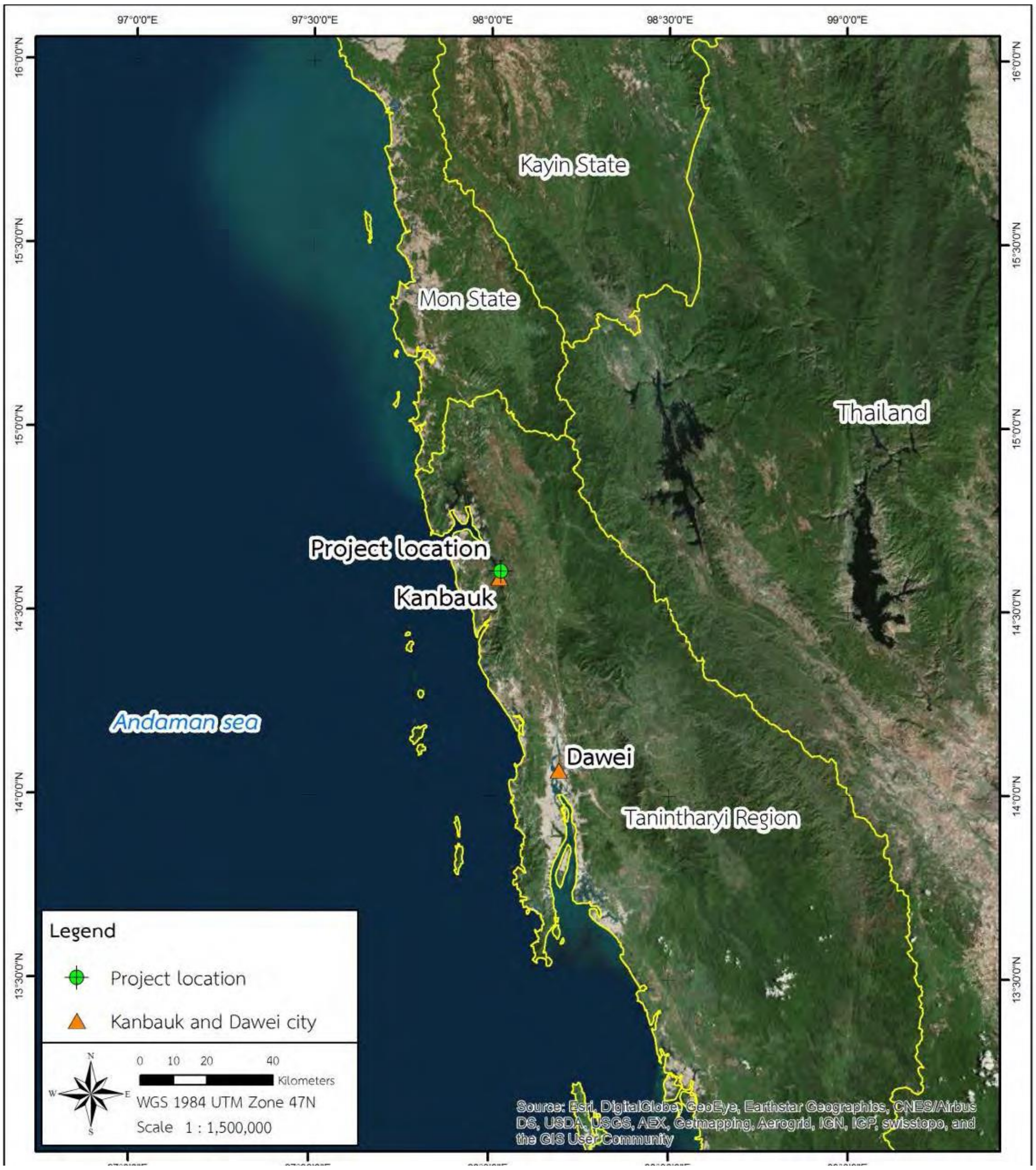


Figure 4. 3 Project Location within Tanintharyi Region

The following 10 villages are located in close proximity (5km radius from the Project site boundary), as shown in Figure 4.4:

Mi Gyaung Aing village;	Shin Byan village;
Hle Gone village;	Pet Taung village;
Kanbauk village;	Pyin Gyi village;
Ohn Pin Kwin village;	Gan Gaw Taung; and
Heinze village;	Ye Ngan Zeik village.

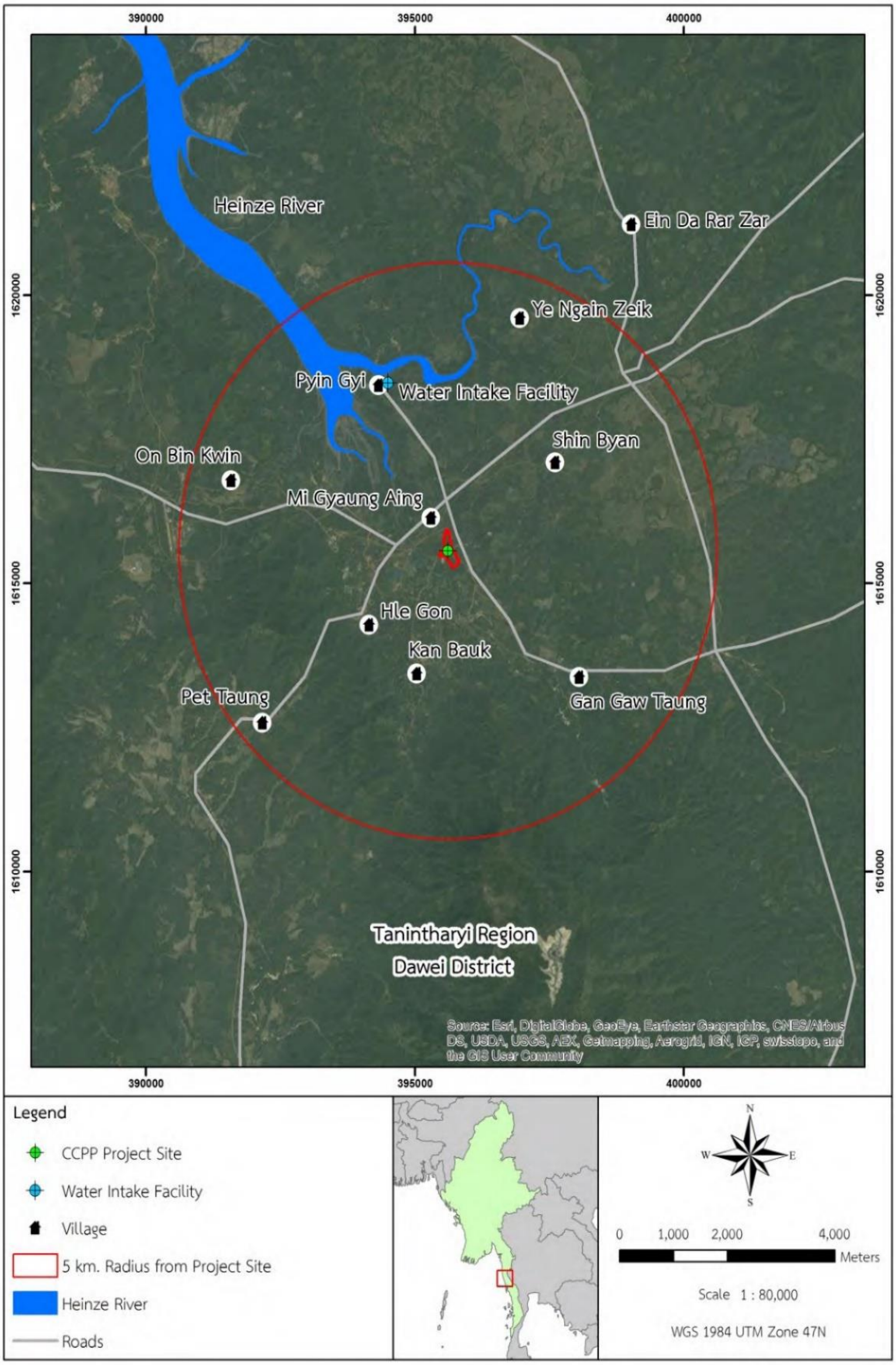


Figure 4. 4 Social Receptor within 5km of the Project site

Only Pyin Gyi village is located within 500m of the Water Intake Site, including the Water Intake Pumping Station, Water Treatment Facility and Water Intake Pipeline.

The Heinze River is located approximately 3km north-west of the Project site boundary. The location of the Heinze River and the proposed Water Intake Facilities are shown in Figure 4.5

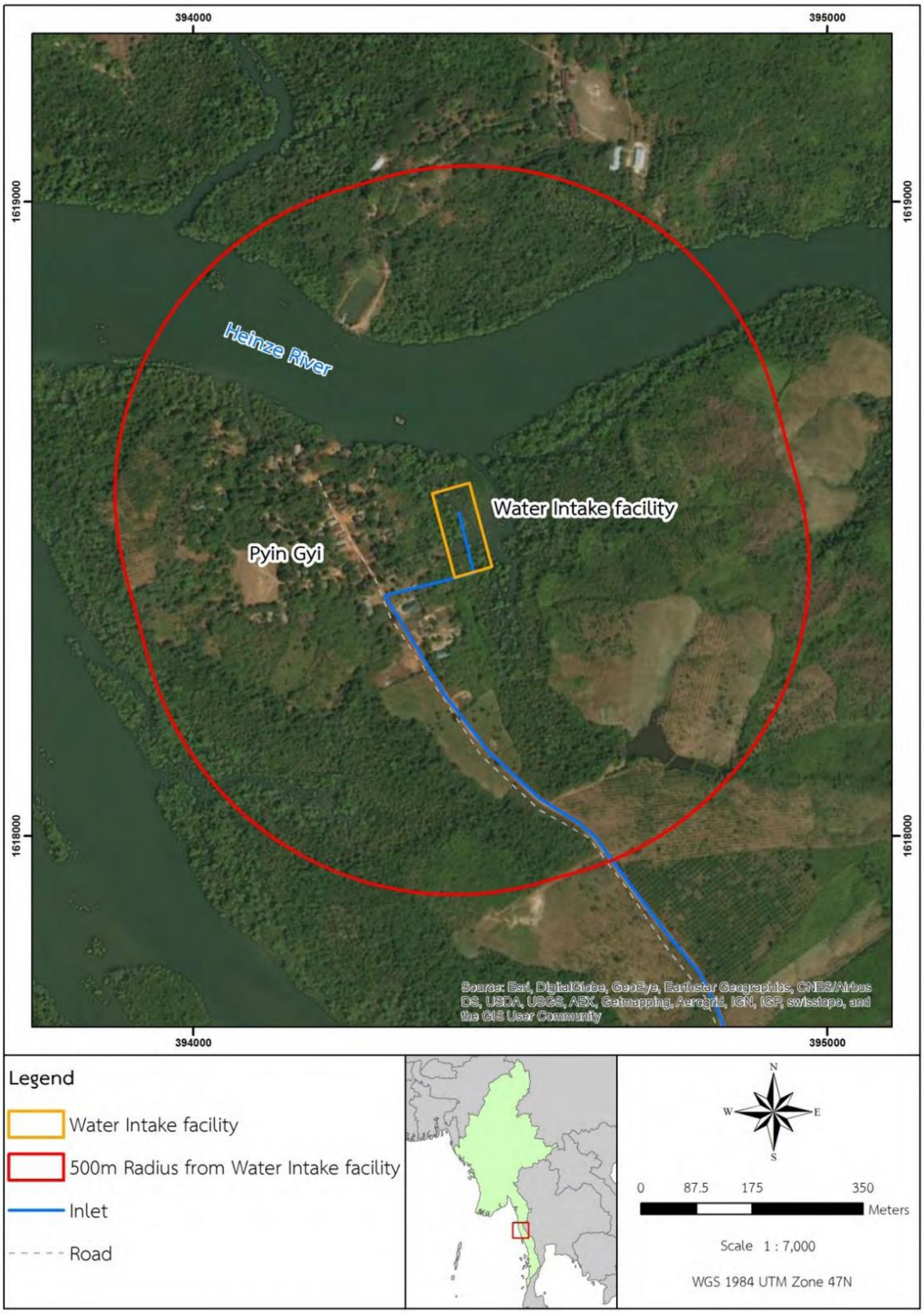


Figure 4. 5 Water Intake Facility Location

To the north of the Project site boundary is a paved road and agricultural area, to the south a tributary of the Heinze River and some agricultural land. To the east a paved road, habitation, agricultural area and a monastery and to the west of the Project site is an existing dirt and paved road and Mi Gyaung Aing and Hle gone villages (see Figure 4.6).

Figure 4. 6 Surrounding Environment of the Project Site

4.3 DESCRIPTION OF THE PROJECT

4.3.1 Project size

The power plant is set up on total 9.47 hectares (ha) of EPGE, which has been allocated for the 200 MW combined cycle power plant.

4.3.2 Production Process

The Power Plant is designed to operate continuously, in combined cycle mode. During normal combined cycle operation, the heat of Gas Turbine exhaust gas will be admitted to the Heat Recovery Steam Generator (HRSG) where superheated steam will be produced which will drive the steam turbine to generate electrical power. The Gas Turbine, equipped with a generator, is generating electrical power as well. The exhaust gas from the HRSG will be released from the main stack of the HRSG to the atmosphere. It is anticipated that the Power Plant will operate at full load for the majority of the time.

The HRSG is designed for dual pressures steam generation (High Pressure (HP) and Low Pressure (LP)) used to maximize energy transfer from the exhaust gas of the gas turbine. The HP steam generated by the HRSG will be fed to the HP steam turbine and the LP steam will be fed to the LP steam turbine.

The power output is net 200MW during combined cycle operation. The Power Plant will use natural gas or LNG.

The indicative general layout of the Project installations is shown in Figure 4.7. The indicative layout of the Power Plant is shown in Figure 4.8. In addition, the CCPP Process Flow Diagram of the Power Plant is shown in Figure 4.9.

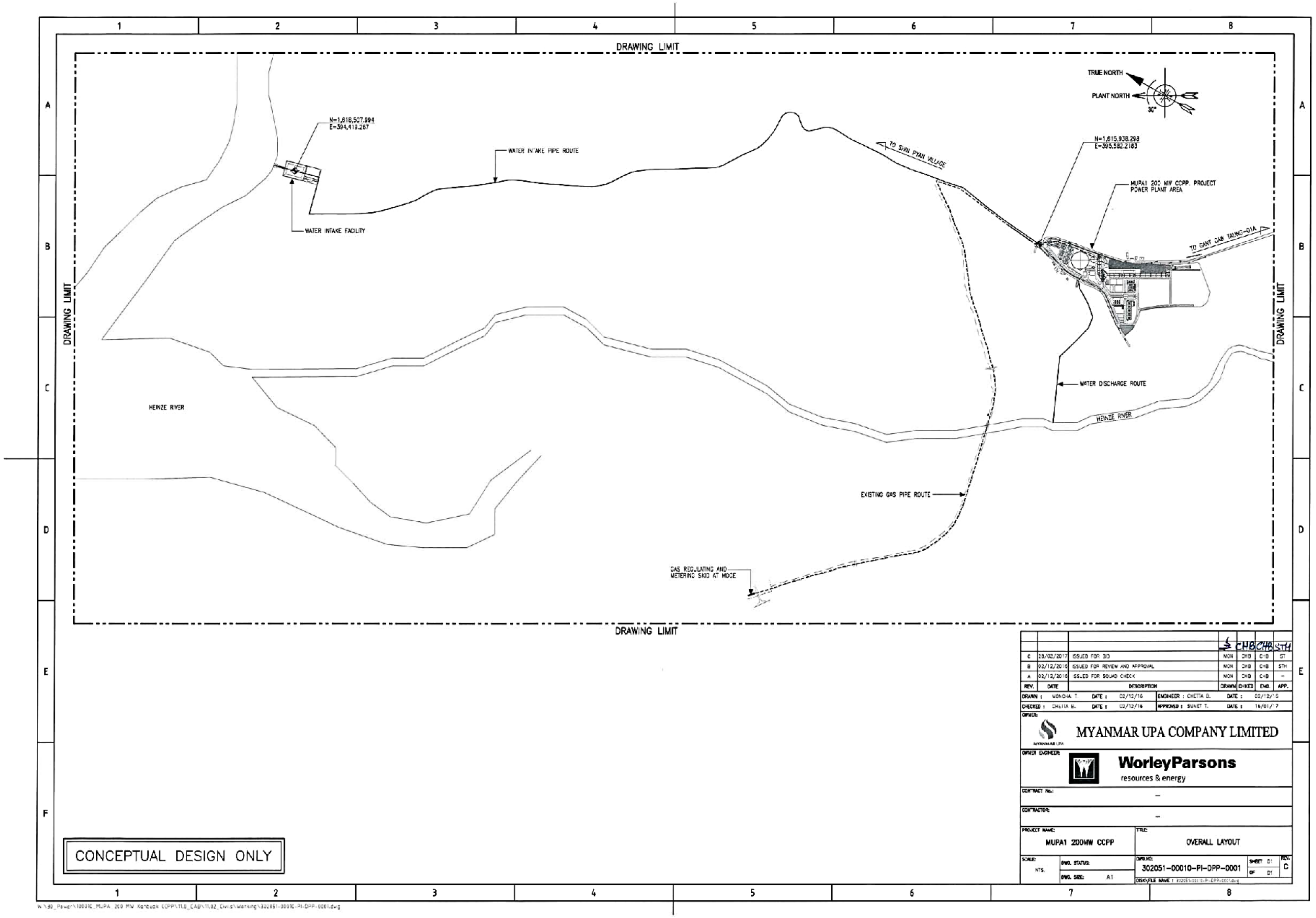


Figure 4. 7 Indicative Layout of the Project Installations

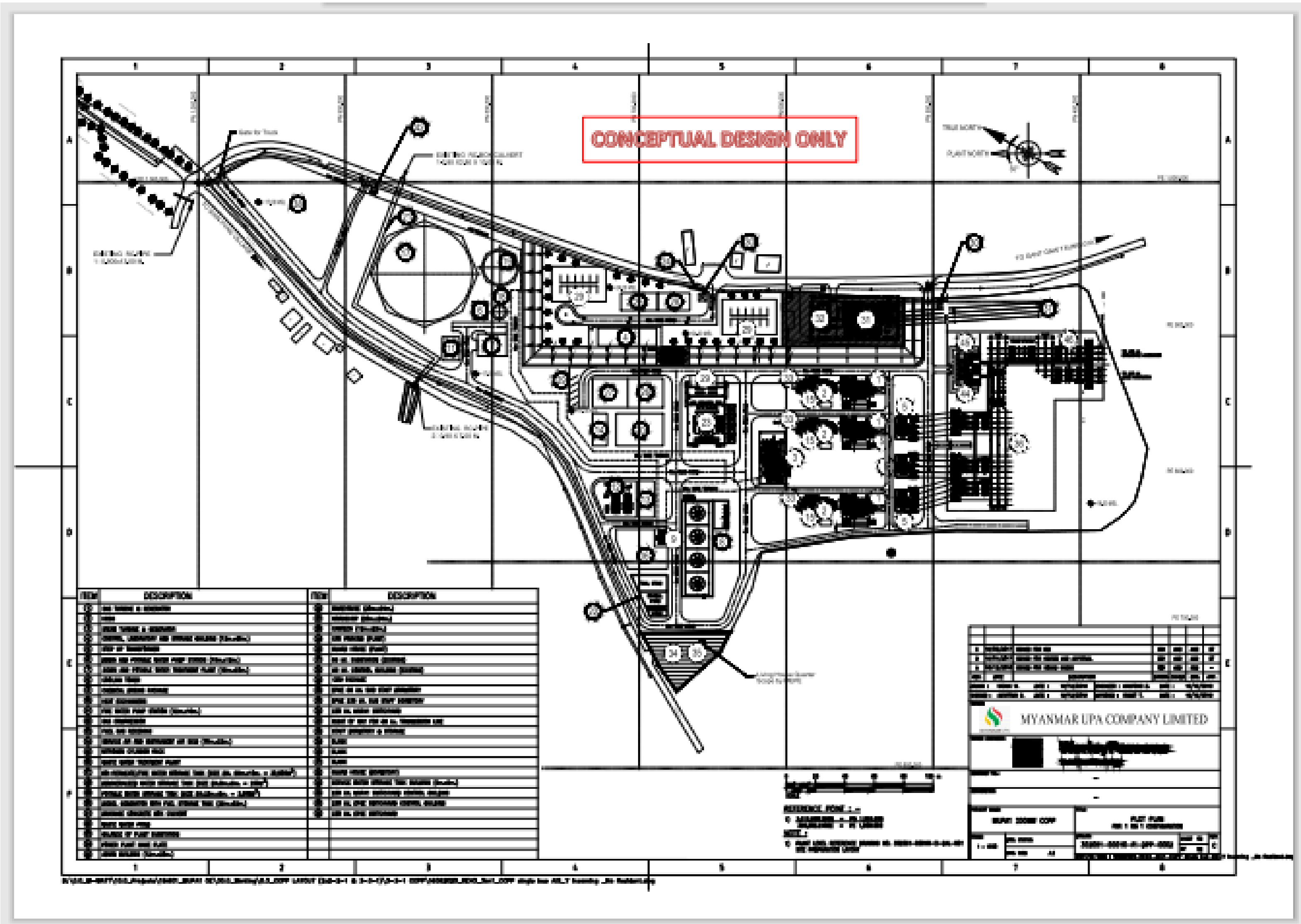


Figure 4. 8 Indicative Layout of the Power Plant

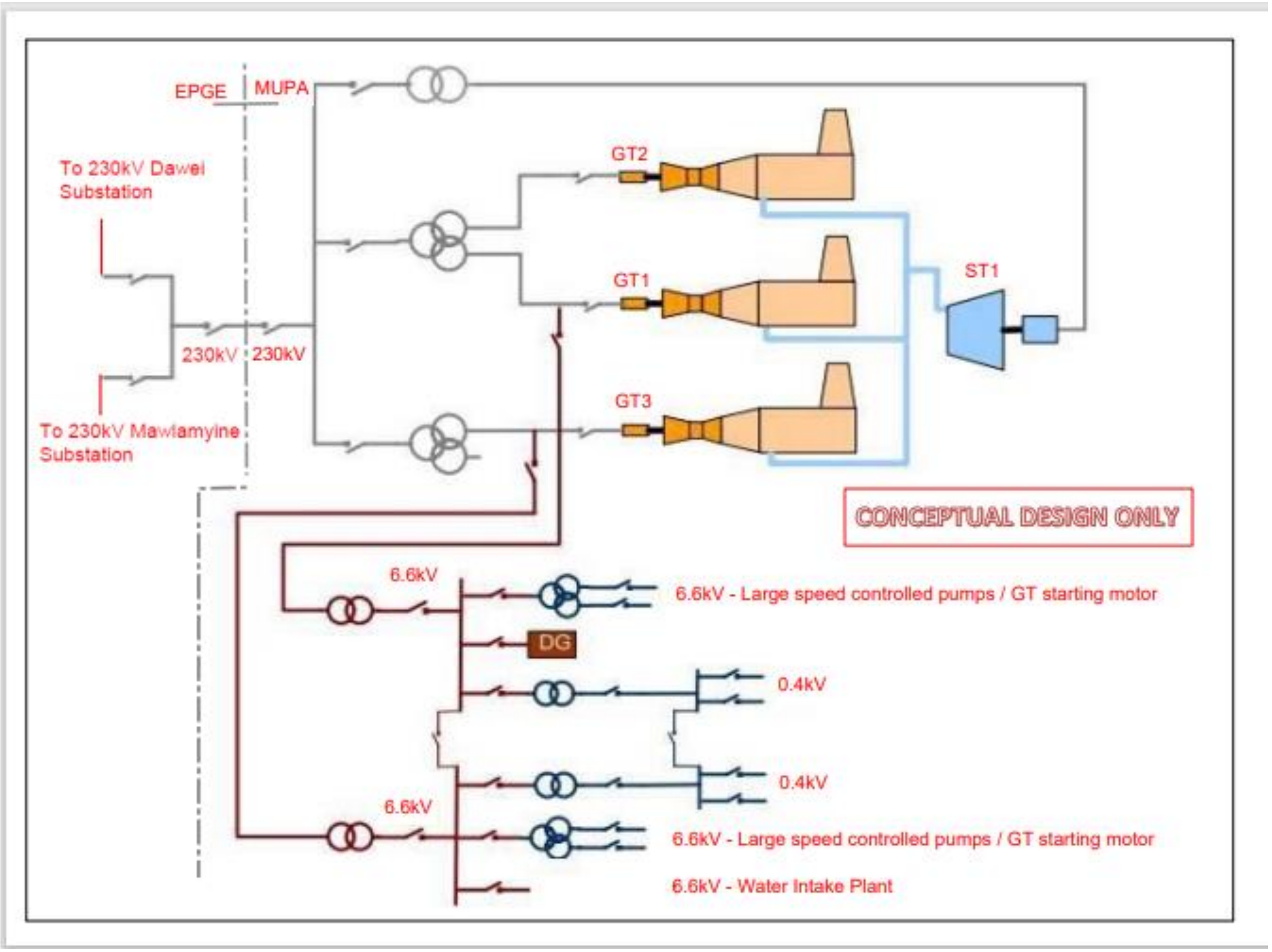


Figure 4. 9 CCPP Process Flow Diagram

4.3.3 Project Facilities

200MW Combined Cycle Power Plant comprising of the following main components:

- 3 sets of Gas Turbine (GT) units;
- 3 sets of Heat Recovery System Generator (HRSG);
- 1 steam turbine generating unit with associated auxiliary equipment;
- 230kV Switchyard area (located in adjacent to the existing 66kV Switchyard);
- Workshop/ warehouse and administrative building;
- Cooling Tower and Cooling Water System;
- Water Storage Tank; and
- Laydown Area.

Water Intake Pipeline connecting the CCPP with the Water Treatment Facility, located on the embankment of the Heinze River, where the raw water will be withdrawn from the Heinze River, through the Water Intake Pumping Station. The Water Intake Pipeline will be approximately 3.3km in length and approximately 35cm in diameter.

The Fuel Supply Infrastructure consisting of Gas Metering Station located within the MOGE Gas Receiving Station and Gas Supply Pipeline from Gas Metering Station to the Power Plant is owned by the Project Proponent. The Gas Supply Pipeline is approximately 2.6km in length, with 25cm diameter.

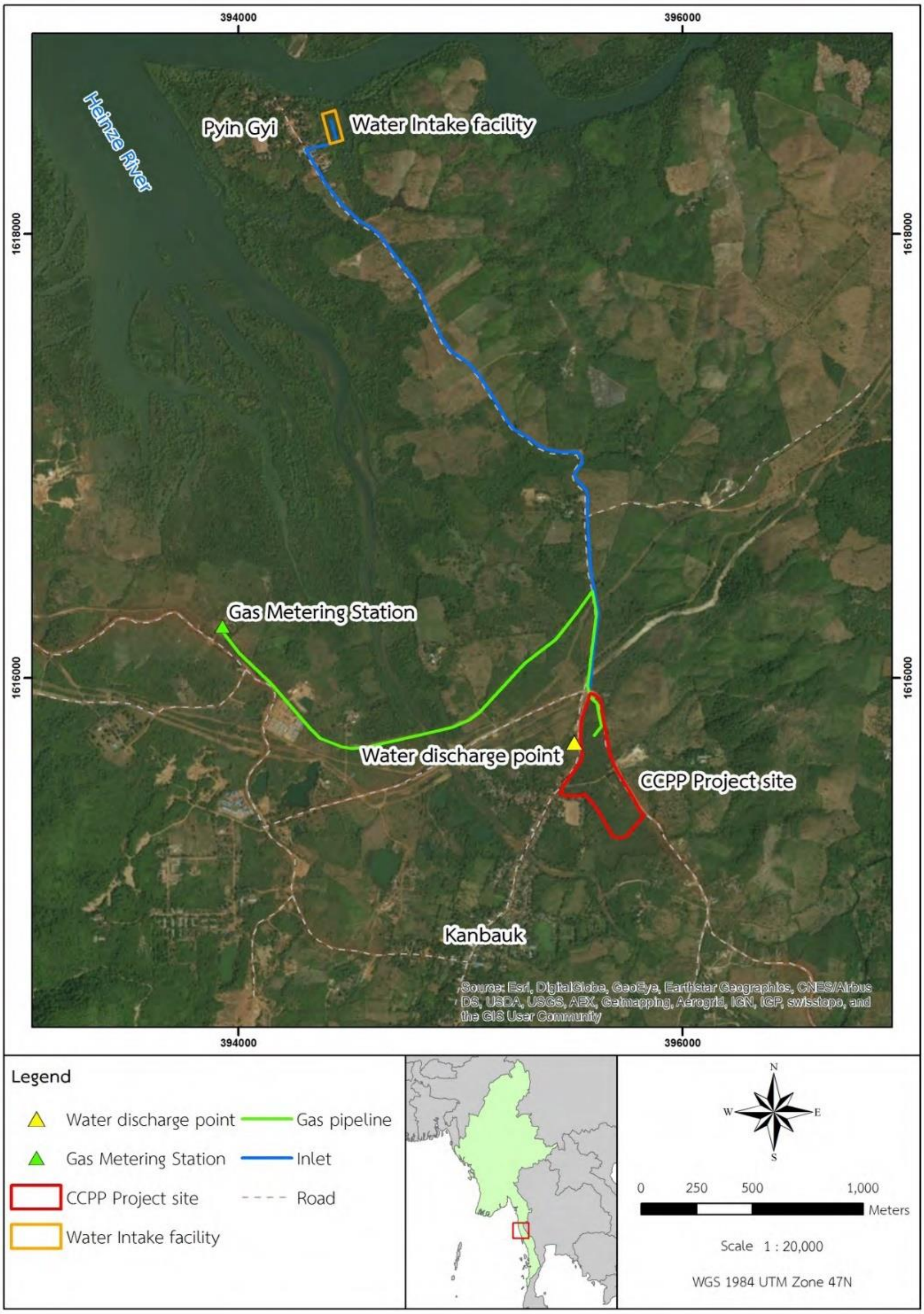


Figure 4. 10 Project Facilities Overview

4.3.4 Main component of 200 MW Combined Cycle Power Plant

4.3.4.1 Gas Turbine and Generator (GTG)

The Siemens gas turbines are selected for this Project. The rotor is supported in only two bearings which lie outside the pressurized region. This provides the basis for ensuring good alignment and thus smooth running. The generator is connected to the gas turbine through a coupling at the compressor or “cold” end. This feature provides for an axial exhaust to optimize the plant arrangement for combined cycle application.

The Power Plant will be operated based on grid dispatch instructions. The Power Plant will be declared available for full load in normal case. The Power Plant is capable for house load operation. In case of any trip, the Power Plant could be started within 2 hours.

One gas turbine unit will be installed for the Project. The gas turbine will be installed within an acoustic, ventilated enclosure with fire detection and protection systems. The gas turbine will have all associated ancillary equipment and systems required for the safe, efficient and reliable operation of the unit under combined cycle operation.

The gas turbine specification for each unit is shown in Table 4.1

Table 4. 1 Gas Turbine Specification

Feature	Specifications
Supplier	Siemens
Country of Origin	Germany
Model/Type	Siemens SGT-800
Fuel system	Gas or other fuel within specification
Starting Means	Electric VSD start-motor connected to the gearbox Frequency
Air filtration	Static type
Compressor/Turbine Cleaning	On and Off-line Compressor Water Wash
Exhaust System	Axial
Emissions Control	Gas – Dry Low Emission (3rd Generation)
Fire Detection	Heat Detectors
Gas Leak Detection	Gas detectors
Fire Protection	High pressure CO_2 System
Off-Base Acoustic Enclosure	Turbine and Load Gear Compartments
On-Base Acoustic Enclosure	Lube oil and Gas module Compartments
Gas turbine generators (GTGs) supplier/country origin	Siemens/Germany

The gas turbine will be capable of operation with its exhaust gases passing into the associated heat recovery steam generator, located on the exhaust ducting upstream of the heat recovery boiler.

All cooling requirements for the turbine shall be met using heat exchangers, fed from the Closed-Circuit Water (CCW) system.

Control of emissions of NOx will be achieved by Dry Low NOx (DLN) burners. The detailed of embedded emission controls are described in a subsequent section

Audible and visual alarms will be located in the Central Control Room (CCR). In addition, a Fire Detection System (FDS) will be installed at each gas turbine.

4.3.4.2 Heat Recovery Steam Generator (HRSG)

The HRSG shall be a two-pressure non-reheat with horizontal flue gas flow. The HRSG shall be designed to match the gas turbine which fires natural gas. The HRSG shall be able to follow load changes of the gas turbine without any delays.

The HRSG and associated equipment shall be designed for base load operation, but with provision for cyclic operation. The heating surfaces shall be optimized to achieve a high and economical steam output without creating any operation problems such as evaporation in the economizers or unstable conditions in the evaporators.

The HRSGs will be sized to operate over the full range of ambient temperatures specified. The HRSG consists of an economizer, evaporator, and super-heater tube bank section(s) with finned tubing, as appropriate, to maximize heat transfer. No supplemental firing facilities will be installed.

All pressure parts will be designed, manufactured and tested in accordance with "ASME Boiler and Pressure Vessel Code, Section 1, Power Boilers" or equivalent standards.

The HRSG specification is provided in Table 4.2.

Table 4. 2 HRSG Specification (at design condition)

Feature	Specifications
Supplier	TBA
Country of Origin	TBA
HP steam rating	230.1 t/h (to be determined)
HP steam pressure	81 MPa(a) (to be determined)
HP steam temperature	518 °C (to be determined)
LP steam rating	51 t/h (to be determined)
LP steam pressure	0.8 MPa(a) (to be determined)
LP steam temperature	277°C (to be determined)

4.3.4.3 Steam Turbine

The SST-600 is a single-casing turbine with front admission, geared or with direct drive. The steam chest is horizontally split and mounted in the outer casing considering the expected thermal expansion. There are four steam channels, which guide the steam directly to the nozzle segments upstream of the control stage. The nozzle segments consist of individual, solid blades with integral hubs and shrouds. The ends of the nozzles half-ring are welded to the horizontal joint and thus secured against rotation.

The steam turbine will be of proven design and complete with all auxiliary oil and steam systems. The steam turbine will be installed indoors for environmental protection (e.g., dust and rains) and to provide acoustic attenuation. The steam turbine building will include an overhead travelling crane suitable for lifting the maximum heavy load for normal maintenance activities and suitable indoor laydown areas for plant maintenance. The steam turbine specification is outlined in Table 4.3.

The steam turbine shall be designed with provisions to enable the combined cycle plant to operate on spinning reserve and provide frequency response. The limits of variations of rated steam conditions shall comply with IEC 45-1.

The cooling system for the steam turbine condenser will be a mechanical draft cooling tower cooling system using either seawater or river water as cooling medium.

The GT and ST units shall be housed indoor in a fully weatherproofed ventilated turbine hall.

Table 4. 3 Steam Turbine Specification

Feature	Specifications
Supplier	Siemens
Country of origin	Germany
Rated out power	82 MW (to be determined)
Rated power factor	0.8 (lagging)
Rated rotation	3000 r/min
Rated frequency	50 Hz
Phase number	3
Cooling mode	TEWAC (Totally Enclosed Water-To-Air Cooled)
Insulation class	Class F (temperature rise as per Class B)
Exciting mode	Static Excitation System
Steam turbine generators (STGs) supplier/country origin	Siemens/Germany

4.3.4.4 Condensers and Auxiliaries

The condensate system is provided with a recirculation system to ensure there is a minimum condensate flow through the pump and gland steam condenser. The minimum flow protection is accomplished by recirculating the condensate back to the condenser via the Condensate Pump Recirculation Control Valve, based on the flow rate measured at the pump discharge header.

4.3.4.5 Feed Water System

The feed water system will provide sufficient and reliable feed water to the HRSG from the demineralization plant. The HP Feed water flow rate shall be approximately 230t/h and the quality shall be in accordance with STG and HRSG Original Equipment Manufacturer recommendations.

The feed water system will include necessary feed water heaters, de-aerators, feed water pumps, control valves and auxiliaries.

4.3.4.6 Circulating Water System

A wet evaporative cooling system shall be provided with Cooling Water (CW) flow to remove heat from the condenser to the atmosphere using a cooling tower. The main CW system shall incorporate the condenser, CW pumps, one cold CW supply pipe feeding the condenser and one hot CW return pipe to return the water to a single mechanical draught wet cooling tower. All valves, instruments and controls shall be included. The layout of the system shall facilitate unrestricted airflow into the cooling tower and access for lifting equipment for maintenance.

The auxiliary cooling water (ACW) system shall be an integral part of the main CW system. Cooling of auxiliary equipment is through a closed-circuit cooling water (CCCW) system using treated condensate quality water or directly through the ACW system depending on the quality of cooling water required. These systems shall have adequate capacity so as not to limit CCPP output under extreme ambient conditions. A complete water management diagram shall be provided showing CW, ACW and CCCW systems during the design review phase of the Project.

As a minimum the EPC Contractor shall provide 2 x 100% duty main auxiliary cooling water heat exchangers.

A make-up water system, blowdown system and automatic closed loop chemical dosing system shall be provided to maintain CW quality and concentrations of controlled chemicals.

4.3.4.7 Closed Cooling Water System

The Closed Cooling Water System is designed to provide reliable cooling water (demineralized water) to the CCPP over the range of ambient and operating condition. The closed cooling water system is of the closed type with indirect coolers. Basically, the heat is transferred to the closed loop cooling water by typical heat exchanger equipment and is removed from the closed system by an exchanger with aux circulating cooling water. Normally, closed cooling water will supply to the following users;

- ST Generator Air Coolers
- ST Lube Oil Coolers
- HRSG Sampling Cooler Unit
- STG Area Sampling Cooler Unit
- Feed Water Pump Coolers
- GT Generator Air Coolers
- GT Lube Oil Coolers

The system shall have a make-up line which is connected from the demineralized water supply header. The closed cooling water head tank provided as part of the closed cooling water system shall be fitted with overflow vent and drain valve.

4.3.4.8 Water Intake System

The water intake system includes the Water Intake Pumping Station, the Water Treatment Facility, the Water Intake Pipeline and the Water Storage Tank. The Water Intake Pumping Station and Water Treatment Facility will be installed at Pyin Gyi, as shown in Figure 4.5.

Water Intake Pumping Station

The raw water will be taken from Heinze River, using the Water Intake Pumping station at the flow rate of approximately 860 t/hour.

Treatment Facility (Reverse Osmosis System)

Raw water treatment plant should include clarification, filtration and reverse osmosis equipment. The clarification and filtration are the primary stages of treatment system which reduces the level of suspended solids in incoming feed water. Incoming feed water is high in suspended solids that can cause a high-pressure drop and reduce the effectiveness of downstream filtration equipment such as reverse osmosis membranes. And then, the RO system is used to remove impurities, ions, and larger particles from the incoming feed water. It uses a semipermeable membrane to selectively allow water molecules to pass through while blocking dissolved solids, contaminants, and minerals. Salty water rejected from the raw water treatment plant shall be discharged back to Heinze River.

EPC Contractor will determine the appropriate location for water discharge point in order to prevent salty water circulation back into the raw water intake system (see Figure 4.11). Quality of cooling water make-up developed by EPC Contractor shall include the consideration of 5 cycle of concentration of cooling water system. This is in order to allow cooling water blowdown can be discharged directly to natural flood way while the water discharge quality still meet the effluent specification required.

Water Intake Pipeline

The treated water will be delivered to the Project site, via a 35cm diameter Water Intake Pipeline, with a total length of approximately 3.3km and will be stored in the Water Storage Tank, located at the Project Site.

The proposed Water Intake Pipeline will run from the Water Treatment Facility to the Water Storage Tank located within the Project Site. The Water Intake Pipeline will be installed, along an existing road. A pump station is needed to be incorporated into the fresh water transfer pipeline design. Surge protection for the fresh water transfer pipeline shall be also provided. The proposed route alignment is surrounded by predominantly rubber tree plantation, agricultural land and follows the road from Pyin Gyi to Kanbauk. The proposed alignment is expected to go underneath several existing dirt path and road including the Kanbauk-Kalainaung road and the dirt road from Pyin Gyi to Kanbauk.

Land required for the water intake pipeline would be minimal as the majority of the water intake pipeline will be located along the existing dirt road.

In terms of social features, the proposed alignment only crosses part of Pyin Gyi village over 200m near the outlets on the Heinze River and will cross Mi Gyaung Auing village.

Water treatment system

Water treatment system shall be located within the CCPP. Fresh water supply from raw water treatment plant shall be stored in one carbon steel welded construction. Fresh water storage tank (Dia.65mx 10m=30,000 m^3) shall be sufficient to allow continuous operation of the CCPP at Maximum Power Output Cogeneration for a period of at least 72 hours under all conditions, and still contain minimum fire water reserve volume for the time required for firefighting purposes.

Fresh water shall be used to further produce potable water and demineralized water. EPC Contractor shall be responsible for providing and connecting the facilities required for water treatment including any required equipment until sending the treated water to store at the storage tank (e.g. potable water storage tank and demineralized water storage tank).

A potable water treatment system and storage tank (Dia.23mx 8m=3,000 m^3) shall be provided with adequate capacity to supply the CCPP for a minimum of 72 hours of potable water consumption. The potable water storage and pumping systems shall be of adequate capacity to ensure secure supply to all users without disruption.

Electrode ionization process shall be applied for demineralized water treatment system. It shall be provided to supply demineralized make-up water to the steam cycle and the closed-circuit cooling water as required. The system shall be capable to produce of demineralized water without any limitation on the fresh water compositions delivered to the water treatment plant for processing into demineralized water. Quality of demineralized water produced shall be such that it meets the quality requirements for water and steam after chemical dosing in accordance with recognized international codes and operation and maintenance guidelines for HRSG and steam turbines.

A demineralized water storage tank (Dia.8mx 5m = 200 m^3) shall be provided with adequate capacity to supply the CCPP for a minimum of 72 hours of demineralized water consumption under highest consumption operating conditions. The demineralized water storage and pumping systems shall be of adequate capacity to ensure secure supply to the CCPP for all CCPP operating conditions.

The location of the Water Storage Tank is shown in the Indicative Site Layout (Figure 4.8).

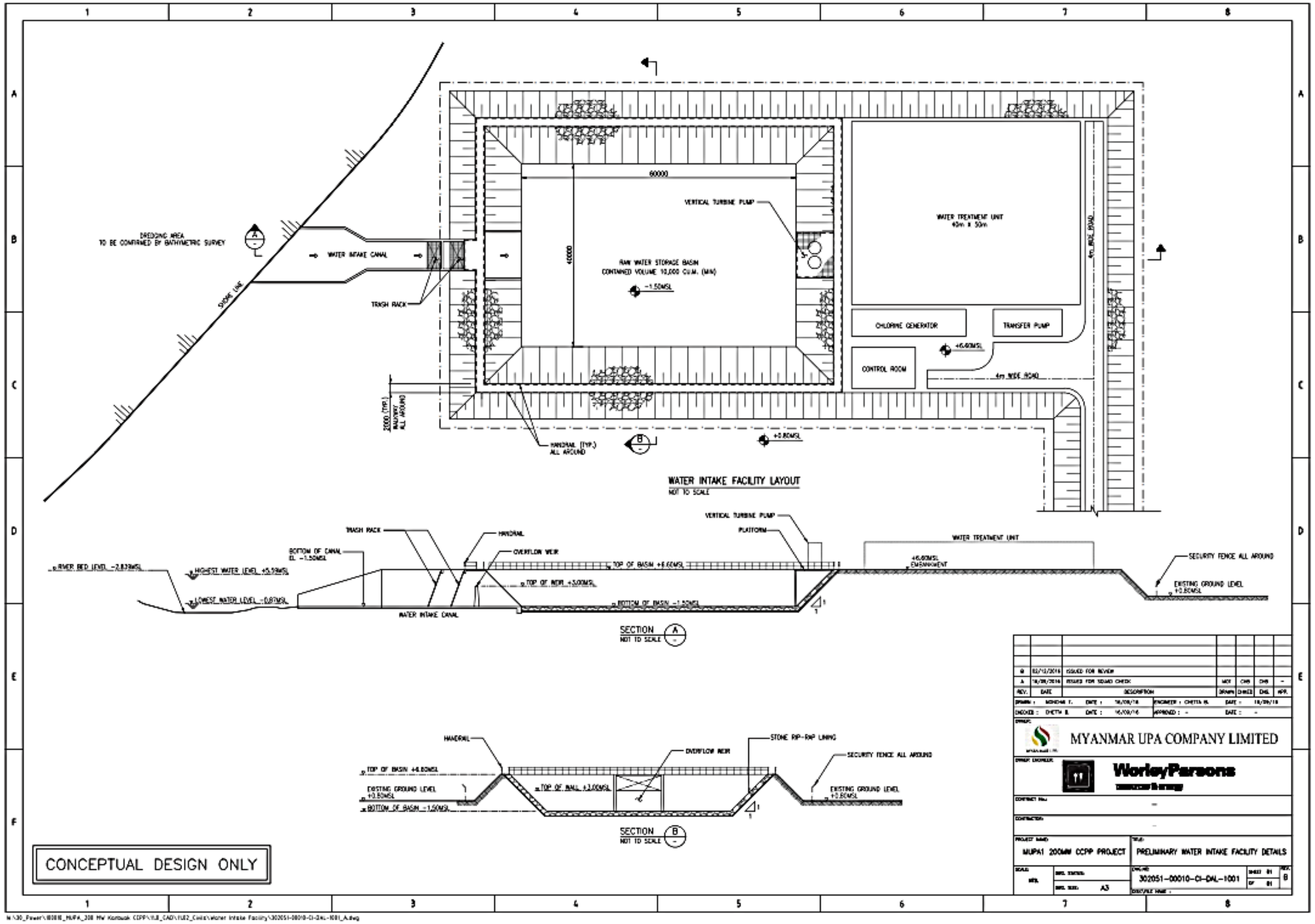


Figure 4. 11 Indicative Layout of Water Intake System

Wastewater Treatment System

The wastewater system will collect and dispose of the following plant wastes:

- ❖ HRSG blowdown;
- ❖ Water treatment plant(s) wastewater;
- ❖ Other contaminated water including, but not limited to, contaminated rainwater, process water and spillages, plant and equipment wash water, water with oily substances; and
- ❖ Domestic sewage.

Figure 4. 12 Wastewater Discharge Point

Continuous monitoring equipment for the continuous monitoring of key parameters in the wastewater discharge stream will be installed as well as manual sampling equipment to allow daily laboratory analysis of other parameters in the waste water discharge stream. The wastewater effluent quality of pH, temperature and flow shall be monitored by on-line analyzer while others shall be by laboratory analysis using laboratory equipment. Wastewater effluent pH, temperature and flow will be measured in waste water effluent piping immediately upstream of waste water terminal point. HRSG blowdown shall be treated as required and collected in the final checking pond. Cooling water blowdown can be discharge directly to natural floodway.

Waste from the water treatment plant shall be treated as required prior to being sent to the final checking pond.

All site drainage from the main plant area shall be piped to a “contaminated drains” area for treatment. Other contaminated water shall also be treated as required and collected in the final checking pond.

Where contaminated water includes oily substances such as oily water from the transformer area, warehouse/workshop, STG hall, etc. oil interceptors shall be included in the drains of the proposed development. The oily water shall then be sent to an oil/water separator of a suitable design to ensure that the outlet water from the oil water separators comply with the effluent level guideline limit for the Project as mentioned in chapter 3.

On Site sewage shall be collected separately from the uncontaminated storm water and contaminated water streams and discharged into a standalone septic tank system.

The EPC Contractor will ensure that all wastewater streams meet the discharge requirements stipulated in the effluent level guideline limit. The EPC Contractor will address in the design review phase of the project the means in which it achieves compliance with the wastewater discharge in respect to discharge temperature, flows and qualities for all ambient temperatures and CCPP operating conditions.

The proposed run-off/ wastewater discharge alignment will run alongside the west of the Project site boundary, and the wastewater will be discharged into the ditch north west of the Project site (Figure 4.12). The wastewater discharge is anticipated to be approximately 70 m3/h at ambient temperature. The Water Balance Simplify Diagram is presented in Figure 4.13.

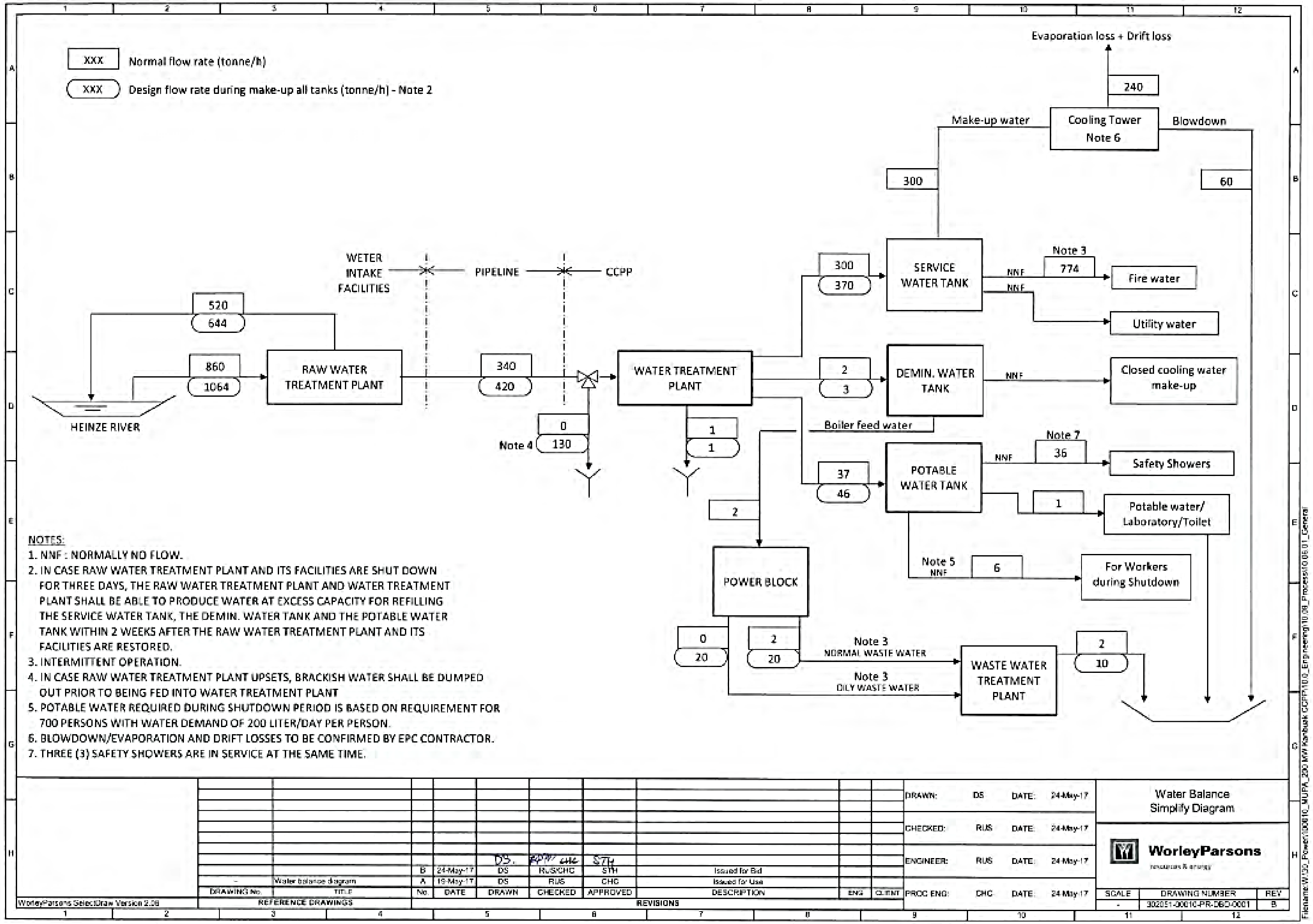


Figure 4. 13 Waste Balance Simplify Diagram

4.3.4.9 Emission Control

The Project will include the 3rd generation of Dry Low Emission (DLE) control technologies to reduce air pollutant emissions to comply with applicable standards.

Dry Low NOx burners

The proposed power plant will be equipped with Dry Low NOx burners developed to achieve low NOx emissions.

The Project will provide Dry Low NOx burners which are Best Available Technology (BAT) for CCPP to guarantee NOx emission levels at the exhaust chimney of 25ppm by volume (dry) at 15% O2 levels.

Continuous Emissions Monitoring Systems (CEMS)

In addition to the emission reduction technologies, the proposed power plant will be installed with both manual stack sampling facilities and Continuous Emission Monitoring System (CEMS) including thermocouple and manual sampling ports.

Both manual stack sampling facilities and Continuous Emission Monitoring system (CEMS) shall be provided across each HRSG stack for continuous on-line monitoring the flue gas at CCR. The CEMS shall measure emissions and temperature from the flue gas at each HRSG stack.

The CEMS controller, Data Acquisition System (DAS)and report generation terminal shall be provided to collect and store the CEMS data and log alarms, generate periodic report, perform and edit CEMS functions, communicate with plant DCIS. All information, alarm and reporting functions shall be available through DCIS System.

The CEMs system container should be located adjacent to the HRSG stack and sized to contain all the analyzers the DCIS interface. The CEMS system container shall be completed with an environment control system include air conditioning (2 x 100 % of split type air conditioning system) and ventilation system, lighting and electrical distribution system. Electric power for all CEMS equipment shall be supplied from a UPS system. Power will be provided to the CEMS system container at 220 VAC 50 Hz. The CEMs container shall have a climate conditioning system to maintain the indoor temperature at minimum 24 °C.

All equipment in CEMs system container shall be completely accessible. The CEMs shall be in accordance with the requirements of the US Environmental Protection Agency as stated in Title 40 Code of Federal Regulations (40 CFR) Part 60 "Standards of Performance for New Stationary Sources," and 40 CFR Part 60 Appendix B "Performance Specifications 1, 2, 3, 4 and 6" and Myanmar Local Regulation of Pollution and Environment.

The power plant shall furnish the oxides of nitrogen (NO_x) analyzers as per IFC and Myanmar NEQ Guidelines (2015). All equipment necessary to draw, filter, condition, or transport samples, or to periodically purge sample lines and probes shall be furnished.

The emission data received from each analyzing equipment via the data acquisition station shall be calculated and converted into the required values such as ppm, Nm3, g/s etc.

Its software shall be especially designed for emission evaluation. Reports shall be printed on dedicated printers.

4.3.4.10 Gas Metering Station and Gas Supply Pipeline

Currently, the existing MOGE Gas Receiving Station is located 1.7Km to the north west of the Project site, off taking the natural gas from Yanada and Zawtika. The Gas Metering is located within the boundary of the MOGE Gas Receiving Station (see Figure 4.14).

Figure 4. 14 Gas Metering Station

The natural gas is transported to the Project Site via a 25cm diameter buried Gas Supply Pipeline, with a total length of approximately 2.6km (see Figure 4.15). The existing gas supply pipeline has been designed as per ANSI B 31.8: Gas Transmission and Distribution Systems. It is mostly buried, apart from 2 small portions which were installed above ground to avoid other existing facilities as shown in Figure 4.16. In addition, Cathodic Protection was in place for the buried section of the pipeline.

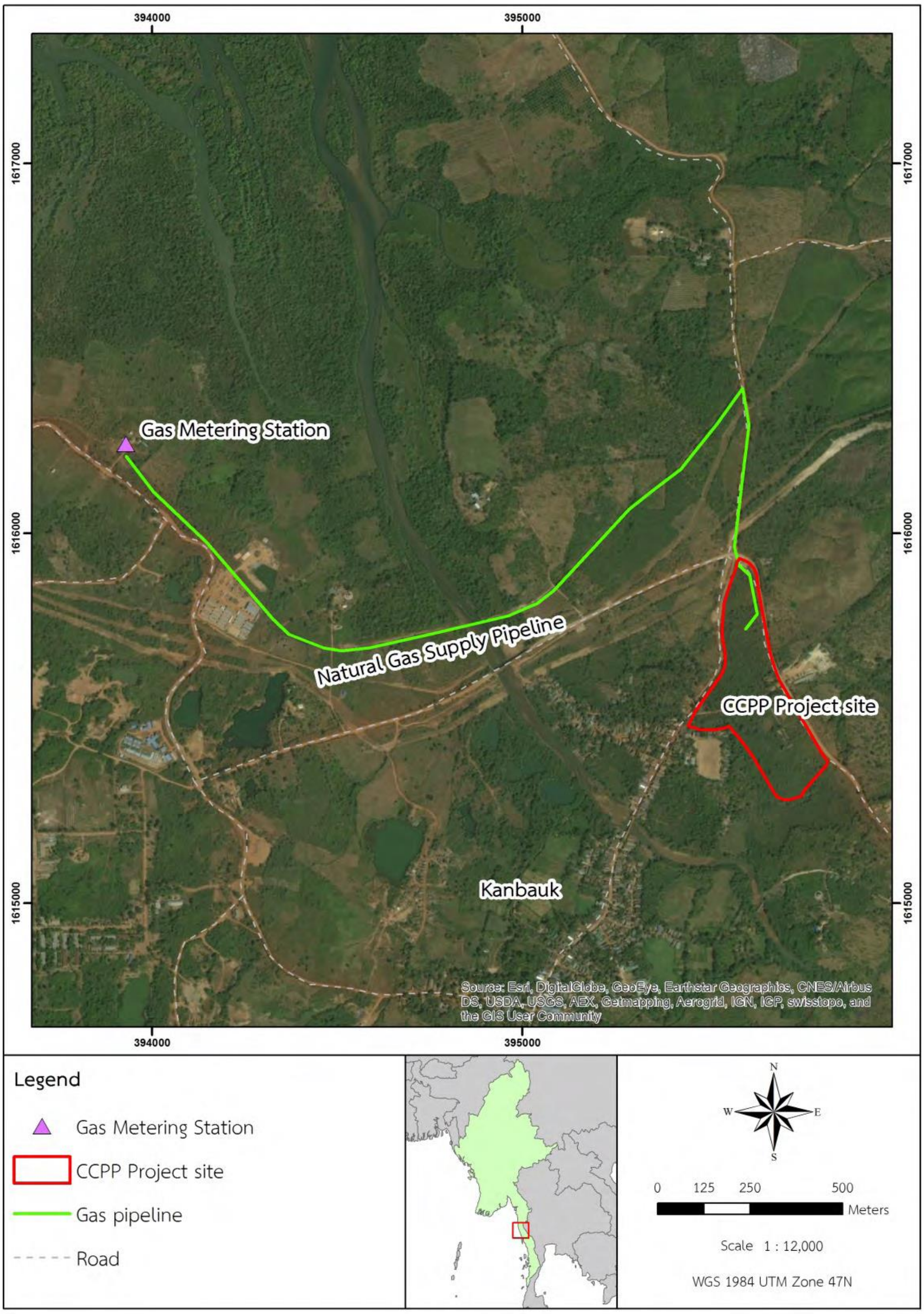


Figure 4. 15 Gas Pipeline Alignment

Figure 4. 16 Over Ground Portion of the Gas Pipeline

It is noted that if the gas supply from Yanada and Zawtika will not be sufficient to meet the Project's requirements, it will be needed to expand or seek additional gas supply. The Power Purchase Agreement (PPA) between EPGE and MUPA states that there will be a gas supply of 39 MMSCFD from Zawtika and 52 MMSCFD from Yanada (or) other gas field of similar gas quality available for the Project.

A natural gas supply and treatment system will be installed at the Power Plant to meet the required gas quality and pressure specified by the gas turbine manufacturer. The natural gas system will include backup metering equipment and all necessary, gas filter-separators, isolation and control valves, safety valves, and other equipment. The gas analysis is provided in Table 4.4 and specifications of gas pipeline are described in Table 4.5.

Table 4. 4 Characteristic of Natural Gas

Component	Unit	Zawtika Gas Field	Yanada Gas Field
Carbon dioxide C02	(% mol)	0.194	4.107
Nitrogen; N2	(% mol)	8.293	25.543
Methane; C1	(% mol)	91.007	69.166
Ethane; C2	(% mol)	0.334	0.928
Propane; C3	(% mol)	0.094	0.172
I-Butane; IC4	(% mol)	0.032	0.018
N-Butane; NC4	(% mol)	0.016	0.029
I-Pentane; IC5	(% mol)	0.008	0.007
N-Pentane; NC5	(% mol)	0.001	0.004

Component	Unit	Zawtika Gas Field	Yanada Gas Field
Neo-Pentane: NeoC5	(% mol)	-	0.002
Hexanes; C6	(% mol)	0.000	-
Hexanes and Heavier: C6+	(% mol)	-	0.021
Heptane: C7	(% mol)	0.019	-
Hydrogen Sulphide; H2S	(% mol)	0	0.001
H2O	(% mol)	0.002	0.002
Heating Value (HHV)	Btu/scf.	913	712

Table 4. 5 Specifications of Gas Pipeline

No.	Content	Value
I	Air Temperature (Annual)	
	Mean Daily Maximum Temperature	29 °C
	Mean Daily Minimum Temperature	25.1 °C
	Mean Daily Average Temperature	26.5 °C
II	Material Properties	
	Carbon Steel Thermal Conductivity	45 W/M.K
	Pipeline Coating (3lpe) Thermal Conductivity	0.46 W/M.K
	Roughness	0.0018 Inch
	Ground Conductivity	0.48 W/M.K
III	Pressure	
	Supply Pressure	32.04 Bara (450 Psig)

Safety Measures

The pipeline is buried underground, making it difficult to steal gas. However, the project proponent will implement security measures along the pipeline route to ensure its protection.

Security measures for gas pipelines typically include a combination of physical, operational, and technological measures aimed at preventing unauthorized access, detecting potential threats, and mitigating risks. There are security measures for gas pipelines include:

- Perimeter Security: Establishing physical barriers, such as fences or walls, around pipeline facilities to restrict unauthorized access. Access points should be limited and controlled through the use of gates, locks, and security personnel.
- Surveillance Systems: Installing surveillance cameras, motion sensors, and intrusion detection systems along the pipeline route to monitor for suspicious activities or trespassing. These systems may be monitored remotely or integrated with on-site security personnel.
- Patrols and Inspections: Conducting regular patrols and inspections of the pipeline route and facilities to identify potential security vulnerabilities, signs of tampering, or damage. Security personnel may also engage in random checks and audits to ensure compliance with security protocols.

- Emergency Response Planning: Developing comprehensive emergency response plans and procedures to address security incidents, such as vandalism, sabotage, or terrorist threats. This includes establishing communication protocols, coordinating with law enforcement agencies, and conducting emergency drills and training exercises.
- Security Awareness Training: Providing training and awareness programs for employees, contractors, and local communities on security risks, procedures, and reporting mechanisms. This helps promote a culture of vigilance and ensures that stakeholders are prepared to respond effectively to security threats.
- Community Engagement: Engaging with local communities, landowners, and stakeholders to build trust, address concerns, and promote cooperation in pipeline security efforts. This may involve establishing community liaison programs, conducting outreach events, and providing information on pipeline safety and security.

4.4 Project Life Cycle Overview

Project life cycle analysis identifies the key issues and concerns that are likely to evolve over the entire lifespan of a project.

In the case of the proposed Project, these issues may arise during the construction, operation and maintenance, and decommissioning. These issues have been considered in this ESIA, prior to any irreversible actions being undertaken by the Project Sponsor, Contractors and other Project associates. The following sub-sections identify the key activities to be completed and facilities to be constructed and operated over the lifetime of the Project.

4.4.1 Overall Project Schedule

Based on the information from the feasibility study report, the **Scheduled Commercial Operation Date** is planned for **March 2030** (as indicated in **Table 4.6**). The necessary implementation has been scheduled and summarized as follows:

- ❖ Memorandum of Agreement (MOA) with the Government of Myanmar (GOM) was signed in August 2014, and the Power Purchase Agreement (PPA) was developed and completed in March 2016.
- ❖ The previous Environmental and Social Impact Assessment (ESIA) Study had been submitted to the relevant authorities by mid-2017. Currently, the revised ESIA is anticipated to be submitted to the ECD by the end of July 2024 and is expected to be approved by the end of 2024.
- ❖ The Engineering & Procurement Contractor (EPC) Execution Phase is set to commence from July 2027. This phase will include pre-engineering, verification of geomechanically information, site preparation (including piling, if necessary), detailed engineering, civil works, and construction and erection. The EPC activities are expected to be completed by the end of 2027.
- ❖ It is assumed that natural gas will be commissioned and tested for plant optimization starting from mid-2029, with trial runs extending until early 2029.
- ❖ The Scheduled Commercial Operation Date is assumed to be March 2030.

Table 4. 6 Tentative Project Schedule

Activity Description	Date
Submission of ESIA Study (Previous)	June 2017
Topographic Investigation	October 2016
Geotechnical Investigation	April 2017
Bathymetric Survey of the River and Water Sampling (if applicable)	October 2016
Preparation for EPC bidding	2025
EPGE consent of Operating Characteristics Detail for the Generating Unit	2024 – 2025
EPC Contract Negotiations and signing	2025 - 2026
NTP / EPC Execution	July 2027
SCOD	March 2030

Note: It is noted that the above Project Schedule is tentative and subject to update based on the implementation of the 230 KV Mawlamyine-Ye-Dawei Transmission Line Project and the issuance of the Notice to Proceed (NTP).

4.4.2 Construction Phase

4.4.2.1 Construction Schedule

Construction is expected to start mid of 2027 and be complete in the region of 30 months with commercial operation targeted at March 2030.

Construction activities of the Project will include: mobilization, site clearance, onshore construction of all Project components and commissioning. Heavy equipment such as bulldozers, excavators, dump trucks, compactors, etc. will be used at the Project Site.

The normal construction hours are anticipated to be 8 hours per day, 6 days per week.

4.4.2.2 Mobilization

Site construction work will start once civil design of site preparation is finalized. All work will be conducted in accordance with the detailed master construction schedule, provided by the EPC Contractor. Prior to commencement of work, all Contractors will be required to provide detailed site-specific plans related to:

- Equipment use;
- Excavation and backfilling management;
- Soil erosion management;
- Traffic management;
- Storm water pollution prevention plan;
- Dust prevention plan;
- Environmental and Social Management Plan;
- Waste Management Plan; and

- Plan drawings of laydown, traffic flow, parking, trash storage, and recycling areas.

4.4.2.3 Earth Works

Earth works will include clearing of vegetation and grading of the Project site. It is anticipated that the subsoil, which will be stripped and removed from the Project site, will be utilized for levelling/ backfilling. It is anticipated that approximately 6,600m^3 of soil will be removed due to excavation activities of the water intake facility including water intake pipeline and then backfilled.

4.4.2.4 Site Foundation

Ground water at the site has high chlorine content due to the close proximity of the sea. The water table fluctuates with the tide and is within several meters of the surface. As a result, the concrete mix for foundations and substructure in contact with the ground water will need to be designed for a high degree of durability. Foundations that are found to be above the water table will be assessed separately for soil contaminants.

The turbine foundation block shall be isolated from adjacent foundations, slabs and floors to avoid transmission of vibration to surrounding plant.

4.4.2.5 Power Plant Construction

Table 4.7 presents the key structures which will be constructed for the Power Plant. It is expected as a part of the mobilization phase the Project site will be fenced. The site fabrication area (77,000 m^2) for the Power Plant will be located midway between the Water intake and the Power Plant next to the existing road as shown in Figure 4.17.

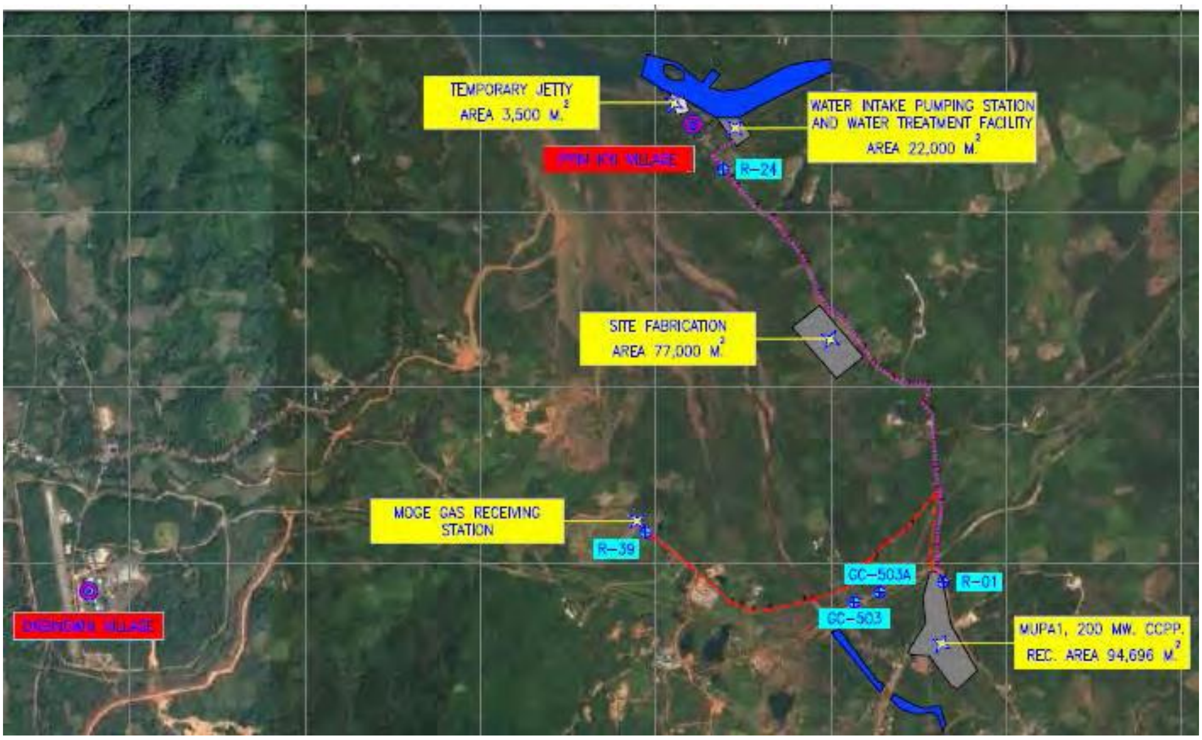


Figure 4. 17 Construction area location

Table 4. 7 Power Plant Key Structures

Item	Description
Steam Turbine Building	The Steam Turbine Building will consist of the following: • Steam Turbine Hall • Turbine Operation Platform • Crane Girder • Turbine Hall Gable Structure • Turbine Generator Pedestals
Main Control & Electrical System Buildings & Structures	The Control & Electrical System Buildings & Structures will consist of the following: • Central Control Room • Plant electrical room • Transformer oil pit • Outdoor power distribution equipment • Emergency diesel generator room / container • Switchyard control building
Main Chemical Water Treatment System Structures	The Main Chemical Water Treatment System Structures will consist of the following: • Boiler Make up Water Treatment Plant • Industrial Waste Water Treatment Plant
Auxiliary Buildings & Structures	The Auxiliary Buildings & Structures will consist of the following: • Administration building • Maintenance & Warehouse • Guard house • Air compressor house shelter • Cooling water pump house and associated equipment (outdoor) • Mechanical draft flow cooling tower (5 cells) • Water basin of cooling tower (1 set) • Mechanical acceleration clarifier (2 sets) (outdoor) • Foundation of service water cum firefighting water storage tank (1 set) • Sewage water equalization tank • Oil water separator
Main HRSG Stack	• 50m height with a diameter of 6.5m approx.

The construction of the buildings and structures in Table 4.7 will typically be reinforced concrete structures or steel frame structures. Reinforced concrete shall be used for primary plant facilities and facilities exposed to an aggressive environment. These facilities are primarily low-rise buildings/structures that have a large footprint area relative to their height. Conversely, steel is used for large expansive structures.

A concrete batching plant will likely to be located onsite during construction. The loading/unloading areas during construction will also take place in the construction area.

4.4.2.6 Site fabrication area

The site fabrication area is a designated area where fabrication activities take place. Fabrication involves the construction or assembly of components, structures, or equipment onsite before they are installed or integrated into the project.

In the context of a combined cycle power plant, a site fabrication area will be designated for following purposes, including:

- Fabrication of Structural Components: This will include assembling steel structures, support frames, or other structural elements required for the power plant's buildings, equipment, or infrastructure.
- Assembly of Equipment: Certain equipment or machinery components will be fabricated onsite before installation, such as piping systems, electrical panels, or mechanical components.
- Preparation of Prefabricated Modules: Some construction projects utilize prefabricated modules or units that are fabricated offsite and transported to the construction site for assembly. The site fabrication area will be used for assembling or integrating these prefabricated modules into the project.
- Testing and Quality Control: Fabrication areas will also be used for testing, inspection, and quality control processes to ensure that fabricated components meet project specifications and standards before installation.
- Storage and Handling: The site fabrication area will include space for storing raw materials, equipment, tools, and supplies required for fabrication activities. It will also include facilities for handling and transporting fabricated components within the construction site.

Overall, the site fabrication area plays a crucial role in the construction process by providing a dedicated space for fabricating, assembling, and preparing components essential for the successful completion of the project. Proper planning, organization, and management of the site fabrication area are essential to ensure efficient and timely fabrication activities while maintaining safety, quality, and adherence to project requirements.

4.4.2.7 Temporary Jetty

Temporary Jetty Design for Combined Cycle Power Plant 200 MW. The temporary jetty will be built to accommodate a weight of up to 300 tons and will be located in the Heinze River near Pyin Gyi Village. The water depth ranges from 7.2 meters to 14 meters, with a tide range of 7 meters and a current speed of 2 knots. The jetty will consist of concrete slabs and a steel structure. The total area is 3500 m^2.

Structural Design:

- The jetty structure will consist of a steel framework supported by pile foundations to provide stability in varying water depths and tidal conditions.

- The steel framework will be designed to support the weight of the concrete slabs and any additional loads imposed by equipment and personnel.

Pile Foundation:

- Pile foundations will be driven into the riverbed to anchor the jetty securely.

- The number and spacing of piles will be determined based on engineering calculations considering the water depth range, tidal range, current speed, and anticipated loads.

Decking Material:

- Concrete slabs will be used for the decking material due to their durability and ability to withstand heavy loads.

- The concrete slabs will be prefabricated off-site and transported to the construction site for installation.

Measures will be implemented to minimize disturbance to aquatic habitats, mitigate sedimentation and erosion, and protect water quality during construction and operation. The design and construction of the temporary jetty will comply with relevant regulatory requirements and obtain necessary permits and approvals from local authorities. Monitoring and maintenance plans will be implemented to ensure the ongoing safety and functionality of the temporary jetty throughout its operational lifespan. Regular inspections and maintenance activities will be conducted to address any issues or concerns that arise during operation. Overall, the design of the temporary jetty will prioritize safety, durability, and environmental sustainability while meeting the needs of the combined cycle power plant construction project.

4.4.2.8 Water Intake Facilities Construction

Construction of the water intake facilities includes the following facilities:

- Water Intake Pumping Station;
- Water Treatment Facility; and
- Water Intake Pipeline.

The construction of the water intake facilities will take approximately 18 months.

The water intake pumping station and water treatment facility will be constructed on the Heinze River bank and will include the retention pond and fixed pump system with a 12hours cycle.

The site clearance activities for the water intake pipeline will involve the clearance of shrubs and vegetation. The construction activities for the water intake pipeline will require the use of cranes, soil compactor, concrete truck, generator set and trucks. The machinery associated with the construction of the water intake pipeline will be operated during daytime only (10 hours per day).

The waste associated with construction of the water intake facilities will comprise of steel pipes, steel plates, structural steel and wooden crates. Opportunities for the disposal sale of the steel pipes and structural steel will be explored. The wooden crates will be disposed of by a licensed waste contractor.

4.4.2.9 Commissioning

After 75 to 80%, completion of the construction phase, priorities shall be shifted from the overall geographic area to that dictated by utilities and process completion. All major equipment will be installed, tested and commissioned under the supervision of the respective representatives.

Commissioning activities would involve the following activities: Combined Cycle:

- GT First Fire
- Steam Blowing;
- GTG No-Load Tests

- GTG Load Tests
- STG No-Load Tests;
- STG Load Tests;
- Plant Fine-Tuning;
- Performance Test; and
- Reliability Run.

4.4.2.10 Transportation of Construction Material

Heavy Cargo

Heavy cargo (see Table 4.8) will be transported by vessel to Dawei Port and transferred to appropriate barge in order to be transported to the temporary auxiliary jetty, which will be located near Pyin Gyi as shown in **Figure 4.17**.

Table 4. 8 Heavy Cargo to be transported from Temporary Jetty to the Project Site

Description	Quantity
Gas Turbine	3
Gas Turbine Generators	3
Steam Turbine	1
Steam Turbine Generator	1
Main condenser	1
HRSG Module	3

The inland transportation for the heavy cargo will start from the temporary jetty to the construction site using the existing with necessary traffic escorts. The proposed transportation route from Temporary Jetty to the construction site is approximately 1.8km. On route the heavy cargo will use the existing road to cross a small stream. From the construction site to the Project site, the distance is approximately 1.5km. This road may require reinforcement and backfilling underneath.

4.4.2.11 Construction Materials

For other construction materials other than the main equipment which need to import from Thailand will be shipped to Dawei private commercial port. The proposed ground transportation route is from Dawei to the Project site using existing roads no. 8 and Kanbauk-Kalainaung road. Construction materials such as structure steel, piping, plant mechanical equipment, electrical and instrumentation equipment and other construction consumables will be used for this route. It is anticipated 2 to 10 trucks per day will use this route during the construction period. The ground transportation route is shown in Figure 4.18.

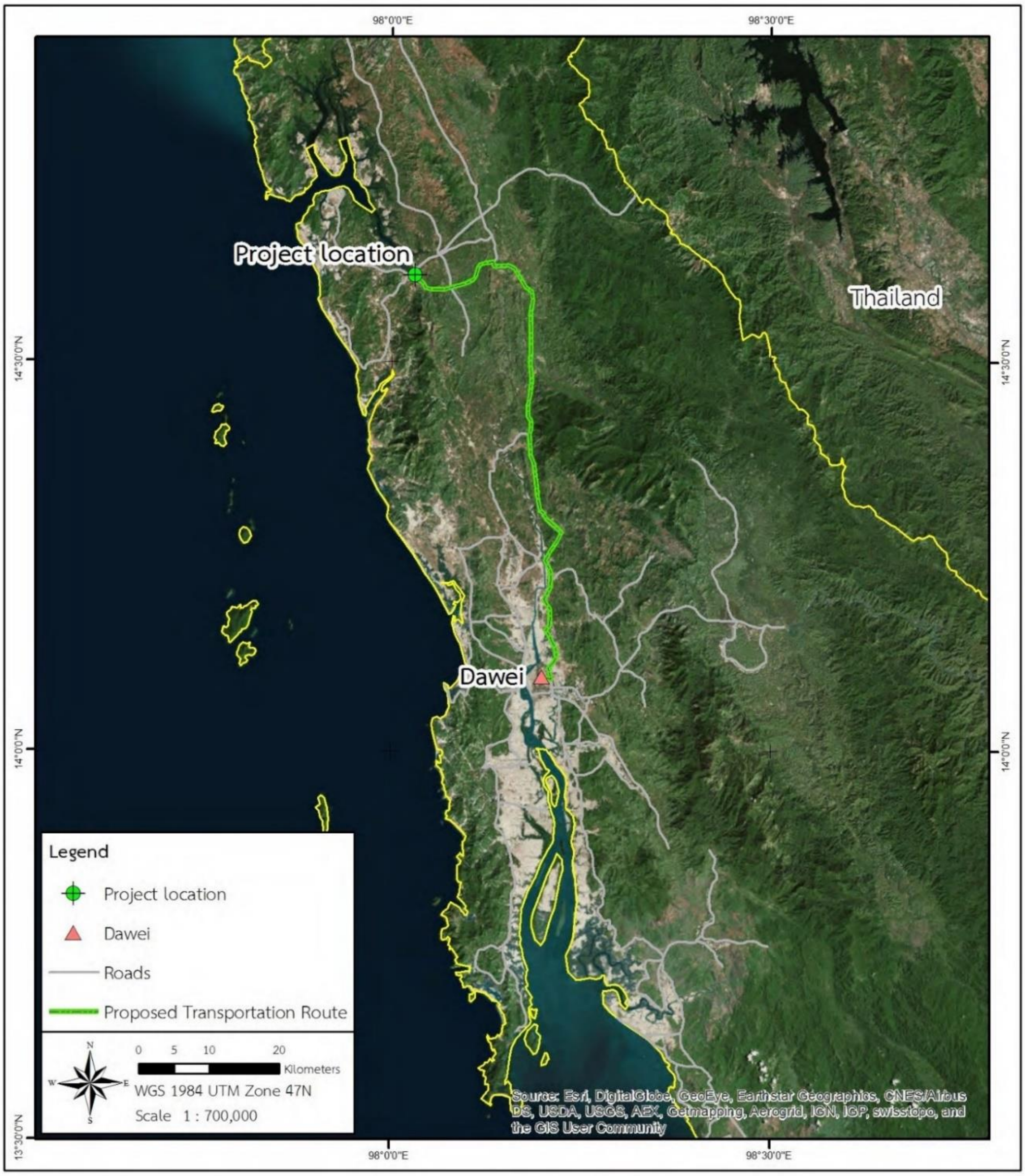


Figure 4. 18 Proposed Transportation Route of Construction Materials to the Project Site

4.4.2.12 Power and Water Supply

Approximately 3,000kW of electricity will be required during the peak construction period, with an average consumption rate of 300MWh/MTh. The electricity will be sourced from the existing 11kV distribution line. The Contractor shall provide

11kV/380V box-type transformer and 300kW diesel generator for emergency.

During construction, water is required for construction worker activities and prefabricated concrete activities. The maximum number of workers onsite during construction is anticipated to be 600 persons and each worker is estimated to consume approximately 33.3 liters of water per day [6]. Prefabricated concrete activities are estimated to consume 40m^3 of water per day.

The average water consumption rate during construction is anticipated to be 1,800 m^3 per month (approximately 60m^3 per day).

The raw water required during construction will be obtained from the local water distribution services. The raw water will be treated and purified to supply for construction.

4.4.2.13 Construction Waste

Solid Waste during Construction

The solid waste generated during construction will include steel pipes, steel plates, structural steel and wooden crates. Opportunities will be explored for selling the steel plates and structural steel. The wooden crates will be disposed of by an appropriate or a licensed waste contractor.

There will also be biomass waste associated with the clearance of tree, shrubs and grass. Approximately 800m^3 of biomass waste is anticipated during construction. Opportunities for providing biomass waste to the local community will be explored or biomass waste will be disposed of by an appropriate or a licensed waste contractor.

All excavated material will be backfilled with no surplus.

Storm water in Construction stage

Stormwater in the construction stage refers to rainwater or snowmelt that runs off the surface of construction sites during precipitation events. This runoff can accumulate various pollutants and sediments as it flows across the site, including soil particles, construction debris, chemicals, and other contaminants. Stormwater runoff from construction activities can pose environmental risks, such as erosion and sedimentation of nearby water bodies, contamination of surface water and groundwater, and degradation of aquatic habitats.

During the construction stage of a project like a combined cycle power plant, activities such as land clearing, grading, excavation, and infrastructure development can disturb soil surfaces and increase the vulnerability of the site to erosion and sedimentation. Additionally, the use of construction materials, machinery, and vehicles can introduce pollutants and chemicals that may be washed into stormwater runoff and transported off-site.

Managing stormwater effectively during the construction stage is essential to minimize its environmental impacts and ensure compliance with regulatory requirements. This typically involves implementing erosion and sediment control measures, designing appropriate drainage systems, and adopting best management practices (BMPs) to prevent or mitigate stormwater pollution and protect water quality. By implementing measures to manage stormwater runoff effectively, construction projects can reduce their environmental footprint and minimize negative impacts on surrounding ecosystems and communities.

Hazardous Wastewater during Construction

Hazardous wastewater will be generated from chemical cleaning of the equipment during the pre-commissioning process. The hazardous wastewater from chemical cleaning will be transported off-site to the appropriate or licensed Hazardous Waste Treatment facilities, available in Myanmar.

[6] Metcalf& Eddy Inc. Wastewater Engineering: Treatment, Disposal, Reuse. 3rd Edition McGraw Hill, Network, 1979

Non-Hazardous Wastewater during Construction

Non-Hazardous wastewater will be generated from the toilet facilities and workers accommodation (sewage). Non-hazardous wastewater will also be generated from the canteen. The sewage generated onsite will be collected through underground pipes into a holding tank, from where the sewage will be routed to an onsite sewage treatment plant or alternatively transported periodically by vacuum trucks and transferred to a septic tank or discharge to common drain.

4.4.2.14 Construction Workforce

The anticipated workforce during construction is shown in Table 4.9.

Table 4. 9 Anticipated Workforce during Construction

Workforce Origin	Average No. of Skilled Workers	Average No. of Semi-Skilled Workers	Average No. of Unskilled Workers	Total Average Workforce (per day)	Total Peak Workforce (per day)
Local Workforce	80	120	200	400	600
Migrant Workforce	40	6	0		

4.4.3 Operational Phase

The main features of the Project have been described in Section 4.3.

There will be no Operation and Maintenance (O&M) contract with any third-party operator, as the Project will be owned and operated by the Project Proponent. The O&M of the Project will be undertaken by the Project Proponent with the support of a long-term service agreement (LTSA) for the GT and ST with the manufacturer and external expertise on each function to counterpart and provide the intensive in-house training during commission until 3 years after SCOD. The LTSA will cover the supply of spare parts, supervision and specialized technicians for inspections, major and minor overhauls.

O&M staff with relevant experience of operating similar plants and with adequate knowledge of comparable technology will be deployed prior to commercial operation date (COD) to commission and take over the Project from the EPC Contractor. Approximately 50 staff will work on the operational phase of the Project.

The below sections will discuss further the key activities during Operation Phase.

4.4.3.1 Operational Schedule

The start of operation is anticipated for March 2030.

4.4.3.2 Water Supply

The main water supply source will be taken from Heinze River via the water intake pumping station through the water treatment facility and transported to the Project Site via the water intake pipeline which will be retained in the water storage tank on site.

The raw water from Heinze River will be passed through the pre-treatment plant and directed to the Reverse Osmosis System. The majority of the water will be supplied

to meet the plant service water / cooling tower make-up and the balance will be taken to meet the plant potable water and other requirements.

Table 4.10 presents the water requirements and their volumes during operation.

Table 4. 10 Water Requirements during Operation

Water Requirement	Volume
Fresh Water from Raw Water Treatment Plant	340m^3/h (300 m^3/h for Circulating Cooling Make-Up water)
Domestic water (local authorized)	4m^3/h

4.4.3.3 Operational Wastewater

As presented herein above, the Project will be equipped to treat all wastewater to comply with the discharge specification before discharge to the small water channel, located to the north west of the Project Site. A sewage treatment plant will also be installed.

Table 4.11 presents details of the wastewater and approximate capacities which will be generated during operation.

Table 4. 11 Wastewater During Operation

Item	Timing of Wastewater Generation	Capacity*
Wastewater from Power Plant		
Sludge from river water pre-treatment	Normal Operation	1 m^3/ hour
DM plant neutralized water	Normal Operation	5 m^3/ hour
Cooling tower blowdown	Normal Operation	60 m^3/ hour (continuous)
Stormwater	Normal Operation	Intermittent
Washing water from Main Block	Normal Operation	Intermittent
Fire protection system	Emergency	
Domestic Wastewater		
Kitchen	Normal operation	
Wash room	Normal operation	
Plant control room	Normal operation	
Condensate polisher / safety shower	Emergency	
Battery room/eye wash	Emergency	
Water treatment plant/safety shower	Emergency	
Sanitary/ Sewage Wastewater	Normal Operation	4 m^3/ hour
*Estimated figures only		

Wastewater from the plant process will be treated with pH control within a pH range of 6 to 9 in the neutralization treatment system and oil-water separator system. The treated wastewater will be discharge into final checking pond before discharge to the small water channel. Sewage will be treated in a package sewage treatment and discharged into the wastewater discharge system to the North West side of the Project site. The sludge will be dewatered and disposed off-site by an appropriate waste contractor.

Stormwater

The rainwater, if not contaminated will be discharge directly to storm water drainage.

The Power Plant drain for stormwater at areas of where lubricating oils are handled will be connected to an oil and grease pit (interceptor). The contaminants will be captured in the pit and removed manually. Contaminated stormwater will be sent to the oil-water separator system before discharge to the final checking pond while uncontaminated stormwater will be discharged offsite into the small water channel discharge point to the North West side of the Project Site.

4.4.3.4 Operational Solid Waste

During operation the re-use, recycle and minimization of waste ethic shall be adopted. A waste management plan will incorporate strategies for the re-use, recycle and minimization of waste on Site. Management strategies for regulated and hazardous waste shall also be included, including a methodology for tracking regulated/hazardous waste generation and disposal.

Appropriate storage and disposal facilities for waste shall be constructed on Site. Bunded, hardstand and roofed areas are a general requirement for hazardous waste such as waste oils, paints and chemicals.

Table 4.12 presents details of the solid waste and approximate capacities anticipated during operation.

Table 4. 12 Solid Waste during Operation

Waste Type	Anticipated Quantity
Domestic Solid Waste	1.65kg per employee per week

The solid waste generated during the operation phase will be collected and segregated for recycle and non-recycle waste (i.e. paper, plastic). Project will use incineration on site and compost.

There will also be minimal other waste such as wood crates from maintenance activities which will be provided to the local community as fire wood.

4.4.3.5 Operational Hazardous Materials

The hazardous materials to be stored on site during operation are presented in Table 4.13. The chemicals will be transported appropriately to the Project site and Material Safety Data Sheets (MSDS) will be prepared from chemical suppliers in Myanmar.

Table 4. 13 Hazardous Materials during Operation

Hazardous Material	Use of Hazardous Materials	Storage Location Onsite	Quantities to be Stored Onsite*
Oxygen Scavenger	Chemical Dosing System	Chemical Storage House	$1m^3$
Phosphates	Chemical Dosing System	Chemical Storage House	$1m^3$
Fouling Agent	Chemical Dosing System	Chemical Storage House	$1m^3$
Anti-corrosion	Chemical Dosing System	Chemical Storage House	$1m^3$
Biocides	Chemical Dosing System	Chemical Storage House	$1m^3$
Hydrochloric Acid	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Water Treatment System and Demineralized Water System	Chemical Storage House	$10m^3$
Hydrogen Chloride	Water Treatment System and Demineralized Water System	Chemical Storage House	$10m^3$
Diesel oil	Liquid fuel for emergency diesel engine generator, emergency diesel generator	Storage Tank	Estimate at 2x7200 liters x 3 days for fuel tank= 43,200 liters.

* Estimated figures only

4.4.3.6 The Anticipated Workforce

The anticipated workforce during operation is shown in Table 4.14.

Table 4. 14 Anticipated Workforce during Operation

Position	Staff Number
Permanent Staff	49 (O&M + Back Office)
Security (external)	12
Contract staff: Cleaners, Gardeners and helpers	10
Contract staff: Technical hands	10
Maintenance (once every 3 years)	90 for 30 days

The Operational and Maintenance Workforce

The Operational and Maintenance (O&M) working will use 8 shift teams to provide 24/7 coverage for plant operation and 8 hours per day, 5 days per week for general corrective and preventive maintenance work.

The shift structure will be as follows:

- 12 hours per shift
- 2 days shift 2-night shift and 4 days off (DDNNOOOO shift patterns)
- 1 shift charge, 1-unit controller and 2 field technicians per shift; and
- 32 staffs will be in the shift roaster

The DDNNOOOO shift patterns with proven record of rotational shift work should reduce circadian rhythm impacts and mental health impacts of shift work.

The rotational shift work between operation staffs and maintenance staffs are required for every 24-week cycle plus special non-allowable vacation 4-week period reserve for plant major outage according to a set schedule to equally distribute workload and average 1,488 working hours for every O&M staff for a 52-week cycle.

4.4.3.7 Ancillary Structures

In addition to the main infrastructure on site, and as described above, the following ancillary buildings will be constructed:

- Administration building (incorporated of the Central Control Room);
- Gatehouse at the main gate of the site;
- Staff canteen; and
- Firefighting pump house.

4.4.3.8 Emergency/Black Start Diesel Generators

The Power Plant will have combined emergency/black start diesel generator with a capacity 6000kW (to be determined) that will only be used during plant safe shutdown as well as for black start. The diesel will be transported appropriately to the Project site from diesel suppliers in Myanmar. Material Safety Data Sheets (MSDS) will be completed for the diesel to ensure appropriate transportation. The diesel generator will be the stationary emergency type and will consist of control gear, lubricating oil system, fuel day tank, cooling system, direct current (DC) starting power and synchronizing equipment, and electrical protection system equipment. Following an emergency shutdown at the power plant, the diesel generators will provide electrical power to maintain the turbine generator unit and its auxiliaries in safe conditions. During area-wise blackout, the diesel generators will provide electrical power to start the CCPP.

4.4.3.9 Fire Protection System

The Power Plants fire protection system will provide personnel safety and plant protection through prompt detection, alarm and suppression of a fire. The system will be designed for any single design basis fire and will be in accordance with all local applicable codes and standards. The primary source of water for the system shall be from the plant's water system.

4.4.3.10 Power Plant Maintenance

During operation, maintenance will be associated with the following:

- Routine Maintenance;
- Planned Preventive Maintenance; and
- Breakdown Maintenance.

4.4.4 Decommissioning Phase

It shall be noted that this Project will be developed on 'Build-Operate-Transfer' (BOT) basis. It is expected that by the end of Operation Phase, the Project will be transferred to the MOEP. However, for completion of this report, the Decommissioning Phase has been considered, based on general practice only.

Decommissioning is the term used to describe all the stages involved in the closure and rehabilitation of the Project site. The process can generally be categorized into three key phases as follows:

- Pre-decommissioning activities: includes the detailed planning (development of the decommissioning plan) and approval procedures;
- Decommissioning activities: removal of plant machinery & equipment and demolition, decommissioning of facilities, turbines and infrastructure, decontaminated land assessment and rehabilitation; and
- Post-decommissioning activities: site survey, close-out report and field monitoring as necessary.

The design lifespan of the power plant is estimated to be 30 years. If the Power Purchase Agreement, Land Lease Agreement, Gas Supply Agreement and the other relevant agreements are not extended or renewed and an alternative economical fuel is available, the power plant may be retrofitted to support alternative power generation. This option would be possible, provided the required retrofits and new emission rates meet the applicable standards and guidelines.

If retrofitting is not feasible and the operational life of the Power Plant expires, the Power Plant will be decommissioned according to the requirements of the authorities at that time according to best industry practices.

The Project facilities will be designed with decommissioning in mind. In general, facilities and machinery will be designed so that they can be isolated and decommissioned in steps which are in reverse of the installation procedure or which are most convenient to do so. The decommissioning phase activities will therefore be similar to those associated with the excavation/foundation work, installation and civil construction phases.

4.5 PROJECT ALTERNATIVES

IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) ("PS1") requires an assessment process that identifies the risk and potential impacts associated with a project. Specifically, "the process may comprise a full scale environmental and social impact assessment, a limited or focused environmental assessment or straight forward application of environmental siting, pollution standards, design criteria or construction standards". PS1 states that for greenfield developments or large expansions with specifically identified physical elements, aspects and facilities that are likely to generate potential environmental or social impacts, the client will conduct a comprehensive ESIA, including an examination of alternatives, where appropriate.

This section presents an overview of the alternatives considered as part of the ESIA study. The main design criteria, plant technology, Project type and Project Location were determined by MOEP and the Project Proponent will have to comply with MOEP requirements and are therefore beyond the remit of this ESIA study and are not included in this review.

In addition, 3 cooling options were initially explored by the MOEP, comprising once through cooling, cooling towers and dry/air cooling technologies. These alternatives are discussed further below.

4.5.1 Project Need

Myanmar adopted political and economic reforms in 2011 which resulted in a significant growth in Myanmar's gross domestic product (GDP) to 6.3% in 2012 compared with an average of 5% in the previous 5 years (Asian Development Bank, 2013). According to a 2012 Asian Development Bank (ADB) study, Myanmar could follow Asia's fast-growing economies and expand at 7% to 8% per year and Myanmar's economic growth is forecast to rise gradually to 6.7% in 2014.

Parallel to the growth in GDP, electricity demand in Myanmar has increased dramatically. ADB released a report on Myanmar's energy sector in October 2012 in which the future power demand was estimated to be doubling from 12,459 million kWh in 2012-2013 to 25,683 million kWh in 2018-2019 (ADB, 2012). Total system installed capacity in 2012 consists of 76.1% hydropower capacity, 20.5% gas-fired capacity, and 3.4% coal-fired capacity (ADB, 2013).

However, the actual power production in 2012 appears to be approximately 10,000 gigawatt-hours (GWh) with only 3,659 GWh available for domestic use (David Dapice, 2012). In 2012, total electricity consumption was 8,434 GWh. With a population of approximately 60 million, Myanmar per capita electricity consumption was only 140 kilowatt-hours (kWh) per year, which was the lowest among the 10 Association of Southeast Asian Nations (ASEAN) countries. The low national average per capita electricity consumption is due to the low electrification rate, low industrial development and lack of investment.

Figure 4.19 shows the estimated electricity demand and supply in Myanmar (ADB, 2012).

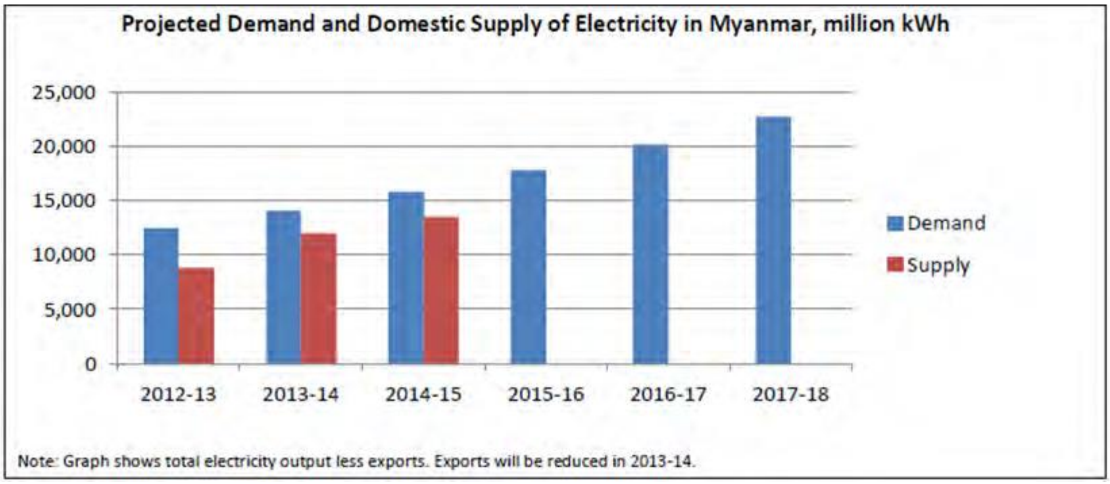


Figure 4. 19 Estimate of Electricity Demand and Supply in Myanmar, million kWh

There is a big medium-term problem with electricity supply in Myanmar. There will be only modest additions to hydroelectric capacity in the period from 2014 to 2019 and very little net new natural gas for domestic use will come on line.

Meanwhile, some hydro that is now exported may be switched to domestic use and some old gas-fired units will get more efficient new equipment and so be able to produce more electricity from the same amount of gas. However, these additions will fall short of new demand growth during 2014-2019. The more than 1,400MW of new gas units officially projected to be come on line in 2015-2016 will be forced to use, in part, LPG or even expensive liquid fuels if the official reports of limited additional supplies of natural gas for domestic use are correct. If world wholesale diesel or kerosene prices continue at their recently lower levels, the cost of electricity would be higher than current prices charged but much less than diesel electricity has cost in the past – over 400 kyat per kWh.

ADB (2012) estimated that demand in 2012 was 12.5 million kilowatt-hours, while supply available for consumption in that year was only 8.3 million kWh. In addition, a growing economy at this low development stage has a high growth of electricity relative to real output growth. The ADB growth cited from the Myanmar Electricity Plan (MEP) was 12.8% a year for electricity consumption. Therefore, even if supplies doubled every five to six years it would still not fully allow for closing the gap between demand and available supply that existed in 2012 or for increasing the coverage of households with grid connected power. Increasing thermal capacity to balance the dry season hydroelectric shortfalls would help to reduce blackouts.

Given that the new gas supply will become available from the Shwe Gas Supply pipeline, the proposed development of a combined cycle gas turbine power plant in Myingyan Township, Myanmar will contribute towards a power source for adding capacity required to cover the shortfall.

The ‘No Project Scenario’ is likely to have a negative effect on opportunities for employment, both directly from the Project and its dependent sectors such as agriculture, industries and manufacturing that require stable power supply in order to operate and be competitive.

4.5.2 Alternatives of Different Power Generation Options

4.5.2.1 Overview

Electricity generation may be achieved from renewable and non-renewable sources. Renewable sources include solar, wind, hydroelectric sources, and biomass while non-renewable sources include fossil fuels such as coal and natural gas. The following section describes the energy mix in Myanmar.

4.5.2.2 Hydroelectric

Myanmar has 20 grid-connected hydroelectric power plants; all operated by Hydropower Generation Enterprise (HPGE). Their installed capacity is 2,780MW accounts for 76.1% of national capacity. Off-grid supply from mini hydropower stations is provided by ESE and IPPs and contributes 33MW.

Table 4.15 shows the existing hydroelectric power plant in Myanmar (> 50MW).

Table 4. 15 Existing Hydroelectric Power Plant in Myanmar (> 50 MW)

Station	Installed Capacity (MW)
Yeywa	790
Shweli-1	600
Paunglaung	280
Dapein-1	240
Baluchaung-2	168
Thauk-ye-khat	120
Mone	75
Shwegyin	75
Kyee on Kyee wa	74
Kun	60
Kinda	56
Keng Taung	54
All Others	188
Total	**2,780**

During the wet season (June-September), the power plants are able to generate at optimum capacity. However, in the dry season, insufficient water storage leads to production drops that necessitate significant load-shedding.

The exploitation of hydroelectric sites has been a top-down affair with little consultation with local communities. This is changing and affected communities, especially in ethnic areas, now expect and should get a role in planning or even investing in their projects. Because this is tied into the peace negotiations, this participation often slows down the pace of investment. For example, an investor will often prefer a high dam as this has a better rate of return, but a high dam will displace more area and people with its reservoir. It is also more of a risk downstream if the dam fails. Local groups often prefer dams of medium height or even run of the river dams that do not store large amounts of water.

In addition, hydrology studies (how much water flows through the proposed dam site– not just on average, but maximum and minimum flows over many years) and environmental assessments can take several years. This is required to ensure that the maximum flow of the dam is not underestimated. This could lead to large releases of water and poor management of the reservoir level. These assessments can take 3 to 5 years to complete. Even then, the influence of water pressure on rock formations causing earthquakes in the region or of downstream sediment deposition may not be fully understood.

Once the design and studies and assessments are completed, large dams can take 5 to 10 years to come online. While hydroelectricity is a low-cost source of power with no ongoing carbon or particulate emissions, it is not costless and without risks.

There are significant amounts of potential hydroelectric capacity and some estimates exceed 40,000MW. This is ten times the current capacity of Myanmar from all sources. Alternatively, if demand needs to double every six years for eighteen years, the capacity in 2032 would need to be 32,000MW. This suggests a significant amount and is above the high estimate of the MEP, however it would amount to approximately 2,000kWh per capita, less than the current Thai usage and equal Vietnam’s per capita generation in a few years. Given the long lags in building these dams, it is important to negotiate the ability to purchase significant amounts of power for domestic use, even from dams invested with foreign capital and initially destined for export.

Currently, the MEP is developing 20 hydroelectric power projects, 14 of which involve investments from China and Japan. The MEP also estimates the hydroelectric power plant projects to be completed during 2013-2016 with the total installed capacity of 472MW as shown in Table 4.16.

Table 4. 16 Expected Hydroelectric Power Plant Projects to be completed during 2013-2016

Station	Installed Capacity (MW)
Thaukyekhat-2	120
Phyu	40
Namcho	40
Upper Paunglaung	140
Baluchaung No.3	52
Kyaukphyu	50
Upper Baluchaung	30
Total	472

4.5.2.3 Gas-fired

Myanmar has 10 gas-fired power plants; all operated by EPGE. Their installed capacities of 996MW account for 20.5% of national grid capacity. Ahlone is the biggest plant with a capacity of 275MW. These plants use gas produced in the offshore fields of Yadana and Yetagun, and onshore fields operated by the Ministry of Energy. The output from these plants has been below expectations owing to low calorific value of local gas (high Nitrogen content) and low pressure without compression.

Table 4.17 shows the existing gas-fired power plants in Myanmar.

Table 4. 17 Existing Gas-fired Power Plants in Myanmar

Station	Installed Capacity (MW)
Kyungchaung	54.3
Mann	36.9
Shwedaung	55.3
Mawlamyaing	12.0
Myanaung	34.7
Hilawga	208.7
Ywama	122.3
Ahlone	275.2
Thaketa	145.6
Thaton	51.0
Total	996

The gas-fired power plants in Myanmar use both liquefied petroleum gas (LPG) and liquefied natural gas (LNG) as fuels, however, the differences between LPG and LNG are not always clear. LPG is propane or butane gas under slight pressure which turns into a liquid at normal temperatures. It is often used for household cooking and delivered in small cylinders, but can be used in place of natural gas in many generators. It currently sells for 15 to 16 USD per million BTU (import price) and can be delivered in small ships of 10-30 thousand tons. It does not require elaborate or costly ports or handling equipment. LPG is a plausible transition fuel for gas-fired generators that will be commissioned in 2015-2018 but not able to use domestic natural gas until a few years later when extra domestic gas supplies should become available. LPG is also cheaper than kerosene or diesel alternatives.

LNG is super-cold natural gas which has turned into a liquid. It is typically delivered in specialized ships which are essentially floating thermos bottles, specially designed to handle the very cold liquid. Recently, most LNG tankers have been very large – up to 12 meters (39 feet) in draft and require costly specialized storage facilities on shore, which take several years to build. Due to the cost of the ships and the onshore facilities that need to be repaid over an extended period, most LNG contracts are for many years, usually at least twenty. If Myanmar will produce more domestic natural gas for its own use starting in 2020, the cost of domestic natural gas would be less than that of LNG. This would make the large onshore investment in equipment unattractive. Besides this, there are not deep-water ports capable of handling large LNG ships close to population centers where electricity is needed.

However, MEP intends to focus on gas-fired power plant to reduce reliance on hydroelectric power plant projects. In its official five-year-plan, MEP has set an ambitious target to increase capacity to 2,500MW capacity by 2015-2016. One key upcoming development is a 500 MW plant set for completion by the end of 2014. It will supply power to Thilawa Special Economic Zone (SEZ) that is jointly developed by Myanmar and Japan. In addition, the World Bank lent 140 million USD in September 2013 to upgrade and add 125MW capacity to Thaton station. The MEP estimates the gas-fired power plant projects to be completed during 2013 to 2016 with a total installed capacity of 1,720MW as shown in Table 4.18.

Table 4. 18 Expected Gas-fired Power Plant Projects to be completed during 2013 to 2016

Station	Installed Capacity (MW)
Hlawga (Zeya Co., Ltd.)	50
Ywama (MyanShwePyay Co., Ltd.)	50
Thaketa (CIC Co., Ltd.)	50
Ahlone (Toyo Thai Co., Ltd.)	100
Ywama (Transferred from Thailand)	240
Thaketa (BKB Co., Ltd. Korea)	500
Hlawga (Hydrolancang Co., Ltd. China)	530
Mawlamyaing (Myanmar Lighting Co., Ltd.)	50
Kyunchaung (Extension)	70
Shwedaung (Extension)	80
Total	1,720

4.5.2.4 Coal-fired

Currently, Myanmar has one coal-fired power plant named Tigyit with an installed capacity of 120MW. Efficiency of the power plant is low, generating power at an average capacity factor of approximately 30%.

There has been public skepticism concerning new coal generating plants. Historically, coal-fired power plants in the emitted significant amounts of soot and sulfur. Sulfur led to acid rain downwind. In addition, certain specifications of coal are also high in mercury, a toxic metal that can pollute watercourses. However, technology has evolved considerably and new coal-fired power plants can be designed to use low- sulfur coal and catch almost all of the ash particles generated from burning. Processing of coal before burning can also remove over half of the mercury.

A single coal unit has a usual capacity of 400 to 600MW and most coal stations have at least two units. A typical station has a capacity of 1,000MW (1 million kilowatts) and operates for 6,000 hours a year, producing six billion kWh a year. Since a ton of good steam coal produces approximately 3,000kWh, the annual coal consumption of one station is in the order of two million tons a year or 5-6 thousand tons a day. If the coal is of lower thermal quality, even larger amounts must be used. Handling such large amounts of coal requires ocean transport on large ships that need deep channels and ports with specialized unloading facilities. These are major investments and there is the potential for significant impact on the area in which they operate.

EPGE aims to add 300MW capacity by 2015-2016. In a key development, World Bank sanctioned a 165 million USD loan in early 2013 to develop coal-fired power plants.

It should be noted that coal-fired plants in general have higher CO2 emissions compared to gas turbines. Gas turbines have relatively low CO2 compared with other fossil fuel energy generation technologies. The Project has employed a CCPP technology which was designed for high reliability and efficiency operation with lower environmental impact. CCPP plant offer half as much CO_2 per kWh compared to other power generation technology. Natural gas provides more efficiency than coal because of higher operating temperatures, and when used together with the more efficient combined-cycle results in even higher efficiencies (IEA, 2006)[7].

4.5.2.5 Non-hydro Renewable Sources

Using non-hydro renewable sources for power generation is still in its infancy in Myanmar and constitutes a small percentage of total installed capacity and generation. While Myanmar is rich in renewable resources, the development remains severely limited by availability of funds to support the research and development, lack of a clear renewable energy policy and lack of talented manpower.

The following provides a brief summary of the limited publicly available information concerning non-hydro renewable projects in Myanmar.

4.5.2.6 Biomass

There are 174MW of biogas power projects in operation.

4.5.2.7 Geothermal

Approximately 90 geothermal locations have been identified to date. Of these, 43 are being tested by the MOEP along with Electrical Power Development Company of Japan, as well as Union Oil Company of California.

4.5.2.8 Wind Energy

Wind power projects are either in experimental phase or undergoing feasibility studies. There are some very small operational projects off the grid (Dattaw Mountain in Kyauske, and Government Technical High School in Ahmar, Ayeyarwaddy). Gunkul Engineering Public Company Limited and China Three Gorges Corporation, both foreign, signed a MOU with the MOEP in 2011 to conduct feasibility studies for the development of 4,032MW of wind energy in Myanmar.

4.5.2.9 Solar Energy

Some pilot PV cell projects financed by the MOEP and university research departments are underway in rural areas; being used to charge batteries and pump water for irrigation. Another example is the installation of 3kW PV systems in remote schools by Mandalay Technological University. Overall, however, at current costs, solar energy is unaffordable.

4.5.3 Alternatives of Technological Options

CCPP plants utilize the heat from the exhaust gases leaving the gas turbine to generate steam in a HRSG. This steam is then used in a steam turbine to generate further electricity. The steam leaving the steam turbine is condensed by either water or air, producing condensate that is then

[7] IEA, 2006a: Energy Technology Perspectives 2006: Scenarios and strategies to 2050. International Energy Agency, Paris, 484 pp.

reused in the HRSG. Potential cooling techniques for the condensing of steam leaving the steam turbine equipment include:

- Wet Cooling Systems:
  - Once Through Cooling System – power stations with an open cooling system (once through cooling) take cooling water from the river/sea. Cooling water is pumped via an intake pipe through the condenser and after heat transfer via a pipe back to the source. If the water source is close enough this is considered the most economical option and also provides the best plant performance due to the low cooling water temperature. As large water quantities are required this can only be used where large water sources are available. Furthermore, the cooling water intake and outlet need to be located far enough from each other to avoid heated water re-entering the cooling cycle. The discharged water will need to comply with the applicable standards regarding water quality.
  - Closed Cycle Wet Cooling Towers – Cooling water is recirculated between a surface type condenser and a cooling tower where it is sprayed into air which cools the water droplets by evaporating a part of the water. This option is preferable where the required volumes of water are not available near the power plant site, or are in sufficient amount.
  - Hybrid Cooling System – these towers are an improved on forced draft wet cooling towers and are characterized by a heat exchange between air and water without direct contact before the water is sprayed in the tower. This option reduces the visibility of the emitted plume from the tower and is often used where the visual impact of the plume on inhabited areas must be avoided. The hybrid option also reduces water consumption by approximately 10 – 15%.
- Wet/Dry Parallel Cooling Systems - this system uses a mix of wet and dry cooling technologies and is implemented at sites where water is partially or seasonally available. This has advantages over the wet and hybrid towers as the towers and plume emitted are smaller and so has less visual impact.
- Dry Cooling Systems:
  - Direct Dry Cooling System – these cooling systems are used in remote dry areas without economic water supplies where the heat transfer is performed by air to finned tubes. This method is affected by the ambient air temperature and so is only used where the availability of cooling water is limited. This option also requires significant land space for cooling and therefore is not applicable in areas where land availability is limited, such as the CCPP Project.
  - Indirect Cooling Systems – these systems can either be used with a surface condenser or with a direct contact jet condenser. The process involves cooled condensate water coming from the cooling tower and being in direct contact with the jet condenser to condensate the exhaust steam of a steam turbine.

The forced draft cell type with wet cooling tower has been selected for further investigation during the ESIA Study. This type of cooling system has been selected based on the requirements for water consumption, plant output and efficiency, operation and maintenance costs and land availability.

4.5.3.1 Water Consumption:

Advantage: Wet cooling towers consume less water compared to once-through cooling systems.

Explanation: In wet cooling towers, water evaporates during the cooling process, reducing the overall water consumption. The forced draft design ensures efficient heat exchange while minimizing water usage.

4.5.3.2 Plant Output and Efficiency:

Advantage: The forced draft design maintains or enhances plant output while improving efficiency.

Explanation: By actively forcing air into the tower, the system optimizes heat exchange. This ensures consistent power generation even under varying heat loads.

4.5.3.3 Operation and Maintenance Costs:

Advantage: Forced draft cooling towers strike a balance between cost-effectiveness and performance.

Explanation: These towers are efficient yet manageable in terms of maintenance costs. The mechanical fans enhance airflow, contributing to overall efficiency.

4.5.3.4 Land Availability:

Advantage: Forced draft cooling towers can be designed with a more compact footprint.

Explanation: Their adaptability to limited space makes them suitable for installations where existing structures or space constraints need consideration.

4.5.4 Alternative Layouts

The Project Proponent has considered a number of different layouts for the Project. The main decisions influencing the Project layout include:

- The availability of land;
- Road access and access arrangements;
- Connection to the national grid;
- Connection of the gas supply pipeline;
- Connection of the water supply pipeline
- Provisions to minimize environmental impacts;
- Plant and personnel safety;
- Technical requirements; and
- Financial considerations.

As the availability of land, a total 9.47 hectares (ha) of EPGE has been allocated for the project based on the connection to the national grid, connection of the gas supply pipeline, and connection of the water supply pipeline. When evaluating alternative layouts with regard to road access and access arrangements, it’s crucial to assess the feasibility of transporting heavy cargo and required material to the project site (Section 4.4).

As mentioned above in section 4.4, Project Schedule is tentative and subject to updates based on the implementation of the 230 KV Mawlamyine – Ye – Dawei Transmission Line Project and the issuance of the Notice to Proceed (NTP). Considering the existing **MOGE Gas Receiving Station**, which lies approximately **1.7 kilometers northwest** of the project site, we should also evaluate this alternative layout. The proximity to the receiving station could significantly impact operational efficiency and logistics. The project relies on water from the Heinze River, situated about 3 kilometers northwest of the project site. Considering the availability of water and the feasibility of pipeline connections, this factor is considered when evaluating alternative layouts.

The minimization of environmental impacts, plant and personnel safety, technical requirements, and financial considerations should be evaluated as alternative layouts throughout the project cycle; project feasibility stage, design stage, and engineering stage.

The Engineering Procurement and Construction (EPC) Contractor who will design and construct the Project is yet to be appointed for the Project. Therefore, it is not until this stage that the detailed design of the layout for the Project will be optimized.

The Project Proponent has considered 2 plant configuration options: 3 gas turbines, 3 HRSG's and 1 steam turbine i.e. 3-on-1; OR 2 gas turbines, 2 HRSG's and 1 i.e. 2-on-1. Through the preliminary engineering studies, the 3-3-1 is currently a preferred option and therefore, this 3-on-1 plant configuration will be used for the purposes of this ESIA Study. If there are changes to the configuration/layout, this will be notified to the ECD.

CHAPTER 5 DESCRIPTION OF SURROUNDING ENVIRONMENT

5.1 Introduction

This Chapter provides an overview of the environment-biophysical baseline conditions within the Project Study Area based on secondary data from published sources as well as primary data collected to fill data gaps. This section of the ESIA report is organized by different biophysical parameters and also includes a discussion of the baseline conditions and any additional methods used to fill in the gaps during primary data gathering at the Project Study Area.

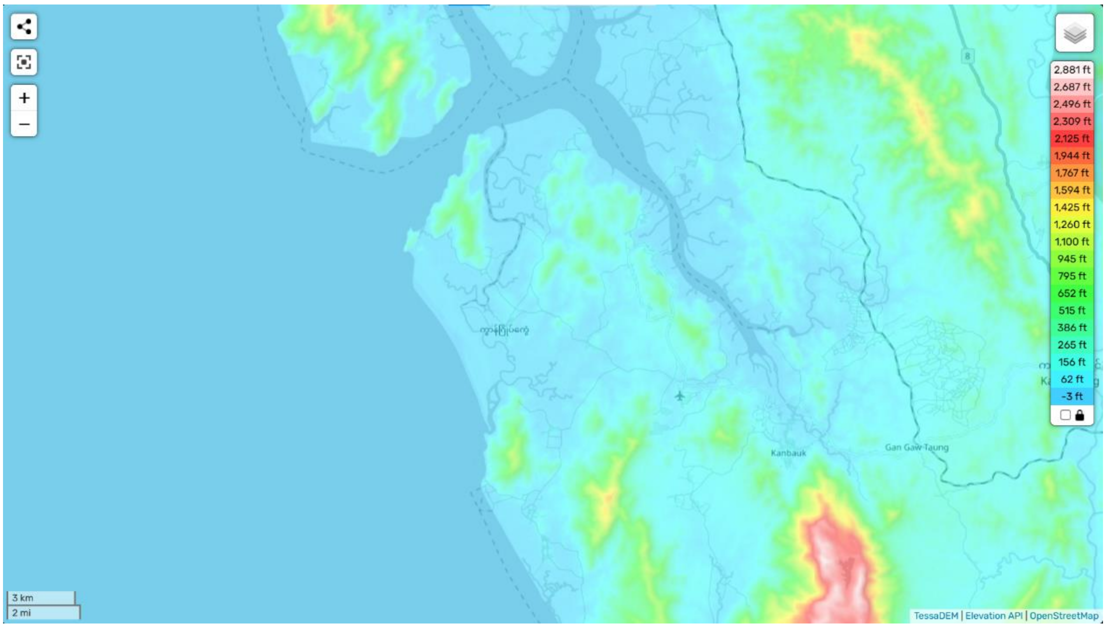
5.1.1 Setting the Study Area Limit

The Project Study Area (hereinafter also referred to as 'study area') refers to the area that needs to be studied in order to adequately understand and describe the baseline conditions likely to be affected by the Project. The Project Study Area comprises a 5km radius of the Project site as well as a 500m buffer each side of the Water Intake Pipeline.

5.2 Existing Physical Environmental Condition

5.2.1 Topographic and Geological Conditions

The topography of Myanmar can be divided roughly into four portions: Sino-Myanmar Ranges/Shan Plates, Central Myanmar Tertiary Belt, Indo Myanmar Ranges (Eastern Chin and Arkan Yoma Area) and Rakhine Costal Area. Mawlamyine basin is located between the Gulf of Mottama and Dawna Range and south of Yangon.

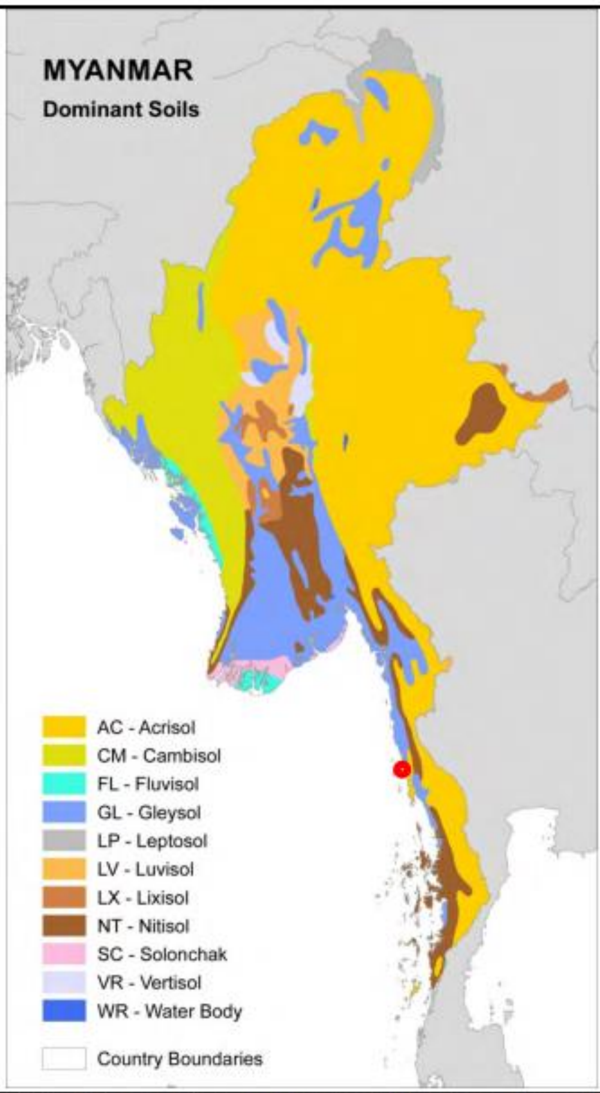


Source: topographic-map.com

Figure 5. 1 Topographic Map of Tanintharyi Region

5.2.2 Soil Type

Based on soil surveys conducted across Myanmar in 19651, soils in the Project Study Area are classified primarily as Gleysol Soils (Figure 5.2). The soils are composed of Saline Muddy Soil Mangroves. This soil has high salt and water, low oxygen and high hydrogen sulphide contents. It contains a high proportion of humus (Macnae, 1968). The best growth and development of mangroves takes place on alluvial and muddy soils, which are generally formed by the deposition of water-borne soil particles. Mangrove soils are mostly anoxic except for the surface layer in which roots spread (Rag, 1987).



Source: Geographical distribution of 10 dominant soil types in Myanmar. Map created by FAO/NRL from Harmonized World Soil Database (HWSD) – FAO. Retrieved from http://www.fao.org/nr/myanmar/SoilMap_Myanmar_300dpi.jpg

Figure 5. 2 Soil Types and Distribution in Myanmar

Alluvial Soil (Fluvisol): In the texture of classification, soil comprises sand, silt and clay. The soil that contains large amount of silt is classified as alluvial soils. They can be found in any region of the country regardless of relief, in the river plains, deltas, former lakes and coastal areas. The soil reaction is usually neutral and being young soils, developed from recent alluvial deposits of the river. Those soils are pervious, easily tilled and thus, they are very important soils for agriculture, suitable for cultivation of rice, plantation crops, vegetables, pulses and beans, chili, sugarcane and maize.

Meadow Soil (Glyesol): There are different subtypes of Meadow soils. The Meadow soils or paddy soils are widely observed in different parts of Myanmar in river plains, delta and low coastal plains and valleys. All types of Meadow Soils have thick solum and are mostly having clayey texture. They are most suitable for paddy cultivation. The Meadow soils of the dry zone in upper Myanmar have the characteristic of being light colors. There are Meadow soils with neural reactions, whereas some have the alkaline reaction. Although plant nutrients are not abundant, they can be used for pulses and vegetables. The Meadow soils in the mountain region with large amount of rainfall and Meadow soils in the lower Myanmar have yellow brown colour with acid to neutral soil reaction. Meadow soil near the river plains with occasional tidal floods are non-carbonate. They usually contain large amount of salt. More plant nutrients are contained more plant nutrients than the Meadow soils of upper Myanmar. Despite high content of iron these soils can nevertheless be utilized for rice and vegetables.

Meadow Alluvial Soil: Meadow Alluvial soil (Fluvic Gleyol) can be found in the flood plains. They have the texture of silty clay loam and can be utilized for groundnut, sesame, sunflower, jute, sugarcane and other vegetable cultivation in addition to rice cultivation. They have neutral soil reaction and are rich in available plant nutrients. Meadow Gley soil (Gleysol) and Meadow swampy soil (Histic Gleysol) can be found in the regions of lower depressions where the land is inundated for more than six months a year. The texture of these soils is clayey to clay. They usually have very strong acid reaction and contain large amount of iron. Moreover, soils with long periods of moisture content may contain large amount of aluminum and soluble iron, sulphur and manganese by chemical process and can be toxic to plants. The humus content is high and usually deficient in phosphorus and potassium. Rice and jute can be grown on these soils after flood recedes.

Gley and Gley Swampy Soil: Grey and grey swampy soil can be found along the rivers where they are critically dependent upon natural water level fluctuations. According to the color, it can be said that they have high content in organic matter. The upper part of this soil layers is composed of undecomposed organic matter and the lower part is composed of humus.

Lateritic soils (Plinthic Ferralsol): These soils occur mostly in the lower Myanmar in the lower slopes of the hills of Bago Yoma, Rakhine Yoma and Dorna hill range. They are found on well drained low uplands and at the foot of low hills. They usually occur at the elevation not higher than 300 feet above sea level. They arc fanned under the influence of the tropical forests under the conditions of wet tropical monsoon climate with 80-200 inches of rainfall. Morphologically, yellow or yellow brown and reddish-brown colors characterize them. TI1e yellow and red colors of the soils are due to the presence of iron with oxidation and reduction processes. In some places the horizons of pisolithic laterite are found at the depth of 18 to 20 inches, whereas, in other pl aces they are not found even at the depth below4 and 5 feet.

The humus contelll of these soils in forest area is high but can be less in the deforested areas. The soil reaction is acidic in the upper horizon and can be more acidic at the lower horizons. The available plant nutrients are very low in these soils. This soil is suitable for plantation crops such as rubber, oil palm, orchards such as durian and mango or reforestation for soil conservation.

Red Brown Forest Soils (Rhodic Ferralsol): The Red Brown Forest soils are the typical soils of tropical ever green forest of Myanmar. They occur on the well-drained hill slopes at the elevation from 1000 to 4000 feet above sea level. These soils also occur in the northern hill region and on the hill slopes of Rakhine mountain range, Tenassaarim and Donna range. These soils are formed under the influence of tropical evergreen forests with the annual rainfall of about 80 to 200 inches. Some are also found at the low uplands. The soils are well structured and have a good drainage. The soil is slightly acid with the pH value ranging from 5.5 to 6.5. Usually, these soils have medium to heavy loamy texture. The soils contain moderate amount of plant available nutrients. These soils can be regarded as forest land of good productivity; however, the soils on the lower elevation are suitable for gardens and plantation.

Yellow Brown Forest Soils (Xanthic Ferralsol): The Yellow Brown Forest soils widely occur in Myanmar covering the low hills of Pegu Yoma, foothills of Tanintharyi Yoma, Rakhine Yoma and sloping areas at the bottom of northern hilly region up to the approximate latitude of 25 feet. They are closely connected with the Red Brown Forest soils in their distribution and usually replacing them down the slope. They mainly occur in the region of gentle slopes of low hills and foothills at the elevation of 300 to 1500 feet above sea level. These soils are typical for the monsoon or tropical mixed deciduous forests. These soils contain more percentage of clay and humus than the Red Brown Forest soils. However, in some places of the slopes, the soils are shallow due to the presence of pisolithic lateritic layer. According to the land use classification, the great majority of these soils are classified as good garden lands. They are suitable for rubber, oil palm and orchards.

Dune forest and Beach Sand (Arenosol): Theses soils can be found only at the coastal line of Myanmar. The areas of their occurrence are insignificant and not very important soils for agriculture. The coastal line should be under wind and water erosion control and utilized for holiday resorts.

5.2.3 Climate/Meteorological Characteristics

5.2.3.1 General

In order to fully define the baseline meteorology and climate, hourly sequential meteorological data is required for:

- Wind Speed;
- Wind Direction;
- Precipitation;
- Relative Humidity;
- Temperature; And
- Cloud Cover

Following IFC recommendations, data is required for five (5) years in order to capture year on year variability; this data is also used in the impact assessment.

There are no meteorological stations in the vicinity of the Project that capture all these parameters or have sufficient data availability. Therefore, five years of meteorological data were modelled using a 12km x 12km grid resolution using the Weather Research and Forecasting Model (WRF). The WRF model is a next generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. The model is extensively validated using actual observations to ensure the best possible accuracy and precision.

Figure 5.3 to Figure 5.7 illustrate the monthly meteorological characteristics at the Project site for a five-year period from 2012 to 2016 inclusive. The figures have been created using the WRF data discussed previously. The data shows that the climate of Myanmar is characterized by a dry season that occurs December and April and winds that blow from the east.

With the increase of population Myanmar has three distinct seasons. The cold season emerges from November to January, dry season starts from February to April followed by the wet season. Myanmar receives its annual rain mainly from south-west monsoon from mid of May to mid of October. Ninety percent of the annual rainfall in different regions of Myanmar are monsoonal. The rainfall varies in intensity and time of year and is depending on the locality and elevation. Rainfall receives 2030 mm to 3050 mm in the deltaic area 2030 mm to 3810 mm in the North, about 1520 mm in the Shan State, rising to 5080 mm in the Rakhine and Tanintharyi coastal regions and only about 760 mm is the central dry zone. And incidentally such localities experiences temperature of 40º C during summer, and dripping to 10ºC to 16º C during winter and below 0º C in some hilly regions. The loss by evaporation is ranging from 1500 mm to 2000 mm. Due to the uneven climatic condition, Scarcity of water during dry season becomes a main issue over most of the areas of the country. The annual average climate is characterized by high temperature and high humidity also.

5.2.3.2 Meteorological data of Tanintharyi from Website

Meteoblue was the world's first weather service to offer weather prediction in a graphical synopsis for any arbitrarily chosen location on earth. Besides that, it predicts weather for several continents on scales not familiar from other weather services, e.g. Europe using a 3 km (1.86 mi) grid, encompassing an area containing Belarus, Greece, Portugal and Ireland, or sub-Saharan Africa using a 10 km grid. Both Non-Hydrostatic Mesoscale Models (NMM, developed by NOAA) and the NOAA Environmental Modeling System (NEMS) are used to predict weather.

The meteorological parameter such as temperature, precipitation, wind speed and wind direction are found for the last 30 years from meteoblue.com.

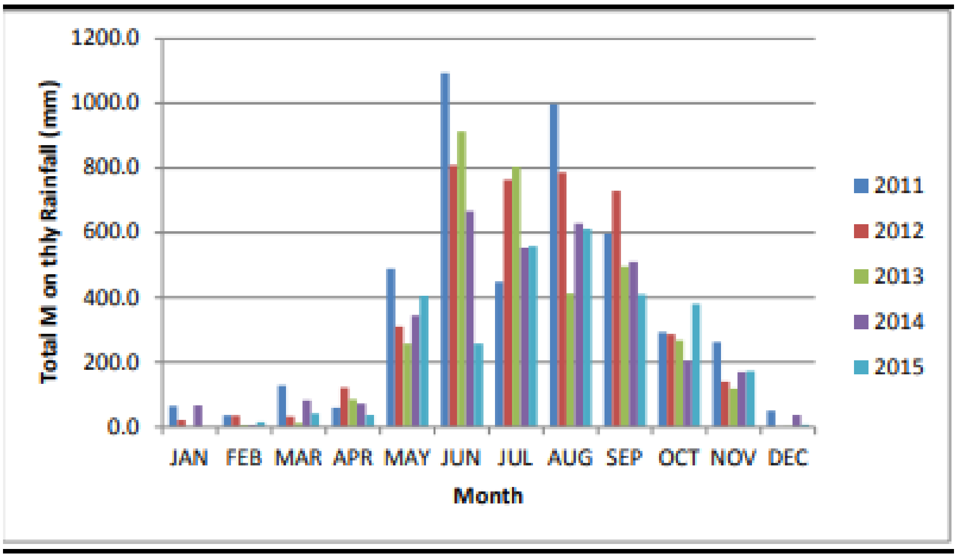


Figure 5. 3 Total Monthly Rainfall

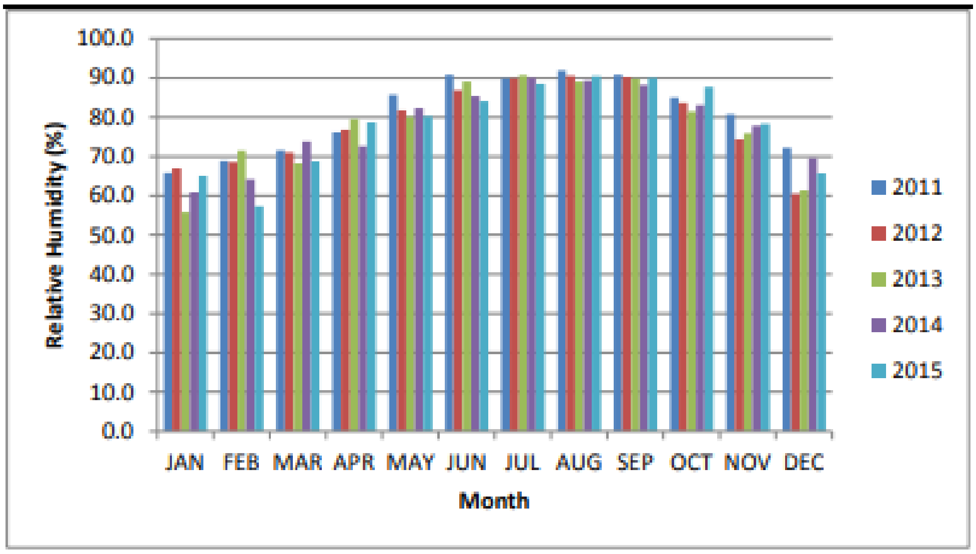


Figure 5. 4 Relative Humidity

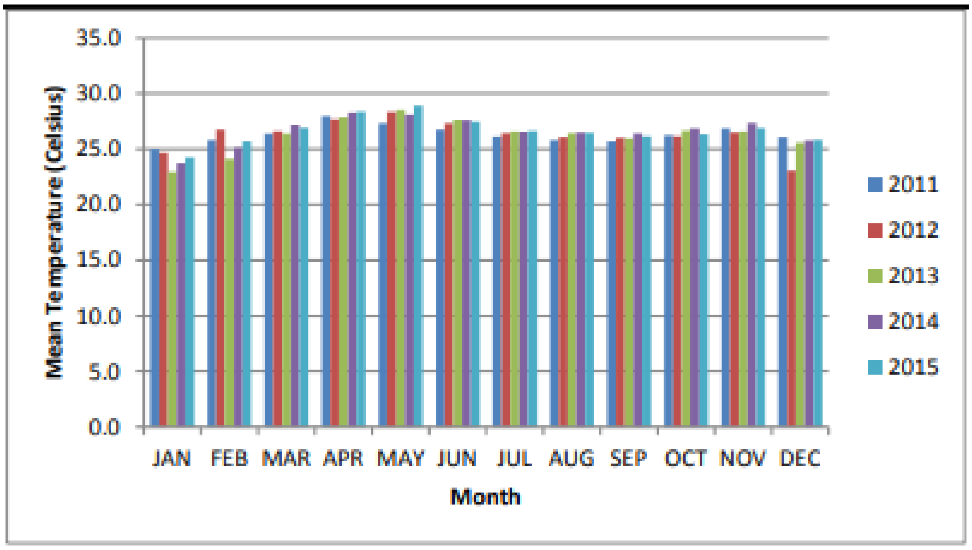


Figure 5. 5 Mean Monthly Temperature

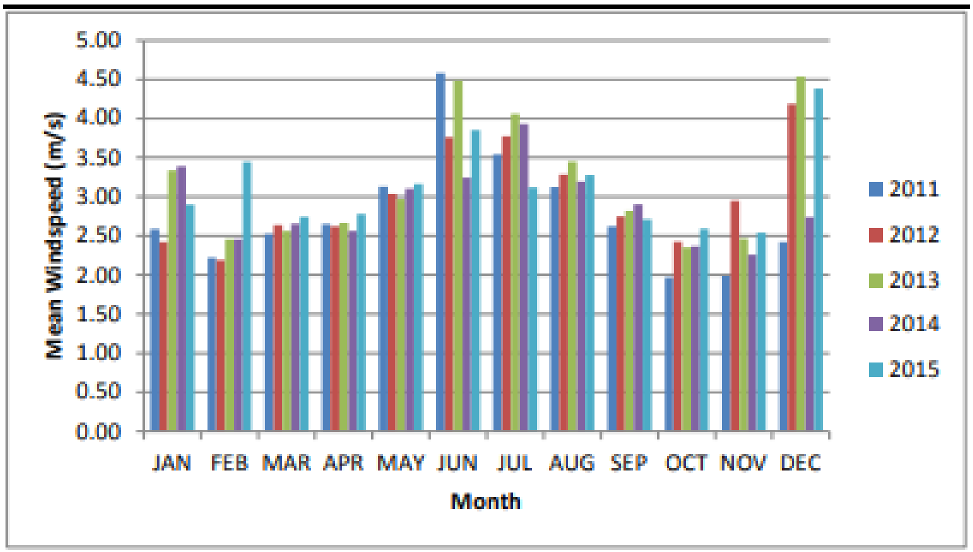
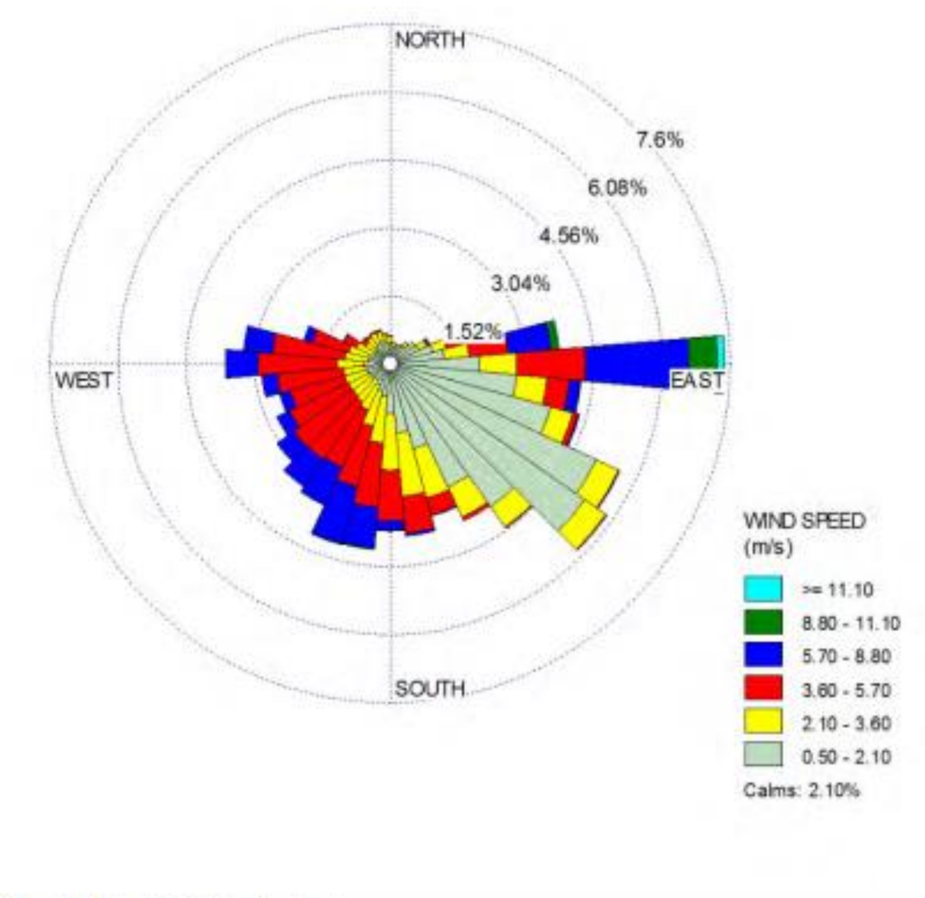


Figure 5. 6 Mean Wind Speed



Note: Wind direction is 'blowing from'

Figure 5. 7 Wind Rose 2012 - 2016

Figure 5.3 indicates that most rainfall is received at the Project site from May to October, with June, July and August being the most consistently wet months in comparison to the rest of the year.

Relative humidity is presented in Figure 5.4. The modelled data shows that humidity in the area is highest from July through to September with December through to February recorded as least humid. The average temperatures presented in Figure 5.5 correlate with average humidity with the highest average temperatures recorded during periods of low relative humidity.

Mean wind speeds are presented in Figure 5.6 and tend to fluctuate throughout the year, with two distinct peaks and troughs.

A wind roses based on the WRF data is shown in Figure 5.7. The figure shows that easterly and south easterly winds dominate. Wind speeds average 3.00 m/s, with a maximum one-hour average of 13.9m/s. Wind direction and wind speed are both important factors when considering air pollution dispersion. Prevailing winds mean receptors downwind are more likely to be exposed to increased concentrations with higher wind speeds leading to increased dispersion. The prevailing wind direction will mean receptors to the West and North West of the Project site will be impacted.

5.2.4 Geography

Yebyu Township is located between 14°12' and 15°15' north latitude and 97°45' and 98°36' east longitude. Yebyu Township has an area of 1585.4 square miles, 34 miles from east to west and 73.4 miles from south to north.

The east of Yebyu Township is Dawei Township and Thailand. The township is bordered by Mon state and Ye Township in the north, Dawei Township and Launglon Township in the south and Andaman Sea in the west.

Yebyu Township's topographical position is full of mountain and hills in the east and north, then the most extensive lowland plain in the west and south. Yebyu is one of the many rivers and streams full region and the water flows from north to south. The most significant river is Dawei river and it also run from north to the south.

5.2.5 Natural Disasters

Myanmar is a country exposed to a number of natural disasters such as floods, cyclones, storm surge, earthquakes, landslides, fires, and tsunamis. Over the decades, Myanmar has experienced a number of cyclones, floods, earthquakes, and landslides. Most parts of the country, especially the coastal regions, are periodically affected by the hazards. Natural disasters happened in Yebyu Township are as following tables:

Table 5. 1 Natural Disasters in Yebyu Township

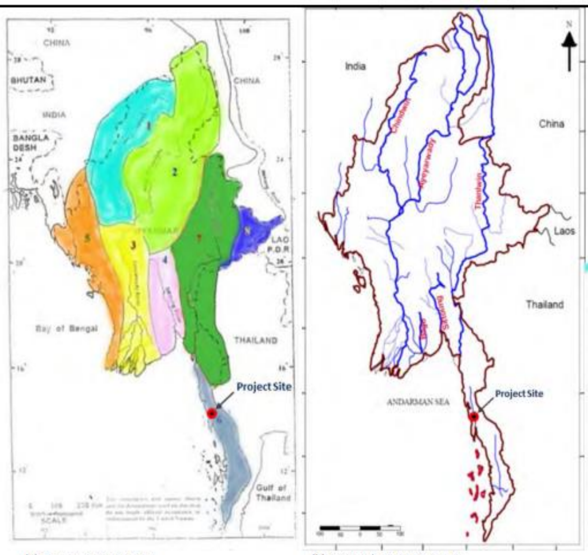
No	Categories	Frequency Occurrence	Death/Lost	Losses				Cost of Lost (Million Kyats)
				Household	Bridge	Bank of Mountain	Other	
1.	Fire	-	-	-	-	-	-	-
2.	Earthquake	-	-	-	-	-	-	-
3.	Cyclone	-	-	-	-	-	-	-
4.	Flood	2	-	10	-	-	-	161.00
5.	WInd	1	-	5	-	-	-	210.00

Source: Yebyu Township Profile MIMU (2019)

5.2.6 Hydrology

An overview of the major river basins in Myanmar is shown in Figure 5.8. The Project lies in Tanintharyi Region, which consists of several rivers and small streams originating from the mountains along the eastern border region. The total drainage area of Tanintharyi Region is about 40,600 km^2, with total surface water of 130.927 km^2.

The main river within the Project area is Heinze River. The Heinze River is located approximately 3 kilometers northwest of the Project site boundary. During the dry season, the river becomes brackish. It has a length of approximately 15 kilometers and originates from several creeks in the Heinze Reserve Forest. The Heinze River flows from east to west and gradually widens as it approaches its mouth. Most of the river is influenced by tides. Additionally, near the Mi Gyaung Aing Village, there is a significant tributary called Mi Gyaung Aing Creek, which is located 200 meters south of the project site. This creek likely shares similar tidal conditions with the Heinze River. Ultimately, the Heinze River flows into the Andaman Sea through a funnel-shaped estuary. Both the estuary and the creeks are navigable by small craft and are surrounded by mangrove forests. Along its banks, there are several villages, and the river is currently utilized for fisheries, navigation, and marine logistics purposes.



River Basin Number	Name of the River Basin	Drainage area (1000 * km²)	Surface water (km³)	Ground water (km³)
I	Chindwin	115.3	141.293	57.578
II	Upper Ayeyarwady	193.3	227.920	92.599
III	Lower Ayeyarwady	95.6	85.800	153.249
IV	Sittoung	48.1	81.148	28.402
V	Rakhine State	58.3	139.245	41.774
VI	Taninthari Division	40.6	130.927	39.278
VII	Thanlwin	158.0	257.918	74.779
VIII	Mekong	28.6	17.634	7.054
	Total	737.8	1081.885	494.713

Source: U Win Kyaw, WWD 2014, Myanmar, 19 Mar 2014)

(a) Myanmar River Basins (b) Potential Water Resources

Source: U Win Kyaw, WWD, 2014 Myanmar 19 March 2014 and http://www.a-a-r-s.org/ws-eowm/download/Plenary3/Myanmar.pdf

Figure 5. 8 Myanmar River Basins

Figure 5. 9 Catchment Area around Project Site

5.2.7 Hydrogeology

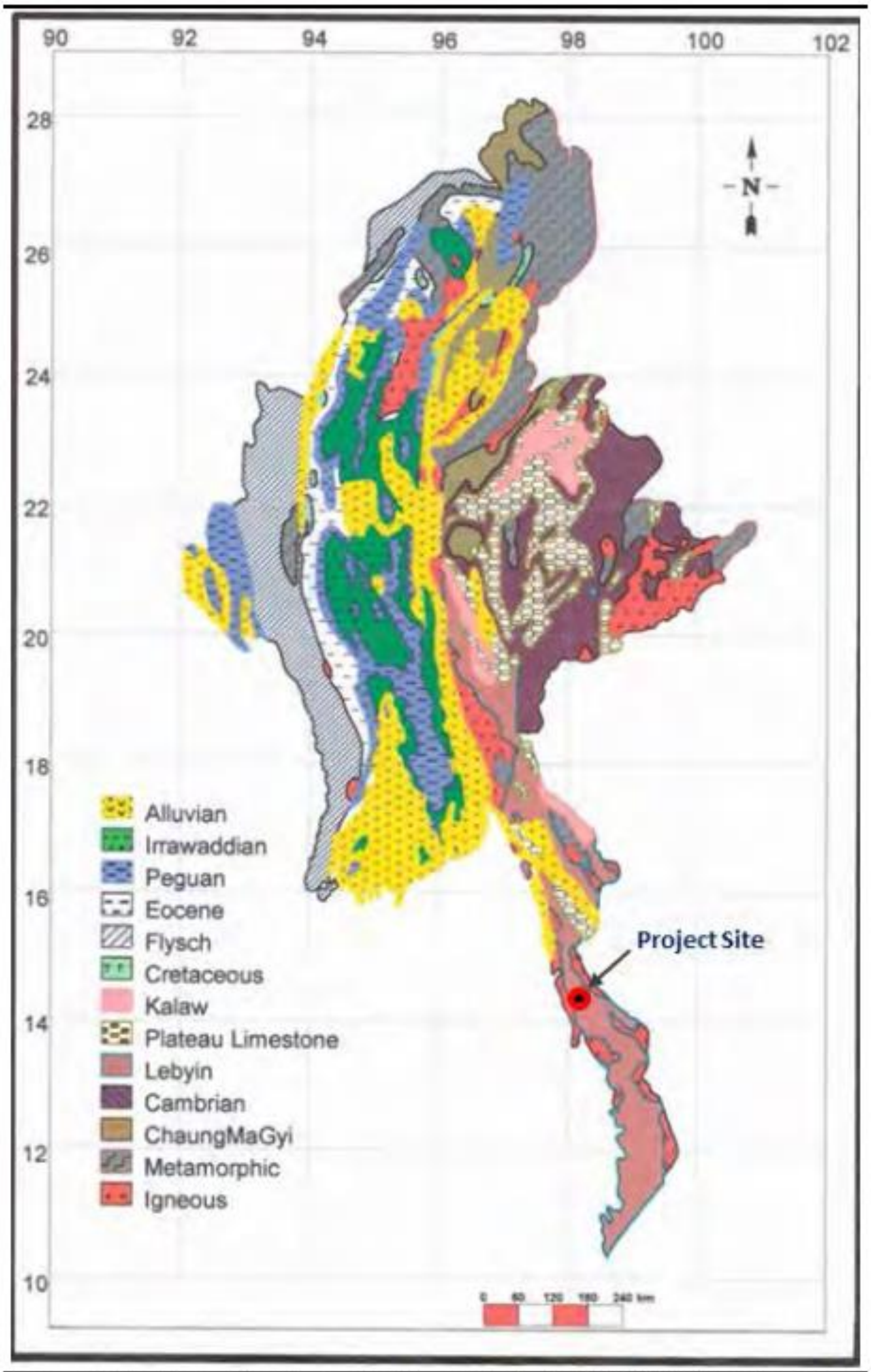
On the basis of stratigraphy, there are 13 different types of aquifers in Myanmar, namely Alluvium, Irrawaddian, Peguan, Limestone, Igneous (or Volcanic) and Other Minor Aquifers. The Project study area is underlain by Lebyin and Igneous aquifers (Figure 5.10). Groundwater aquifers are prone to leaching during the monsoon periods, especially on impervious surfaces, e.g. clay seams, clay layers, bedrocks, etc. Rising groundwater can cause saturation of the soil and can cause very high pore-water pressure in slopes in sedimentary deposits. The estimated groundwater potential in the Tanintharyi Region is 39.28 km^3, as shown in Table 5.2.

Table 5. 2 Estimated Groundwater Potential across Myanmar

Sr	River Basin	Catchment Area (km^2)	Groundwater Potential (km^3)
1	Chindwin	115,300	57.58
2	Ayeyarwady (Upper)	193,300	92.60
3	Ayeyarwady (Lower)	95,600	153.25
4	Sittaung	48,100	28.40
5	Rivers in Rakhine State	58,300	41.77
6	Rivers in Tanintharyi Region	40,600	39.28
7	Thanlwin (within Myanmar)	158,000	74.78
8	Mekong (within Myanmar)	28,600	7.05
Total		**737,800**	**494.71**

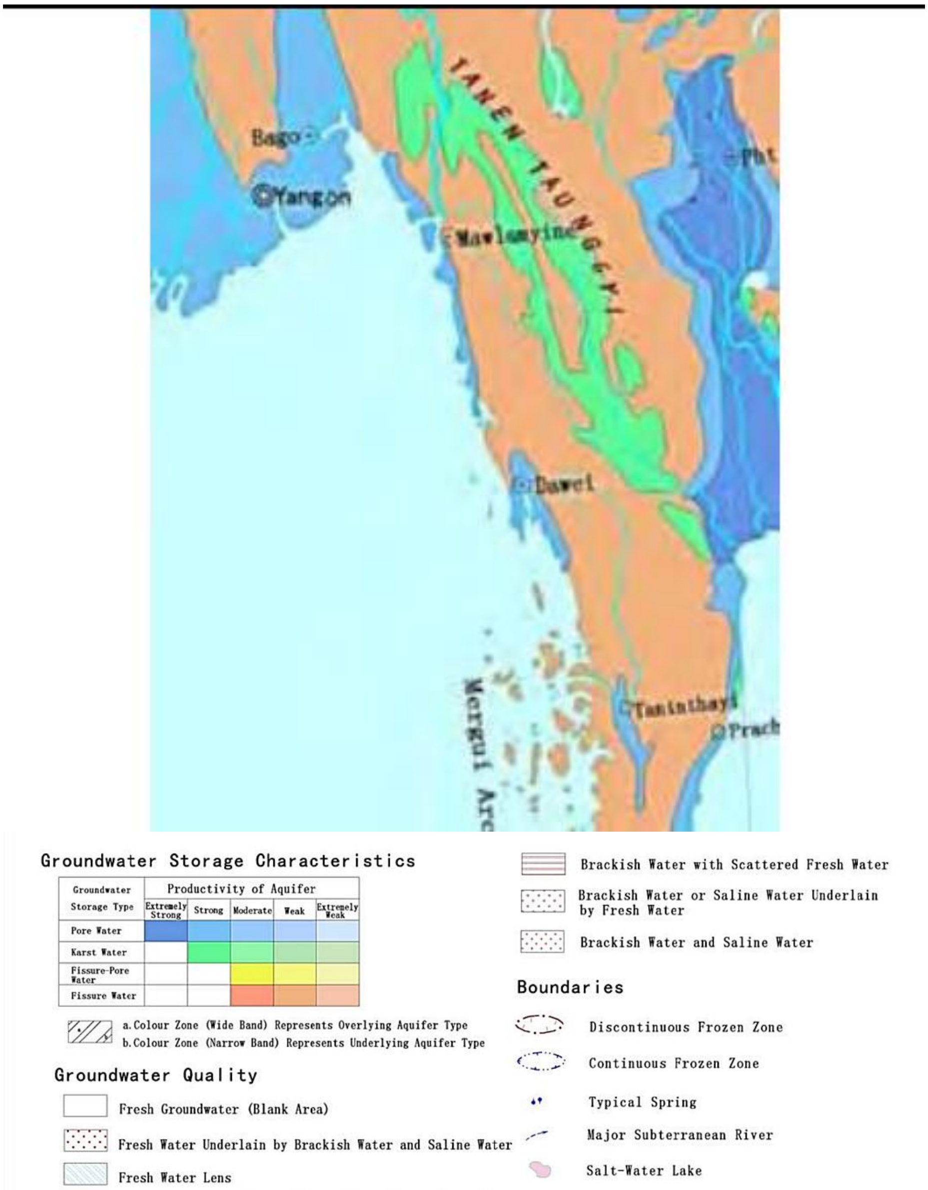
The China Geological Survey has organized the publication of a document titled "Groundwater Serial Maps of Asia", which was compiled by the Institute of Hydrogeology and Environmental Geology of CAGS in 2012, and summarizes research on groundwater systems in Asian countries, including Myanmar. Excerpts of two useful maps from this document, a Hydrogeological Map, and Groundwater Resources Map, are presented in Figure 5.11 and Figure 5.12, respectively.

Based on these maps, the productivity of aquifers near the Project area can be classified as "Strong Pore Water", or "Weak Fissure Water", and groundwater quality is considered "Fresh Groundwater". The groundwater type ranges from "Pore Water" to "Fractured Water". Groundwater resources classifications consist of "Discontinuous Aquifer in Hilly Area" and "Continuous Aquifer in Plain and Intermontane Basin", with Natural Recharge Modulus ranging from 200,000-500,000 m3 /km^2 -yr.



Source: Adapted from http://danishwater.dk/wp-content/uploads/2013/09/Ministry-of-Agriculture-

Figure 5. 10 Major Aquifers of Myanmar Relative to Project Area



Source: Adapted from "Groundwater Serial Maps of Asia" which was compiled by the Institute of Hydrology and Environmental Geology of CAGS in 2012

Figure 5. 11 Hydrogeological Map of Project Area

Source: Adapted from "Groundwater Serial Maps of Asia" which was compiled by the Institute of Hydrology and Environmental Geology of CAGS in 2012

Figure 5. 12 Groundwater Types in Project Area

Exploitation of Myanmar's aquifers has thus far been limited to municipal water supply and intensive irrigation of vegetables and other high value crops from handdug wells. Water use in Myanmar has been increasing, particularly in the agricultural and industrial sectors. Table 5.3 shows the water use in different sectors for the year 2008-09. As much as 89% of water use is tapped for irrigation purposes, while about 8% is for domestic consumption and 3 % is for industry.

Table 5. 3 water use in different sectors for the year 2008-09

Sector	Surface Water	Groundwater	Total
Domestic	1.15 (3%	2.55 (68%)	3.7 (8%)
Industrial	1.17 (3%)	0.33 (9%)	1.5 (3%)
Irrigation	41.97 (94%)	0.85 (23%)	42.82 (89%)
Total	**44.29**	**3.73**	**48.02**

According to TEAM Consulting's groundwater surveys in June 2013, they found that groundwater was used for domestic purposes at the sampling locations in nearby communities. These results were confirmed by ERM field survey and social baseline and are detailed in Chapter 6.

5.2.8 Land Use and Visual

As illustrated in Figure 5.13, the proposed CCPP is at the center of the 5km radius study Area, covering a total of 9.47 hectares (ha), while the Water Intake Pumping Station (including Water Treatment Facility) will be located on the Heinze River to the north of the study area. Overall, the Project falls within a rural setting, surrounded largely by flat agricultural land, with low-lying hills to the south west, the Heinze River to the north and its tributaries reaching across from the middle to the north west of the study area. These is a relatively large area of development / bare soil noted to the south of the study area, just south of Kanbauk village, which is a mine that has been operational for over 100 years.

Overall, there are a number of villages located within the study area, as detailed below:

- Kanbauk village – total population of approximately 9,976, with the main population located approximately 1.8 km south of the CCPP site but with some houses reaching up to the site boundary;
- Mi Gyaung Aing village – population of approximately 600, located just to the north of the Project site;
- Hle Gon village – population of approximately 1,778, located approximately 1.7 km to the south west of the Project site;
- Pyin Gyi village– population of approximately 350, next to the Water Pumping Station;
- Other villages as indicated in Chapter 4, with limited further information:
  - On Bin Kwin village;
  - Shin Byan village;
  - Pet Taung village;
  - Gan Gaw Taung;
  - Heinze village; and
  - Ye Ngan Zeik village.

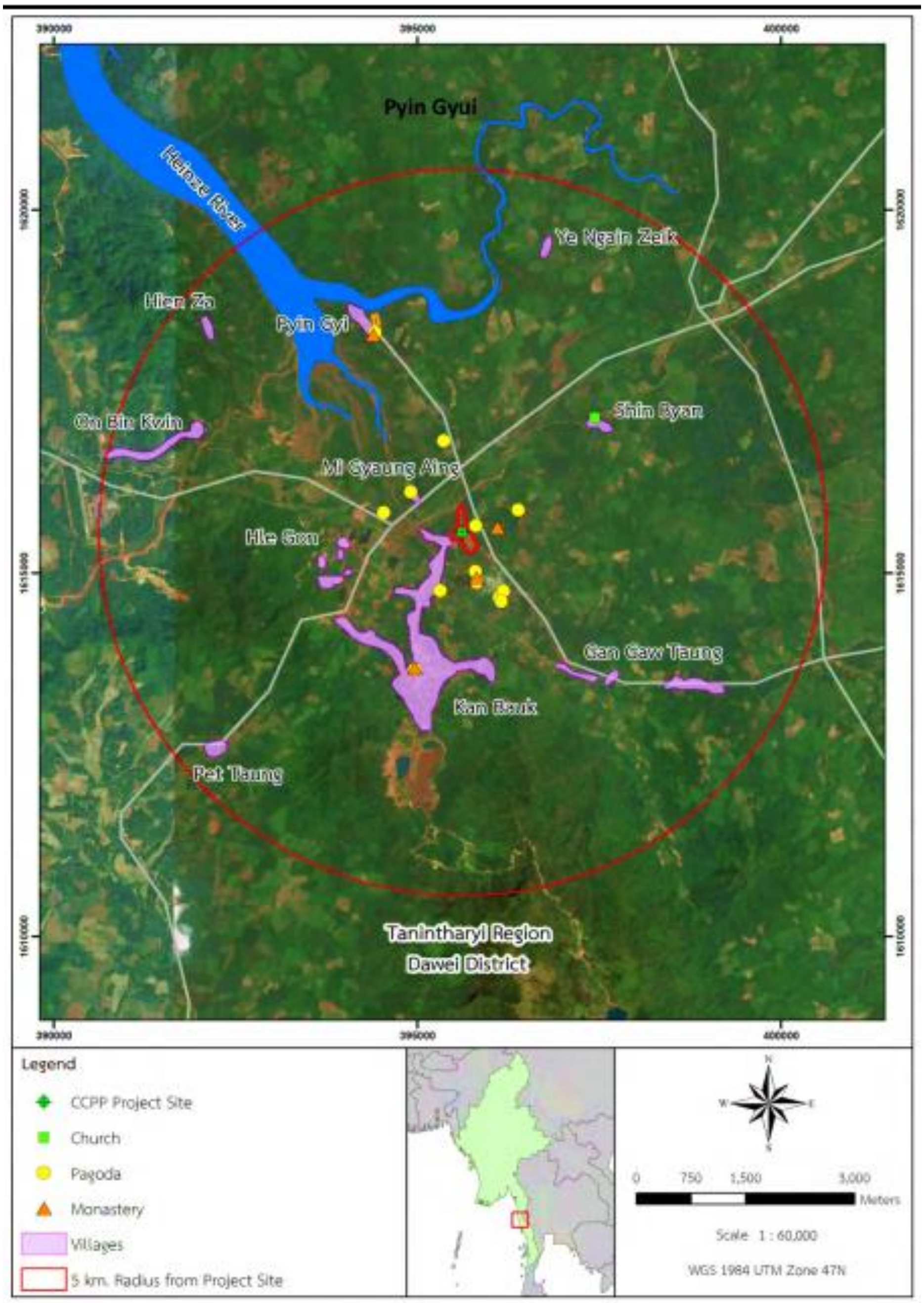


Figure 5. 13 General Landscape overview and Villages within the 5km Study Area

The proposed CCPP will be located on a vacant brown field site. It is on rolling terrain with the highest ground level area at the central northeast side (ground level: 28 m above mean sea level (MSL)), the northern tip of land at 12-17 m MSL and lower ground level at the southern and eastern side at 7.5 m MSL. Some land along the northern section of the site is lower than 5 m MSL. This Project site is surrounded by agricultural land and old rubber plantations and the main Heinze River is approximately 3km north-west of the CCPP site boundary. To the north of the site boundary is a paved road and agricultural area, to the south a tributary of the Heinze River and some agricultural land and to the east a paved road, habitation, agricultural area and a monastery. To the west there is an existing dirt road and the closest village houses within the villages of Mi Gyaung Aing and Hle Gon. Figure 5.14 provides some photographs of the CCPP Project site and landscape around it.

Fencing around the proposed CCGT site, with signage regarding the Project

Rubber Plantation to the western and northern side of the Project boundary

Low-lying hill to the southern part of the area

Heinze River to the north-west of study the study area

Figure 5. 14 Images of landscape in the vicinity of the CCPP Project site.

The proposed Water Intake Pumping Station and Treatment facility is located on the Heinze River on the border with Pyin Gyi Village. The location is on a small inlet surrounded by mudflats and mangrove habitat.

Heinze River at Water Intake Facility location

Mangrove habitat in the floodplains area

Plantation along the Heinze River bank

Figure 5. 15 Images of landscape in the vicinity of Water Intake Pumping Station

5.2.8.1 Visual Sensitive Receivers

VSR 1 – Inhabitants of Villages

The longstanding residents of the villages have a high level of association with the landscape, particularly the surrounding agricultural land. All agricultural land is accessible to these people, and it is highly likely that they place great value on this landscape due to the high contribution it makes to livelihoods in the area. The closest inhabitants will be next to the proposed CCPP and the proposed Water Intake Pumping Station. Overall given that this is their home they are regarded as having high sensitivity to changes to the visual aspect of the area.

VSR 2 – Worshipers at Local Pagodas/ Worshiping Sites

There are a number of local pagodas and worshipping sites in the area as indicated in Figure 5.13. Visitors to these sites will classically confer a high value to the landscape and visual context of these sites and are considered to have high sensitivity.

VSR 3– Recreational Visitors and Tourists

No studies have been undertaken with regards to the tourism and recreational aspects of the Project area. There is one touristic spot outside the 5km study area boundary, a waterfall and although it is perceivable that some tourists may visit the area it is not generally considered a touristic area. Tourists and recreational visitors typically have a high level of vested interest in the landscape and visual amenity, particularly agricultural areas and villages which contain a variety of temples and other religious features. Given the likely low numbers of tourists in the area, these VSRs are considered to have low sensitivity to any change of this landscape.

5.2.8.2 Cultural Heritage

VSR 1 – Inhabitants of Villages

The longstanding residents of the villages have a high level of association with the landscape, particularly the surrounding agricultural land. All agricultural land is accessible to these people, and it is highly likely that they place great value on this landscape due to the high contribution it makes to livelihoods in the area. The closest inhabitants will be next to the proposed CCPP and the proposed Water Intake Pumping Station. Overall given that this is their home they are regarded as having high sensitivity to changes to the visual aspect of the area.

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5.2.10 Protected Areas

Myanmar currently has a total of 57 Protected Areas (PAs), which account for only 4% of the country's total surface area (Protected Planet, 2014-15). The Project Area is located near to two Protected Areas being the Tanintharyi National Park (18km SW) and the Moscos Kyun Archipelago Wildlife Sanctuary (30KM NE). The Project Area is not located within a Protected Area. The location of the Project Area in relation to the adjacent Protected Areas is shown in Figure 5.16.

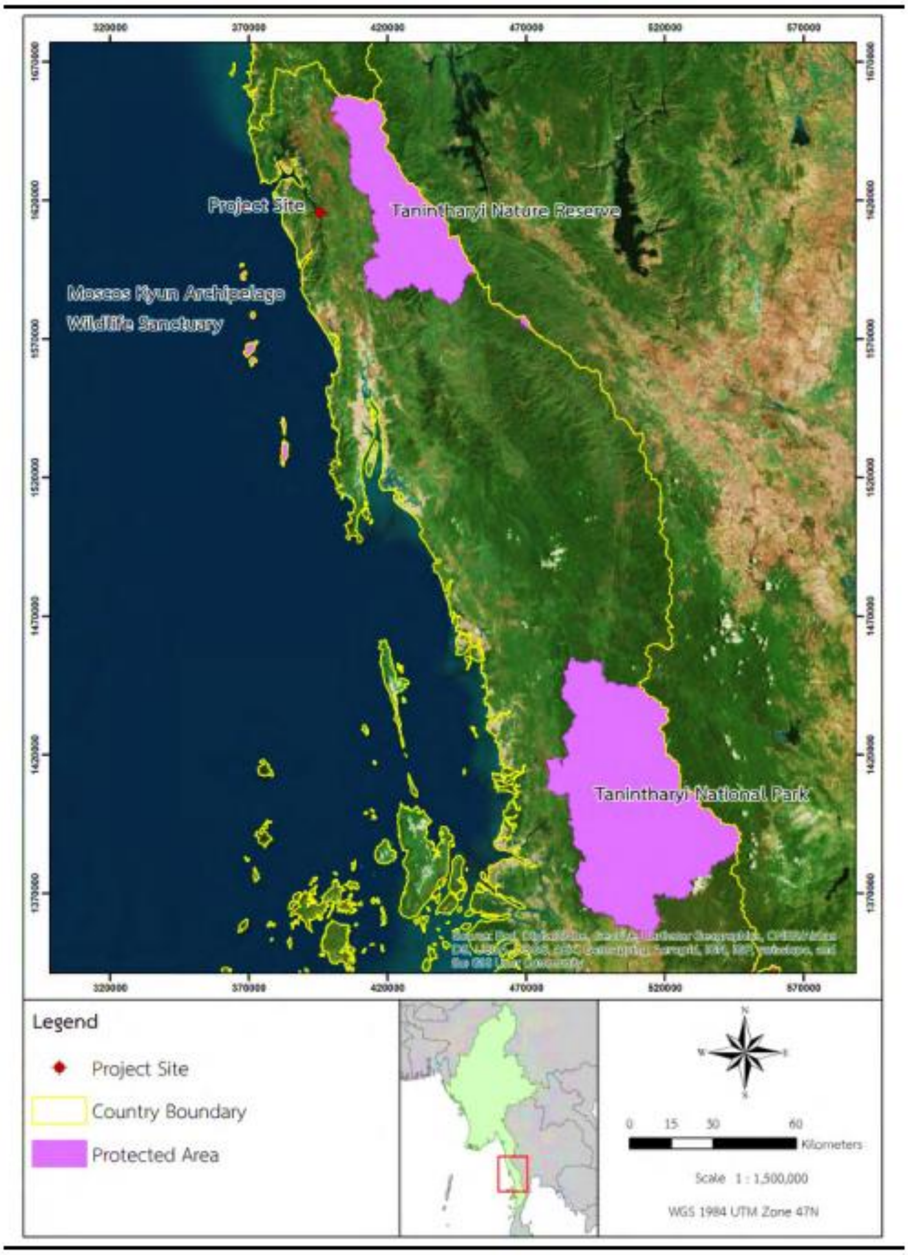
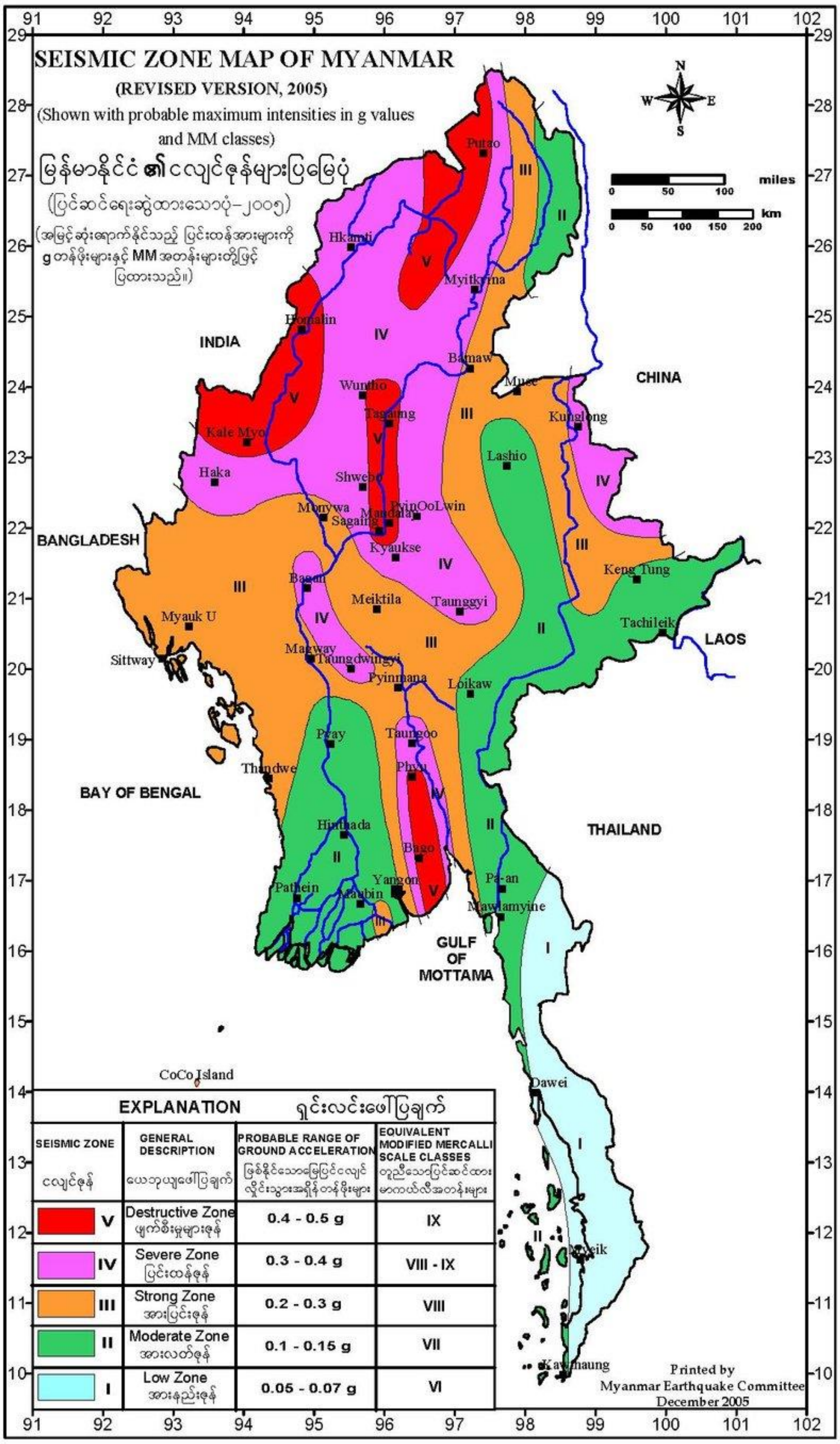


Figure 5. 16 Key Biodiversity Areas and Protected Areas adjacent to the Project Area

5.2.11 Earthquake Intensity

Yebyu Township is situated within the Zone I (Low Zone) showing in figure 5.17 and there is no earthquake in history according to the MIMU 2019.The nearest Fault beyond Yebyu Township is the south-east section of the Sagaing Fault which has not been active in the past 50 to 75 years indicating that the faults may be under accumulating stress increasing the potential for an earthquake. The origin and occurrence of earthquakes occurred all over the Myanmar except the southern part of the country in where the project exists. Earthquake intensity of the area can be seen in the following figure 5.17.



Revised by Dr. Maung Thein, U Tint Lwin Swe and Dr. Sone Han (December 2005)

Source: Myanmar Earthquake Committee

Figure 5. 17 Seismic Zone Map of Myanmar

As shown in the map, five seismic zones are demarcated and named (from low to high) Zone I (Low Zone), Zone II (Moderate Zone), Zone III (Strong Zone), Zone IV (Severe Zone), and

Zone V (Destructive Zone), mainly following the nomenclature of the European Macro Seismic Scale 1992.

As per the map, the proposed project is located within the Zone I (Low Zone). Although the project is under the Zone I, the project has to consider possible risks and to fulfill all engineering requirements of the buildings to stand earthquakes as well as to prevent damages affected by earthquakes as the project involves construction of high buildings.

5.3 ENVIRONMENTAL QUALITY MEASUREMENT

5.3.1 Ambient Air Quality

5.3.1.1 Receiving Environment

a) Overview

A critical part of the ESIA is to establish the state of the existing environment (referred to as the baseline). This section presents the baseline conditions, sensitive receptors, and climatic and meteorological conditions (Section 5.2.3) in the study area. This is informed by a bespoke air quality survey undertaken in support of the ESIA.

b) Assumptions and Limitations

It is assumed that:

- baseline air quality data collected is representative of the entire Project study area; and
- the meteorological data collected is representative of the entire Project study area.

c) Study Area

There are no set guidelines on the sphere of influence; however, considering the nature of activities during the construction and operation phases, a study area of 500m and 5,000m has been established for the respective assessments. The study area has been determined so that all potentially impacted air sensitive receivers during both construction and operation phase have been identified.

d) Air Sensitive Receivers

Air sensitive receivers are split into three categories as described below.

- Human – these are locations where people are present in the long term, and include villages and towns, isolated dwellings, schools, hospitals, clinics and government offices. The relevant pollutants of interest for sensitive human receptors are NO_2, SO_2, $PM_{2.5}$ and PM_{10}.
- Ecological – these are locations where there are local, national or internationally protected habitats. The relevant pollutants of interest for sensitive ecological receptors are NO_x and SO_2.
- Agricultural - these are locations where there are crop growing activities, as crop growth may be detrimentally affected and crops soiled as a result of project activities. The relevant pollutants of interest for sensitive agricultural receptors are NO_x and SO_2.

A number of human sensitive receivers have been identified in the in the construction and operation study area and are presented in Figure 5.18 and Figure 5.19. There are also a number of agricultural areas in the study area which will be considered in the air quality impact assessment.

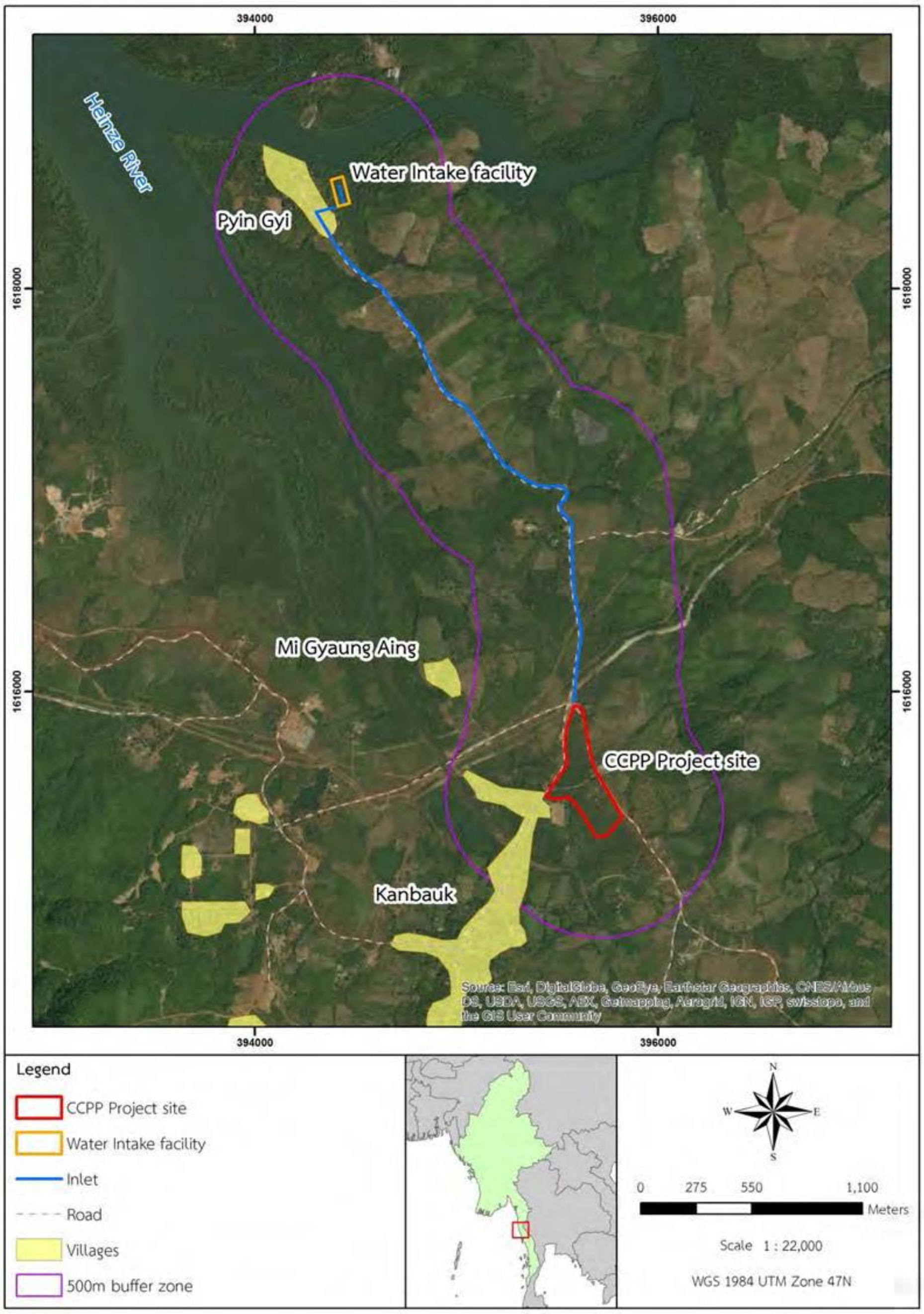


Figure 5. 18 Human Sensitive Receivers within 500m of the Combined Cycle Power Plant and the Associated Infrastructure Site Boundary

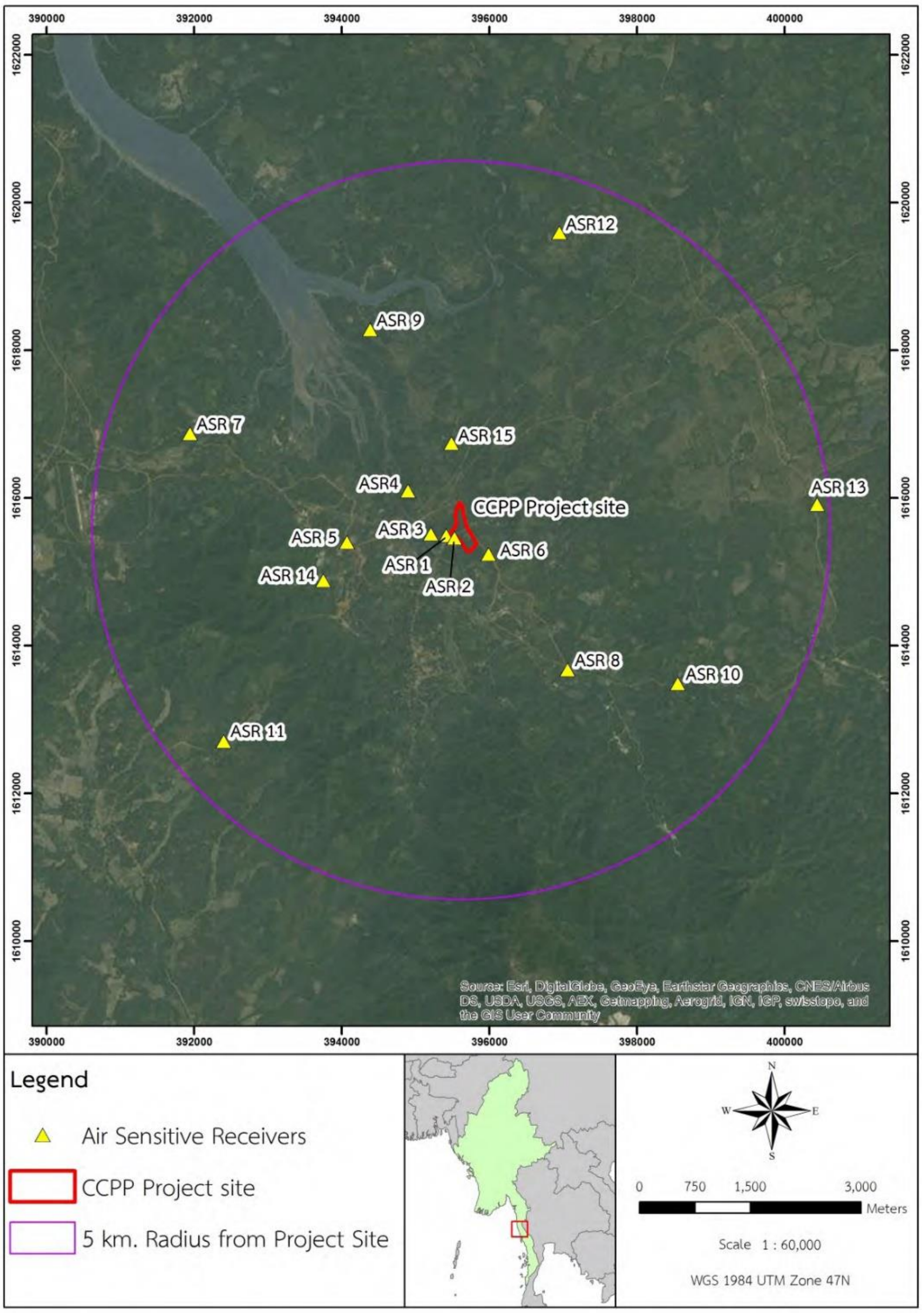


Figure 5. 19 Human Air Sensitive Receivers within 5,000m of the Combined Cycle Power Plant Project Site Boundary

5.3.1.2 Air Quality Baseline

a) Overview

In accordance with IFC guidelines, the monitoring parameters selected should reflect the species of concern associated with the Project processes over time.

To determine the scope of the baseline monitoring survey, an air emission screening assessment was undertaken to screen out the process contributions (i.e. the environmental concentration of each substance released from the Project) with insignificant environmental impacts. The results of the screening assessment indicate that NO_2, SO_2, $PM_{2.5}$ and PM_{10} are not insignificant and therefore require a quantitative assessment of impacts using dispersion modelling. A baseline is therefore required to inform the quantitative assessment and define the significance of the impact in line with the methodology.

On this basis, Project specific monitoring survey was undertaken to provide an indication of ambient concentrations of the abovementioned pollutants in the study area.

5.3.1.3 Baseline Collection Methodology

Ambient air quality monitoring of was undertaken at each of the selected monitoring sites using two (2) approaches so as to capture both short- and long-term trends in ambient air quality in both the dry and wet season. The monitoring methodology, duration and details regarding the substances monitored are presented below in Table 5.4.

Table 5. 4 Air Quality Monitoring

Season	Monitoring Method	Monitoring Period	Duration	Substances Monitored	Representativeness
Wet	Haz-Scanner EPAS[1]	September 24^{th} to September 28^{th}, 2016	Maximum 72 hours at each monitoring location	NO_2, SO_2, $PM_{2.5}$, PM_{10}	Indicative of short-term air quality
	Diffusion tube[2]	17^{th} December to 8^{th} January, 2017	3 weeks at each monitoring location	NO_X, NO_2	Indicative of long-term air quality
Dry	Haz-Scanner EPAS[1]	January 7^{th} to January 10^{th}, 2017	Maximum 72 hours at each monitoring location	NO_2, SO_2, $PM_{2.5}$, PM_{10}	Indicative of short term air quality
	Diffusion tube[2]	8^{th} January to 27^{th} January, 2017	3 weeks at each monitoring location	NO_X, NO_2	Indicative of long term air quality

(1) The HAZ-Scanner EPAS Wireless Environmental Perimeter Air Station is a multi-pollutant ambient air quality monitor utilizing 90° infrared light scattering methodology for monitoring particulates and electrochemical sensor for monitoring NO_2.

(2) Diffusion tubes are passive samplers that consist of small plastic tubes which contain a chemical reagent to absorb the pollutant to be measured directly from the air. The preparation and analysis of the diffusion tubes is undertaken to BS EN 13528 and the technique is widely recognized, including by the International Finance Corporation (IFC), the United States Environmental Protection Agency (USEPA) and national regulatory bodies. There is best practice guidance, adopted by this assessment, available from the US EPA and from the UK Department for the Environment, Food and Rural Affairs (DEFRA) on the siting and deployment of tubes. The analysis of the exposed tubes is completed through Ion Chromatography (United Kingdom Accreditation Service (UKAS) Accredited Method ISO/IEC 17025:2005).

The Weather Research and Forecasting Model (WRF) was used to generate meteorological data for the purpose of reviewing climatic conditions, review regional air quality, identify sensitive receptors and to support the qualitative and quantitative air quality impact assessment (see chapter 8). Locally monitored data, where available, has also been presented for reference and to verify the modelled data.

a) Monitoring Locations

Monitoring locations were initially selected using aerial photography, local available knowledge about villages, accessibility and security to determine the location of operations and nearby sensitive receptors. The final decision on locations was then made while in the field to determine the most suitable and representative locations for monitoring equipment to be deployed.

Monitoring locations were chosen to determine general background concentration levels. Sites were primarily located to measure typical concentrations in areas of high population density i.e. where sensitive receptors are located. Locations were also chosen to reflect local wind conditions with locations downwind of prevailing winds being of important consideration. Information regarding the monitoring locations is provided in Table 5.5 and their locations map shown in Figure 5.20.

Table 5. 5 Ambient Air Quality Monitoring Locations

Name	Location		Description of Monitoring Point
	Latitude	Longitude	
AQM1	14º 35’ 39.20” N	98º 01’ 30.00” E	In the compound of Shwezadi Monastery, Hle Kon Ward, Kanbauk Village, Ye Pyu Township
AQM2	14 º 36’ 15.43” N	98 º 01’ 40.05” E	In the compound Withokedaryama Monastery, Mi gyaung Aing Ward, Kanbauk Village, Ye Pyu Township
AQM3	14 º 37’ 28.10” N	98 º 02’ 49.40” E	Near Primary school of Shinpyan Village, Ye Pyu Township

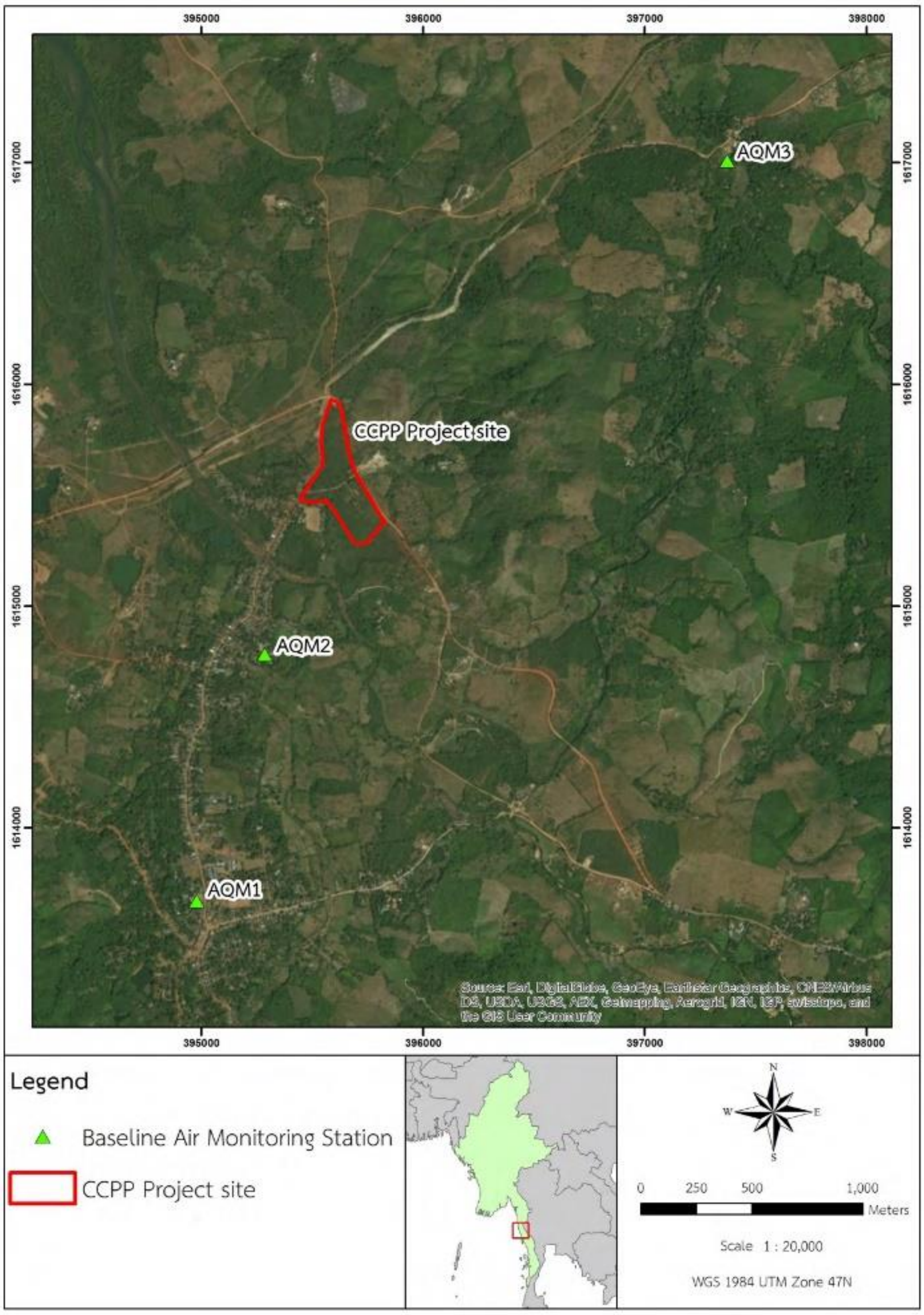


Figure 5. 20 Ambient Air Quality Monitoring Locations Map

5.3.1.4 Baseline Monitoring Results and Discussion

a) Short-Term Monitoring

Monitoring was undertaken using the Haz-Scanner for a 72-hour period at each monitoring location in both the dry and wet seasons and will be used as indicative of the short term (24-hour) trend in ambient air quality in the study area. A summary of the findings is presented in Table 5.6 and Table 5.7. Photo of monitoring study are presented in Figure 5.21.

A summary of the results is shown in below table. According to the observed values, the level of concentration for PM_{10}, $PM_{2.5}$, NO_2, SO_2 were within the NEQ Guideline values in both seasons.

Table 5. 6 Results of Air Quality Measurement for wet season

Site Name	Location		Date	Time	NO_2	SO_2	$PM_{2.5}$	PM_{10}
	Latitude	Longitude			µg/m³			
AQM1	14º 35' 39.20" N 98º 01' 30.00" E		24th – 25th September 2016	24 hours	64	30	16	18
			25th – 26th September 2016	24 hours	75	27	19	19
			26th – 27th September 2016	24 hours	49	20	15	17
AQM2	14 º 36' 15.43" N 98 º 01' 40.05" E		25th – 26th September 2016	24 hours	70	15	14	20
			26th – 27th September 2016	24 hours	55	16	12	15
			27th – 28th September 2016	24 hours	45	19	17	18
AQM3	14 º 37' 28.10" N 98 º 02' 49.40" E		24th – 25th September 2016	24 hours	65	8	10	12
			25th – 26th September 2016	24 hours	50	10	11	15
			26th – 27th September 2016	24 hours	47	10	10	15
Myanmar Air Quality Standard				**24 hours**	**n/a**	**20**	**25**	**50**

Table 5. 7 Results of Air Quality Measurement for dry season

Monitoring Location	Location		Date	Time	NO_2	SO_2	$PM_{2.5}$	PM_{10}
	Latitude	Longitude			µg/m^3			
AQM1	14º 35' 39.20" N 98º 01' 30.00" E		7th – 8th January 2017	24 hours	70	30	40	40
			8th – 9th January 2017	24 hours	70	30	40	50
			9th – 10th January 2017	24 hours	80	30	30	30
AQM2	14 º 36' 15.43" N 98 º 01' 40.05" E		7th – 8th January 2017	24 hours	20	30	40	80
			8th – 9th January 2017	24 hours	30	30	40	40
			9th – 10th January 2017	24 hours	100	10	30	50
AQM3	14 º 37' 28.10" N 98 º 02' 49.40" E		8th – 9th January 2017	24 hours	50	30	20	60
			9th – 10th January 2017	24 hours	50	10	20	30
			10th – 11th January 2017	24 hours	60	10	10	20
Myanmar Air Quality Standard				**24 hours**	**n/a**	**20**	**25**	**50**

AQ -1 at Wet Season

AQ-1 at Dry Season

Source: ERM

Figure 5. 21 Recorded Photograph of Air Quality Measurement during Wet and Dry Season

b) Long-Term Monitoring

Monitoring was undertaken using the diffusion tube methodology for a continuous three (3) week period at each monitoring location in both the dry and wet season. This information will be used as indicative of long term (annual) concentrations of both NO_x and NO_2. The results from the survey are presented in Table 5.8.

Table 5. 8 Summary of Wet and Dry Season Diffusion Tube Survey

Season	Monitoring Location	Date	Time	NO_2	NO_X
Wet Season	AQM1	18th December 2016 – 8th January 2017	504 – 521 hours	7.71	15.4
	AQM2			4.75	8.78
	AQM3			3.08	6.52
	Myanmar Air Quality Standard		**Annual**	**40**	**n/a**
Dry Season	AQM1	8th January 2017 – 27th January 2017	504 – 521 hours	7.92	13.3
	AQM2			5.30	8.83
	AQM3			2.61	6.38
	Myanmar Air Quality Standard		**Annual**	**40**	**n/a**

AQ-2 at Wet Season

AQ-2 at Dry Season

Source: ERM

Figure 5. 22 Recorded Photograph of Air Quality Measurement during Wet and Dry Season

c) Interpretation of the Monitoring Results

The United Kingdom Department for Environment, Food and Rural Affairs (DEFRA)[8]provides conversion factors for converting between averaging periods. This approach has therefore been adopted to interpret the baseline findings for different and relevant averaging periods. In order to derive a 1-hour average NO_2 baseline for comparison to the 1-hour average air quality standard, the 24-hour concentrations presented in Table 5.6 and Table 5.7 have been divided by 0.59. Likewise, to derive an annual average $PM_{2.5}$ and PM_{10} baseline for comparison to the annual average air quality standard, the 24-hour concentrations presented in Table 5.6 and Table 5.7 have been divided by two. A summary of the baseline used in the assessment is presented in Table 5.9, Table 5.10 and Table 5.11.

[8] Department for Environment, Food and Rural Affairs (DEFRA) (2016) Air emissions risk assessment for your environmental permit [Online] Available from: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Accessed 2nd March 2017]

Table 5. 9 Summary of NO_x/NO_2 Baseline Conditions

Season	Monitoring Location	Short Term NO_2 ($\mu g/m^3$)			Long Term NO_2/NO_x ($\mu g/m^3$)		
		Date	1-hour (1)	24-hour	Date	Annual NO_2	Annual NO_x
Wet	AQM1	24th – 25th September 2016	108	64	18th December 2016 – 8th January 2017	7.71	15.4
		25th – 26th September 2016	127	75			
		26th – 27th September 2016	83	49			
	AQM2	25th – 26th September 2016	119	70		4.75	8.78
		26th – 27th September 2016	93	55			
		27th – 28th September 2016	76	45			
	AQM3	24th – 25th September 2016	110	65		3.08	6.52
		25th – 26th September 2016	85	50			
		26th – 27th September 2016	80	47			
Dry	AQM1	7th – 8th January 2017	119	70	8th January 2017 – 27th January 2017	7.92	13.3
		8th – 9th January 2017	119	70			
		9th – 10th January 2017	136	80			

Season	Monitoring Location	Short Term NO_2 ($\mu g/m^3$)			Long Term NO_2/NO_x ($\mu g/m^3$)		
		Date	**1-hour (1)**	**24-hour**	**Date**	**Annual NO_2**	**Annual NO_x**
	AQM2	7th – 8th January 2017	34	20		5.30	8.83
		8th – 9th January 2017	51	30			
		9th – 10th January 2017	169	100			
	AQM3	8th – 9th January 2017	85	50		2.61	6.38
		9th – 10th January 2017	85	50			
		10th – 11th January 2017	102	60			
Myanmar Air Quality Standard			**200**	**n/a**		**40**	**n/a**
Maximum Concentration as % of standard			84.5%	n/a		19.8%	n/a
Average concentration as % of standard			50%	n/a		13%	n/a
Airshed Classification			Non-degraded	n/a		Non-degraded	n/a

Table 5. 10 Summary of SO_2 Baseline Conditions

Season	Monitoring Location	Short Term SO_2 ($\mu g/m^3$)	
		Date	24-hour
Wet	AQM1	24th – 25th September 2016	30
		25th – 26th September 2016	27
		26th – 27th September 2016	20
	AQM2	25th – 26th September 2016	15
		26th – 27th September 2016	16
		27th – 28th September 2016	19
	AQM3	24th – 25th September 2016	8
		25th – 26th September 2016	10
		26th – 27th September 2016	10
Dry	AQM1	7th – 8th January 2017	30
		8th – 9th January 2017	30

Season	Monitoring Location	Short Term SO_2 ($\mu g/m^3$)	
		Date	24-hour
		9th – 10th January 2017	30
	AQM2	7th – 8th January 2017	30
		8th – 9th January 2017	30
		9th – 10th January 2017	10
	AQM3	8th – 9th January 2017	30
		9th – 10th January 2017	10
		10th – 11th January 2017	10
Myanmar Air Quality Standard			**20**
Maximum Concentration as % of standard			150%
Average concentration as % of standard			105%
Airshed Classification			Degraded

Table 5. 11 Summary of $PM_{2.5}/PM_{10}$ Baseline Conditions

Season	Monitoring Location	Short Term $PM_{2.5}/PM_{10}$ ($\mu g/m^3$)			Long Term $PM_{2.5}/PM_{10}$ (1) ($\mu g/m^3$)	
		Date	24-hour $PM_{2.5}$	24-hour PM_{10}	Annual $PM_{2.5}$	Annual PM_{10}
Wet	AQM1	24th – 25th September 2016	16	18	8	9
		25th – 26th September 2016	19	19		
		26th – 27th September 2016	15	17		
	AQM2	25th – 26th September 2016	14	20	7	9
		26th – 27th September 2016	12	15		
		27th – 28th September 2016	17	18		
	AQM3	24th – 25th September 2016	10	12	5	7
Dry	AQM1	7th – 8th January 2017	40	40	18	20
		8th – 9th January 2017	40	50		
		9th – 10th January 2017	30	30		
	AQM2	7th – 8th January 2017	40	80	18	28
		8th – 9th January 2017	40	40		
		9th – 10th January 2017	30	50		

Season	Monitoring Location	Short Term $PM_{2.5}/PM_{10}$ ($\mu g/m^3$)			Long Term $PM_{2.5}/PM_{10}$ (1) ($\mu g/m^3$)	
		Date	**24-hour $PM_{2.5}$**	**24-hour PM_{10}**	**Annual $PM_{2.5}$**	**Annual PM_{10}**
	AQM3	8th – 9th January 2017	20	60	8	18
		9th – 10th January 2017	20	30		
		10th – 11th January 2017	10	20		
Myanmar Air Quality Standard			**25**	**50**	**10**	**20**
Maximum Concentration as % of standard			160%	160%	180%	140%
Average concentration as % of standard			88%	62%	106%	76%
Airshed Classification			Degraded	Degraded	Degraded	Degraded

The results from the monitoring conducted in the area indicate that ambient concentrations of NO_x and NO_2 are below the relevant air quality standards; however ambient concentrations of SO_2, $PM_{2.5}$ and PM_{10} are found to exceed the relevant air quality standards. The receiving airshed has therefore been classified for the substances of interest and summarized in Table 5.12.

Table 5. 12 Airshed Classification

Pollutant	Airshed Classification
NO_2	Non-degraded
NO_x	Non-degraded
SO_2	Degraded
$PM_{2.5}$	Degraded
PM_{10}	Degraded

(1) Non-degraded means the baseline is below the relevant air quality standard.
(2) Degraded means the baseline exceeds the relevant air quality standard

5.3.2 Noise Level Measurement

5.3.2.1 Overview

In accordance with IFC General EHS Guidelines, noise monitoring should be carried out for the purpose of establishing existing ambient noise levels around the Project area in the absence of the facility or noise source. The baseline noise levels will then be adopted for noise level guidelines to determine the significance of the impact at the noise sensitive receivers (NSR) during construction and operational phases.

5.3.2.2 Baseline Noise Methodology

Baseline noise monitoring was conducted in September 2016. Hourly A-weighted equivalent continuous sound pressure levels (LAeq, 1 hour) were recorded continuously over 72 hours. Daytime and night-time noise levels in LAeq were calculated by averaging the hourly sound pressure levels measured over the 72-hour period between 0700 and 2200 hours and between 2200 to 0700 hours, respectively.

Noise levels (LAeq) were recorded using a Type II sound level meter at about 1.5m above ground with no reflecting surface nearby in accordance with the Myanmar NEQ and IFC guidelines. Sampling frequency was at 10-minute interval for 72 hours continuously. Sound level meter employed for the baseline noise monitoring and the measurement parameter are summarized in Table 5.14.

Table 5. 13 Equipment Used for Baseline Noise Monitoring and Measurement Parameters

Sound Level Meter	*Measurement Parameter*
Lutron SL-0423SD	Sound Pressure Level, LAeq, 10min, dB(A)

5.3.2.3 Baseline Noise Monitoring Locations

Existing noise sensitive receivers (NSR) located near the Project Site have been identified that may be potentially affected by the Project during construction and operation phases (see details in Section 9.6). Baseline noise monitoring was conducted at three locations to establish the background levels in the area. The location of baseline monitoring station is summarized in Figure 5.23.

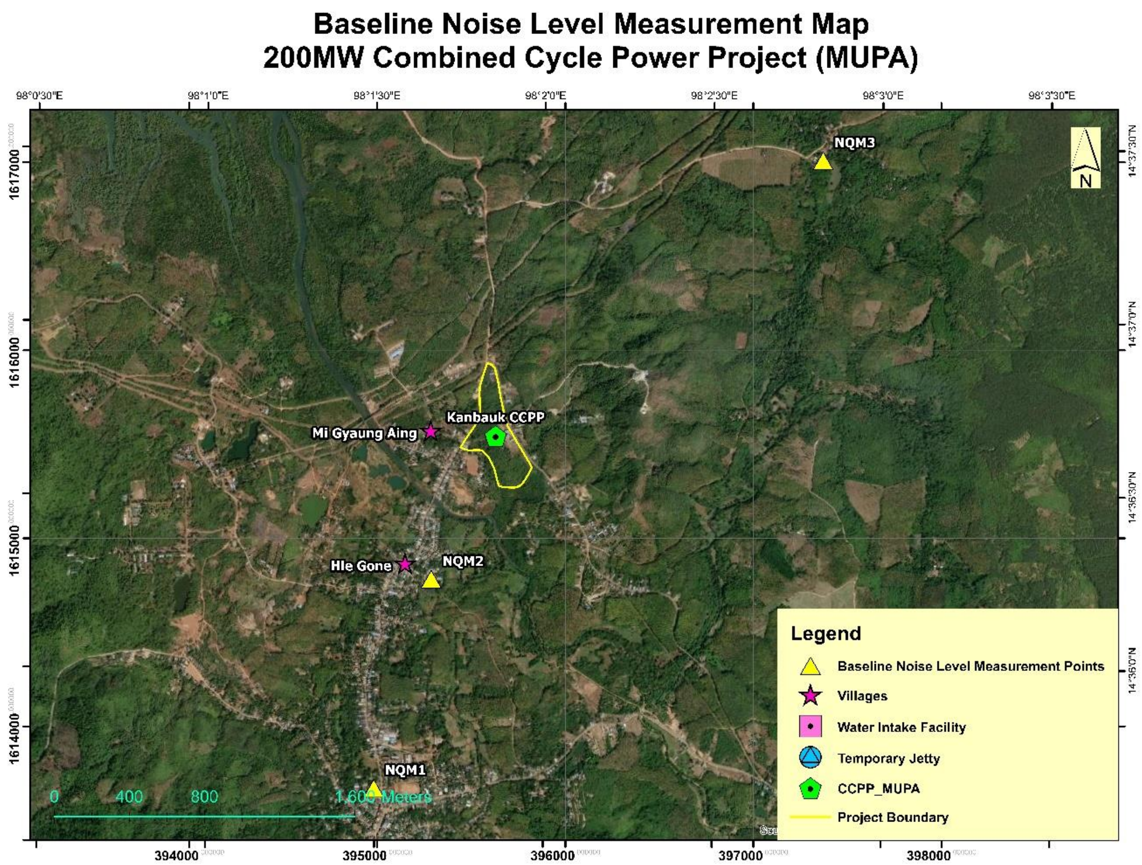


Figure 5. 23 Baseline Noise Monitoring Location

Figure 5. 24 Noise Monitoring

5.3.2.4 Results of Baseline Noise Monitoring

The sources of noise pollution are likely to include the road traffic from the nearby local road to village.

Ambient noise level was measured during 24th - 27th September 2016 for N1 and N3, and 25th – 28th September 2016 for N2 at the same location of air measurement. The noise level was measured and recorded continuously for 72 hours by means of LAeq,1hr. Results of noise level measurement are given in Table 5.23.

These results showed that noise levels during daytime and nighttime periods at all stations were over than Myanmar NEQ (Emission) Guidelines. The baseline noise levels are typical of rural settings with high noise levels. The sampling locations were located closed to community area and the main road of village. The dominant source of noise was from human activities, including vehicle traffic and school in the nearby area.

Table 5. 14 Results of Background Noise Measurement (September 2016)

Station	Date	LAeq,1hr (Daytime) dB(A)	LAeq,1hr (Nighttime) dB(A)
Kanbauk Monastery (N1)	24-25 Sep	61.7	63.4
	25-26 Sep	57.1	51.4
	26-27 Sep	61.9	66.9
Min-max		57.1-61.9	51.4-66.9
Average		60.7	63.8

Station	Date	LAeq,1hr (Daytime) dB(A)	LAeq,1hr (Nighttime) dB(A)
Mi Gyaung Aing Primary School (N2)	25-26 Sep	64.6	51.3
	26-27 Sep	55.0	50.3
	27-28 Sep	53.3	48.4
Min-max		53.3-64.6	48.4-51.3
Average		60.5	50.2
Shin Byan Primary School (N3)	24-25 Sep	60.3	59.5
	25-26 Sep	58.4	62.8
	26-27 Sep	56.5	63.4
Min-max		56.5-60.3	59.5-63.4
Average		58.7	62.2
Myanmar NEQ (Emission) Guidelines		55*	45**

5.3.3 Surface Water Quality

A number of baseline water quality sampling surveys in the Project area have been conducted, both for previously conducted ESIA studies, and as part of this ESIA report. An overview of the surveys and their results are presented in this section.

5.3.3.1 Previous Survey by TEAM Consulting, 2013

Surface water quality tests were conducted by TEAM at 4 stations within 5 km of the Project during 7-19 June, 2013. All four surface water sampling stations were located on the Heinze Chaung River, the main water resource for local people in the area and the power plant for the cooling system. The details of observed results and measurement locations can be seen in Annex L.

5.3.3.2 Wet Season Survey (September 2016)

Sampling Methodology and Locations

Surface water samples were collected by ERM-Siam and SEM from the 25th to the 27th September 2016 at six (6) locations as shown in Figure 5.25 and detailed in Table 5.15. In-situ testing was conducted on site, and the samples were also sent for laboratory testing.

Summary of Results

Results of the physical and chemical parameters of surface water quality testing are shown in Table 5.16.

The results were compared to EPA's recommended aquatic life and human health criteria and National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation. Results indicate that Arsenic and Cyanide levels were compliant with the criteria at all monitoring locations. Concentrations of Iron (1.160 mg/l) at SW4 was found to exceed the USEPA CCC criteria of 1.0mg/l.

Although the Lead Concentration ($4.30x10^{-3}$ mg/l) was found to exceed the USEPA CCC criteria of 0.0025mg/l, the concentration of Lead ($4.30x10^{-3}$ mg/l) at SW4 was complaint with the standard of National Surface Water Quality Standard (0.01 mg/l). Therefore, it can be regarded as an acceptable value in Myanmar.

In comparison with the National Surface Water Quality Standard (8 mg/l) for Chemical Oxygen Demand (COD), the result of COD for SW4 was compliant with the criteria and the results of SW1 (85.0 mg/l), SW2 (101 mg/l), SW3 (12.6 mg/l), SW5 (9.4 mg/l) and SW6 (9.4 mg/l) were exceed to the standard.

In Biochemical Oxygen Demand (BOD), the SW1 (5.9 mg/l) and SW4 (4.00 mg/l), SW5 (7.60 mg/l) and SW6 (4.40 mg/l) were exceed the standard of National Surface Water Quality (3 mg/l) and the results of other locations were compliant with the standard.

The results for total dissolved solids indicated high concentrations at SW1 (10,998mg/l), SW2 (9,858mg/l) and SW3 (414mg/l). This is likely due to the dissolved salt in the brackish water.

According to the observed result, the salinity concentration was higher than guideline value. This is likely due the reason for the higher salinity level is the intrusion of seawater.

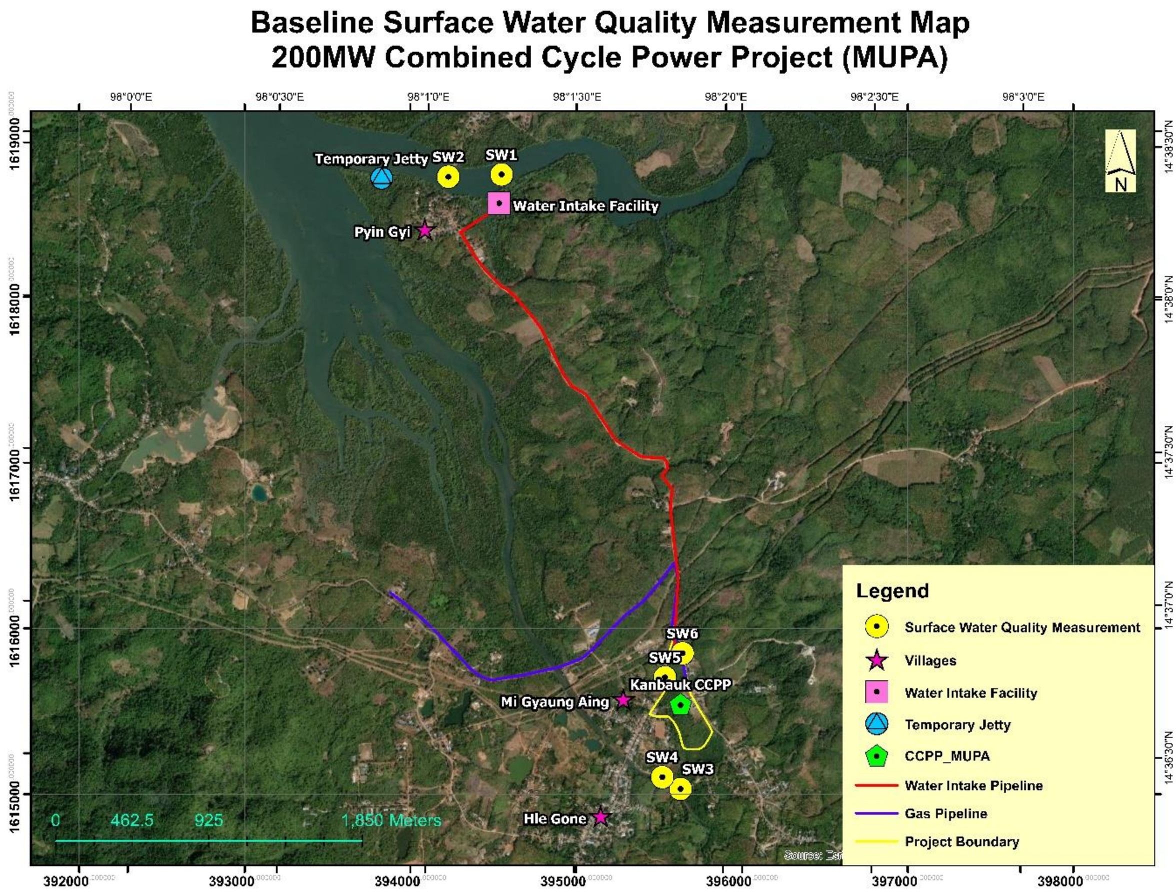


Figure 5. 25 Surface Water Quality Measurement during Wet Season

Table 5. 15 Surface Water Quality Monitoring Station Information for Wet Season Survey in September 2016

Item	SW1		SW2		SW3		SW4		SW5	SW6
Location	Heinze Chaung (up)		Heinze Chaung (Down)		Mi Gyaung Auing Chaung (up)		Mi Gyaung Auing Chaung (Down)		Up Stream before factory	Up Stream After factory
Latitude Longitude	14°38'24.10"N 98° 1'14.86"E		14°38'23.62"N 98° 1'4.14"E		14°36'23.61"N 98° 1'51.47"E		14°36'25.90"N 98° 1'47.80"E		14°36'45.49"N 98° 1'48.25"E	14°36'50.26"N 98° 1'51.77"E
Sample	1	2	1	2	1	2	1	2	1	1
Date/Time	25/09/2016 13:52	27/09/2016 9:10-10:50	25/09/2016 14:07	27/09/2016 11:00_12:35	26/09:2016 09:50	27/09/2016 16:10	26/09/2016 08:50	27/09/2016 14:25	26/09/2016 10:20	26/09/2016 10:05
Weather	Slightly Sunny	Cloudy	Cloudy	Sunny	Rainy	Cloudy	Rainy	Cloudy	Rainy	Cloudy
Tide Condition	Low	High	Low	High	-	-	-	-	-	-
Remark	In-situ test	Sampling & In-situ test	In-situ test	Sampling & In-situ test	In-situ test	Sampling & In-situ test	In-situ test	Sampling & In-situ test	Sampled on 27/09/2016 16:30	Sampled on 27/09/2016 16:30

Table 5. 16 Results of Surface Water Quality Measurement for Wet Season Survey (September 2016)

Parameter	Unit	Detecting Limit	Analytical Result						US EPA Criteria		US EPA Criteria		National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation
			SW1	SW2	SW3	SW4	SW5	SW6	CMC1 (acute)	CCC2 (chronic)	Human Health for the consumption of Water + Organism	Human Health for the consumption of Organism Only	
pH	-	1.00	6.08-6.80	6.57-6.85	6.65-7.74	7.50-8.70	6.79	6.83	-	6.50 - 9.00	5.00 - 9.00	-	6.5-8.5
Water Temperature	°C	-	26.2-28.8	27.9-28.7	24.3-28.3	26.9-28.7	23.9	23.5	-	-	-	-	-
Water Depth	m	-	2.30-4.10	3.70-4.00	1.30-1.70	0.50-1.00	0.250	0.250					-
Flow Rate	m/s	-	0.10-0.20	0.20-0.30	0.70-0.75	0.400	0.100	0.300					-
Conductivity	μs/cm	-	169-177	104-169	55.9-211	59.7-200	295	6.20	-	-	-	-	-
Dissolved Oxygen (DO)	mg/l	0.500	5.61-6.50	6.16-6.92	6.90-7.52	7.60-7.66	5.70	3.021	-	-	-	-	>5
Total Suspended Solids (TSS)	mg/l	10.0	<10.0	<10.0	11.1	14.4	<10.0	<10.0	-	-	-	-	50
Total Dissolved Solids (TDS)	mg/l	50.0	10,998	9,858	414	94.0	<50.0	<50.0	-	-	250		-
Salinity	psu	1.00	1.00-9.80	2.00-5.50	0.00	0.00	0.00	6.50	-	-	-	-	-
Biochemical Oxygen Demand (BOD)	mg/l	-	5.90	2.40	2.20	4.00	7.60	4.40	-	-	-	-	3

Parameter	Unit	Detecting Limit	Analytical Result						US EPA Criteria		US EPA Criteria		National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation
			SW1	SW2	SW3	SW4	SW5	SW6	CMC1 (acute)	CCC2 (chronic)	Human Health for the consumption of Water + Organism	Human Health for the consumption of Organism Only	
Chemical Oxygen Demand (COD)	mg/l	5.00	85.0	101	12.6	6.30	9.40	9.40	-	-	-	-	8
Total Coliform Bacteria	MPN /100 mL	1.80	17.0	9.20	33.0	6.10	39.0	2.00	-	-	-	-	-
Lead (Pb)	mg/l	$2.00x10^{-3}$	$<2.00x10^{-3}$	$<2.00x10^{-3}$	$<2.00x10^{-3}$	$4.30x10^{-3}$	$<2.00x10^{-3}$	$<2.00x10^{-3}$	0.0650	0.00250	-	-	0.01
Iron (Fe)	mg/l	0.100	0.150	0.140	0.640	1.160	0.100	0.900	-	1.00	-	-	-
Arsenic (As)	mg/l	$2.00x10^{-4}$	$<2.00x10^{-4}$	$2.00x10^{-4}$	$3.00x10^{-4}$	$3.00x10^{-4}$	$6.00x10^{-4}$	$2.90x10^{-4}$	0.340	0.150	-	-	0.05
Cyanide (CN)	mg/l	$5.00x10^{-3}$	$<5.00x10^{-3}$	$<5.00x10^{-3}$	$<5.00x10^{-3}$	$<5.00x10^{-3}$	$<5.00x10^{-3}$	$<5.00x10^{-3}$	0.0220	$5.2x10^{-3}$	$4.00x10^{-3}$	0.400	0.07

Note: * US EPA National Recommended Aquatic Life Criteria for freshwater
- CMC: Criterion Maximum Concentration
- CCC: Criterion Continuous Concentration

** US EPA National Recommended Water Quality Criteria - Human Health Criteria Table

5.3.3.3 Dry Season Survey

Sampling Methodology and Locations

Surface water samples were collected by ERM-Siam and SEM on 9th - 10th January, 2017, at three (3) locations as shown in Figure 5.26 and detailed in Table 5.17. In-situ testing was conducted on site, and the samples were also sent for laboratory testing. The reason for reducing the number of sampling stations is a change in the Project design (Water discharge pipeline was discarded) and the absence of water at SW5.

Water samples were taken by Alpha horizontal water sampler and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection. Samples were also collected for laboratory analysis preserved according to standard procedures. All samples were kept in iced boxes and were transported to the laboratory within 24 hours. Flow rate, width and depth of river were also measured using Vale port Flow Meter equipment and depth sounder. Photographs of the sampling operations are shown in Figure 5.27.

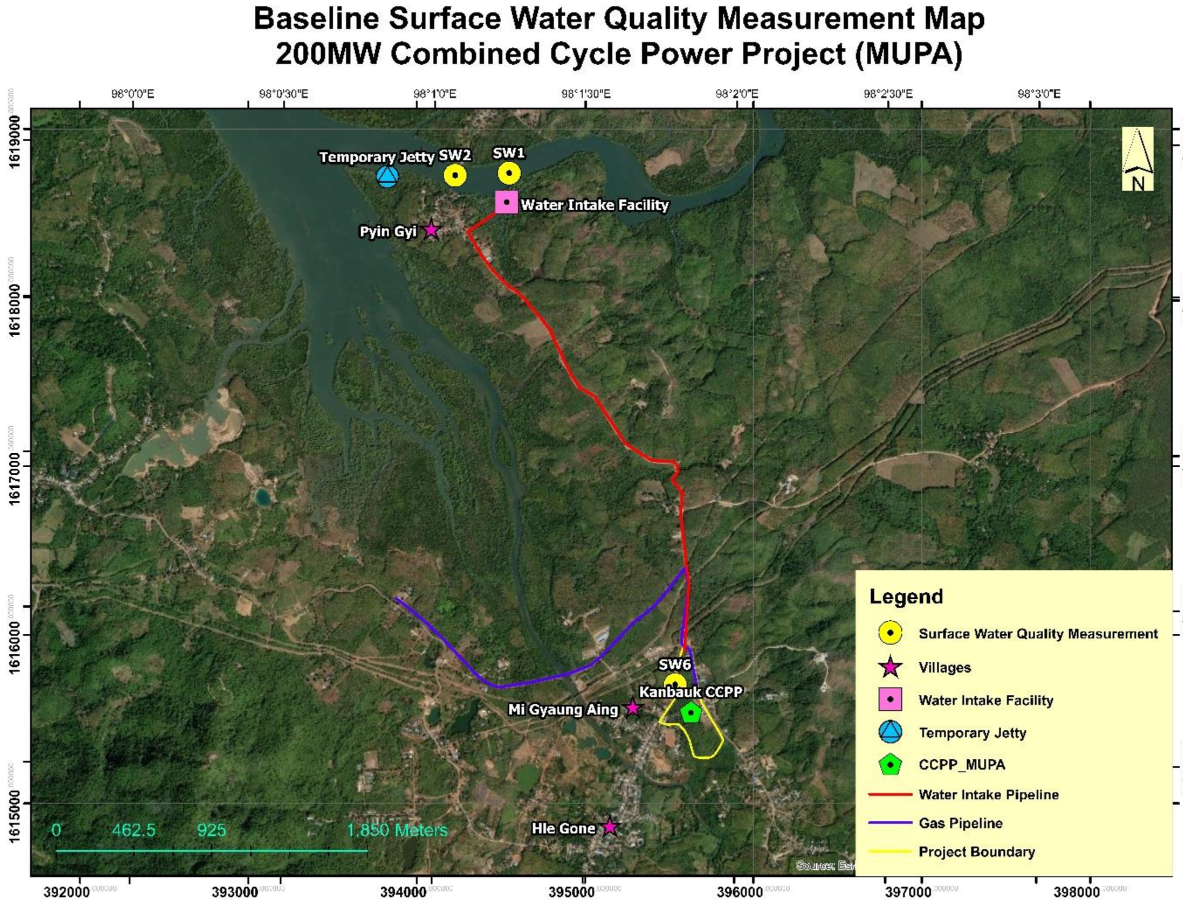


Figure 5. 26 Surface Water Sampling Stations for Dry Season Survey in January 2017

Table 5. 17 Surface Water Sampling Stations for Dry Season Survey in January 2017

Item	SW 1		SW 2		SW 6
Location	Heinze Chaung (up)		Heinze Chaung (Down)		Factory
Coordinates	14°38'26.58"N 98° 1'20.70"E		14°38'23.78"N 98° 1'1.60"E		14°36'46.65"N 98° 1'48.09"E
Description of Sampling Point	Upstream of water intake location in Heinze Chaung, near about 0.5 kilometres east of Pyin gyi jetty		Downstream of water intake location in Heinze Chaung, near about 0.1 kilometres west of Pyin gyi jetty		Downstream after the factory
Sample	1	2	1	2	1
Date/Time	09/01/2017 08:08	10/01/2017 13:46	09/01/2017 08:30	10/01/2017 15:08	10/01/2017 10:40
Weather	Sunny	Rainy	Sunny	Sunny	Slightly Sunny
Tide Condition	High tide	Low tide	High tide	Low tide	-
Remark	In situ test	Sampling & In situ test	In situ test	Sampling & In situ test	-

Summary of Results

The in-situ and laboratory results for surface water quality sampling during the dry season survey are shown in Table 5.18.

The results were compared to EPA's recommended aquatic life and human health criteria and National Surface Water Quality Standard for Human Health and Environmental Conservation. Arsenic was found at levels above the EPA Criteria (chronic) and National Surface Water Quality Standard (0.05mg/l) at all locations including SW1(0.10mg/l), SW2(0.25mg/l) and SW3(0.25mg/l). This is likely due to arsenic content in the nearby soils being carried by runoff, as high arsenic levels were also found in soil samples (see Section 5.3.5).

The results of cyanide, Iron, Lead, turbidity, salinity, total Suspended Solids, conductivity, flow rate, water dept and water temperature were compliant with the EPA standards and National Surface Water Quality Standard respectively.

The results of Chemical Oxygen Demand (COD) at SW1 (20.4mg/l) and SW2 (20.4mg/l) were above the level of National Surface Water Quality Standard (8mg/l) and the result of Biochemical Oxygen Demand (BOD) at SW1 (5.6mg/l) was exceed the standard of National Surface Water Quality Standard (3mg/l). All the other locations were compliant with the standards for COD and BOD.
In addition, results indicated high concentrations of total dissolved solids (TDS) at all stations, as well as very high conductivity. This is again likely due to the dissolved salt in the brackish water.
At SW6(2.46mg/l), Dissolved Oxygen (DO) value was exceeded the criteria of National surface Water Quality Standard (>5 mg/l).
Total Coliform Bacteria levels were also found to be higher than during the wet season survey. The presence of total coliform bacteria indicates that there is at least some existing faecal contamination of the river. Sources of total coliform include sewage waste from humans and fecal matter from warm-blooded animals such as livestock, both of which could either be directly discharged into the river or carried in runoff during rainfall.

Table 5. 18 Results of Surface Water Quality Measurement for Dry Season Survey (January 2017)

Parameter	Unit	Detecting Limit	Analytical Result			US EPA Criteria		US EPA Criteria		National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation
			SW1	SW2	SW6	CMC (acute)	CCC (chronic)	Human Health for the consumption of Water + Organism	Human Health for the consumption of Organism Only	
Colour	-	-	Colourless	Colourless	Colourless	-	-	-	-	-
pH	-	1.00	5.61 – 6.70	5.85 – 6.98	7.68	-	6.50 - 9.00	5.00 - 9.00	-	6.5-8.5
Water Temperature	°C	-	27.76-27.88	27.68-27.76	27.10	-	-	-	-	-
Water Depth	m	-	2.3 – 3.7	1.9 – 3.8	-	-	-	-	-	-
Flow Rate	m/s	-	0.2 – 0.3	0.1 – 0.2	0.0	-	-	-	-	-
Conductivity	µs/cm	-	46,457.3 – 53,365.1	43,085.8 – 53,327.9	40.2	-	-	-	-	-
Dissolved Oxygen (DO)	mg/l	0.500	4.85 – 5.11	4.94 – 5.31	2.46	-	-	-	-	>5
Total Suspended Solids (TSS)	mg/l	10.0	<10.0	16.3	<10.0	-	-	-	-	50
Total Dissolved Solids (TDS) (in-situ)	mg/l	50.0	28,688.49 – 32,878.24	26650.48 – 32,931.40	25.13	-	-	250		-
Total Dissolved Solids (TDS) (lab)	mg/l	50.0	24,450	24,640	1,360	-	-	250		-

Parameter	Unit	Detecting Limit	Analytical Result			US EPA Criteria		US EPA Criteria		National Surface Water Quality Standard of Myanmar for Human Health and Environmental Conservation
			SW1	SW2	SW6	CMC (acute)	CCC (chronic)	Human Health for the consumption of Water + Organism	Human Health for the consumption of Organism Only	
Salinity	psu	1.00	29.0 – 33.8	26.7 – 33.8	0.0	-	-	-	-	-
Turbidity	FNU	-	29.0 – 33.8	26.7 – 33.8	0.0	-	-	-	-	-
Biochemical Oxygen Demand	mg/l	-	5.6	1.4	0.4	-	-	-	-	3
Chemical Oxygen Demand	mg/l	5.00	20.4	20.4	<5.0	-	-	-	-	8
Total Coliform Bacteria	MPN/100 mL	1.80	220	130	<1.8	-	-	-	-	-
Lead (Pb)	mg/l	$2.00x10^{-3}$	<0.0020	<0.0020	<0.0020	0.0650	0.00250	-	-	0.01
Iron (Fe)	mg/l	0.100	0.0002	0.0003	0.0004	-	1.00	-	-	-
Arsenic (As)	mg/l	$2.00x10^{-4}$	0.10	0.25	0.25	0.340	0.150	-	-	0.05
Cyanide (CN)	mg/l	$5.00x10^{-3}$	0.005	<0.005	<0.005	0.0220	$5.2x10^{-3}$	$4.00x10^{-3}$	0.400	0.07

Note: * US EPA National Recommended Aquatic Life Criteria for freshwater

- CMC: Criterion Maximum Concentration

- CCC: Criterion Continuous Concentration

** US EPA National Recommended Water Quality Criteria - Human Health Criteria Table

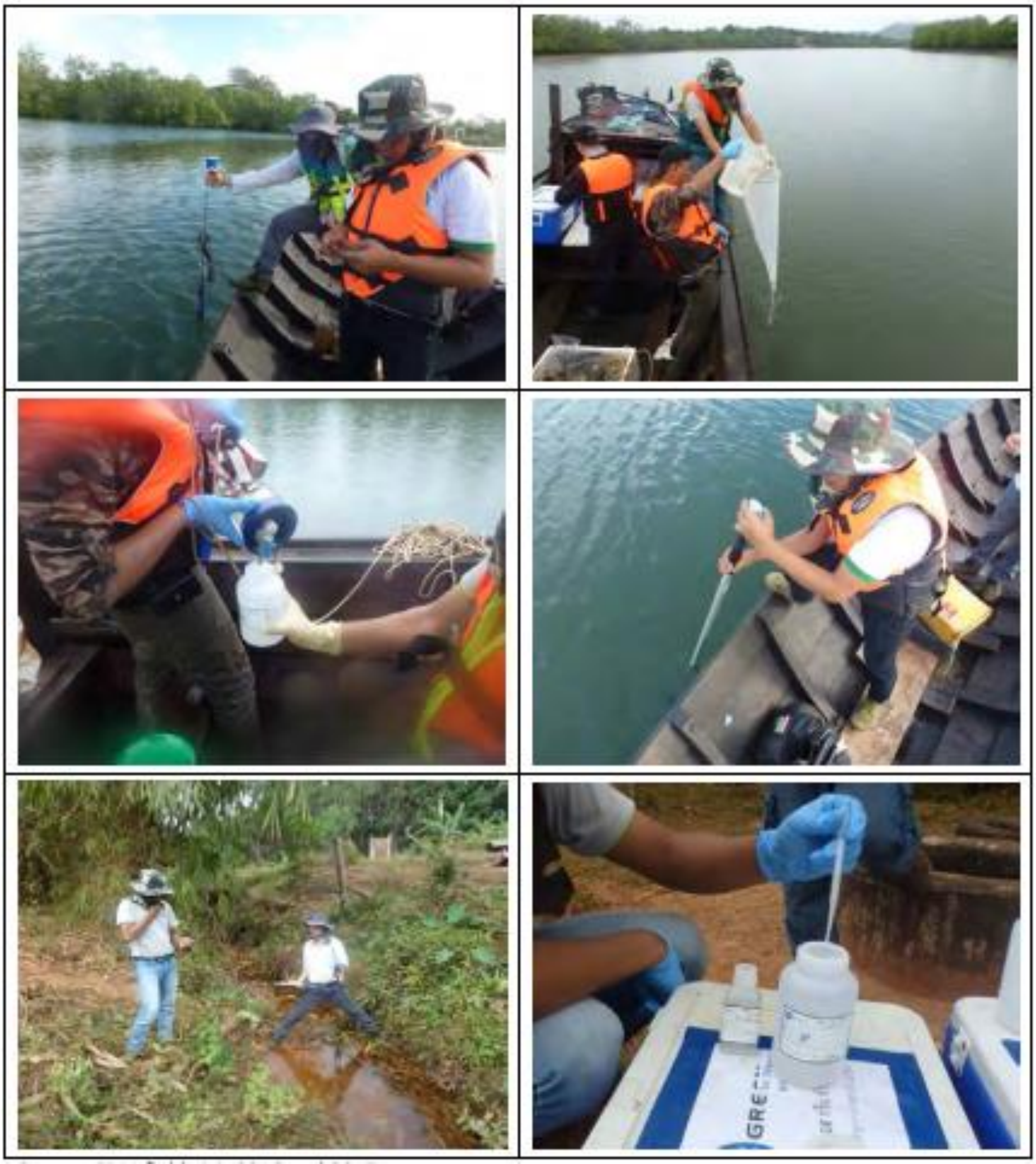


Figure 5. 27 Recorded Photograph of Surface Water Quality Sampling

5.3.4 Ground Water Quality Survey

5.3.4.1 Sampling Methodology and Locations

Groundwater samples were collected from three (3) household wells in riparian communities (Hle Gone 1, Mi Gyaung Aing and Shyn Byan) located within 3 km of the Project site on the 26th September 2016. The location of each sampling station is shown in Figure 5.19.

Table 5. 19 Location of Ground Water Quality Sampling

Item	GW1	GW2	GW3
Location	Hle Gone	Mi Gyaung Auing	Shyn Byan
Latitude Longitude	14°36'33.91"N 98° 1'43.50"E	14°36'16.11"N 98° 1'32.31"E	14°37'26.80"N 98° 2'47.48"E

5.3.4.2 Summary of Results

The results of groundwater measurements are shown in Table 5.20. The groundwater quality results were compared to US EPA and WHO standards. The results indicate that heavy metal levels are compliant with the US EPA National Primary Drinking Water Regulations and WHO standard at all monitoring locations. pH was found to be lower than the US EPA Standards. The previous groundwater results from the survey done by TEAM Consulting in 2013 can be seen in Annex L.

Table 5. 20 Results of Ground Water Quality Measurement (September 2016)

Parameters	Unit	Detection Limit	Analytical result			US EPA National Primary Drinking Water Regulations*		US EPA National Secondary Drinking Water Regulations**	WHO Drinking Water Standard***
			GW1	GW2	GW3	MCLG	MCL		
pH at 25°c	-	-	5.54	4.35	6.22	-	-	6.5-8.5	-
Temperature	°C	-	30.3	28.3	28.2	-	-	-	-
Conductivity	µs/cm	-	126	446	78.8	-	-	-	-
Dissolved oxygen	mg/l	-	0.520	1.72	3.55	-	-	-	-
Turbidity	NTU	0.100	35.4	1.30	0.70	-	-	-	-
Total Suspended Solids (TSS)	mg/l	10.0	<10.0	<10.0	<10.0	-	-	-	-
Total Dissolved Solids (TDS)	mg/l	50.0	87.7	273	55.2	-	-	500	-
Arsenic (As)	mg/l	2.00×10^{-4}	$<2.00 \times 10^{-4}$	$<2.00 \times 10^{-4}$	$<2.00 \times 10^{-4}$	-	0.0100	-	0.0100
Barium	mg/l	0.100	<0.100	<0.100	<0.100	2.00	2.00		0.700

Parameters	Unit	Detection Limit	Analytical result			US EPA National Primary Drinking Water Regulations*		US EPA National Secondary Drinking Water Regulations**	WHO Drinking Water Standard***
			GW1	GW2	GW3	MCLG	MCL		
Cadmium	mg/l	$5.0x10^{-5}$	$1.10x10^{-4}$	$<5.0x10^{-5}$	$<5.0x10^{-5}$	$5.00x10^{-3}$	$5.00x10^{-3}$		$3.00x10^{-3}$
Chromium	mg/l	$5.00x10^{-4}$	$1.10x10^{-3}$	$<5.00x10^{-4}$	$<5.00x10^{-4}$	0.100	0.100		0.0500
Trivalent Chromium	mg/l	-	$1.10x10^{-3}$	ND	ND	-	-	-	-
Hexavalent Chromium	mg/l	0.0100	<0.0100	<0.0100	<0.0100	-	-	-	-
Cobalt	mg/l	$1.00x10^{-4}$	$1.00x10^{-3}$	$3.00x10^{-3}$	$<1.00x10^{-4}$	-	-	-	-
Copper	mg/l	0.0500	<0.0500	<0.0500	<0.0500	1.30	TT; Action level = 1.3	1.00	2.00
Mercury	mg/l	$3.00x10^{-4}$	$<3.00x10^{-4}$	$<3.00x10^{-4}$	$<3.00x10^{-4}$	$2.00x10^{-3}$	$2.00x10^{-3}$		$6.00x10^{-3}$
Lead (Pb)	mg/l	$2.00x10^{-3}$	$<2.00x10^{-3}$	$4.60x10^{-3}$	$<2.00x10^{-3}$	zero	TT; Action level = 0.015		0.0100
Molybdenum	mg/l	$1.00x10^{-4}$	$2.00x10^{-4}$	$1.00x10^{-4}$	$<1.00x10^{-4}$	-	-	-	-

5.3.5 Soil Quality Survey

5.3.5.1 Soil Quality

Soil samples were collected from two (2) sample points in the study area on the 26th September 2016 and tested for heavy metal content. The location of each sampling point is shown in Figure 5.29. The results of the analysis are presented in Table 5.21 and have been compared against USEPA Regional Screening Levels (RSL), which are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. The results indicate that concentrations of arsenic at both sampling sites were in exceedance of the USEPA screening criteria. The measured concentrations of all other heavy metals were below the USEPA RSL for resident soil. As mentioned in Section 5.3.3 although arsenic can occur naturally, it can also be indicative of discharges from industrial activities, such as mining, smelting and coal-fired power plants. Arsenic contamination can also occur due to its use in agricultural pesticides and in chemicals for timber preservation. At this time, it is not known whether the cause of elevated arsenic levels in the Project study area are due to natural or industrial sources.

Figure 5. 28 Recorded Photograph of Soil Sampling

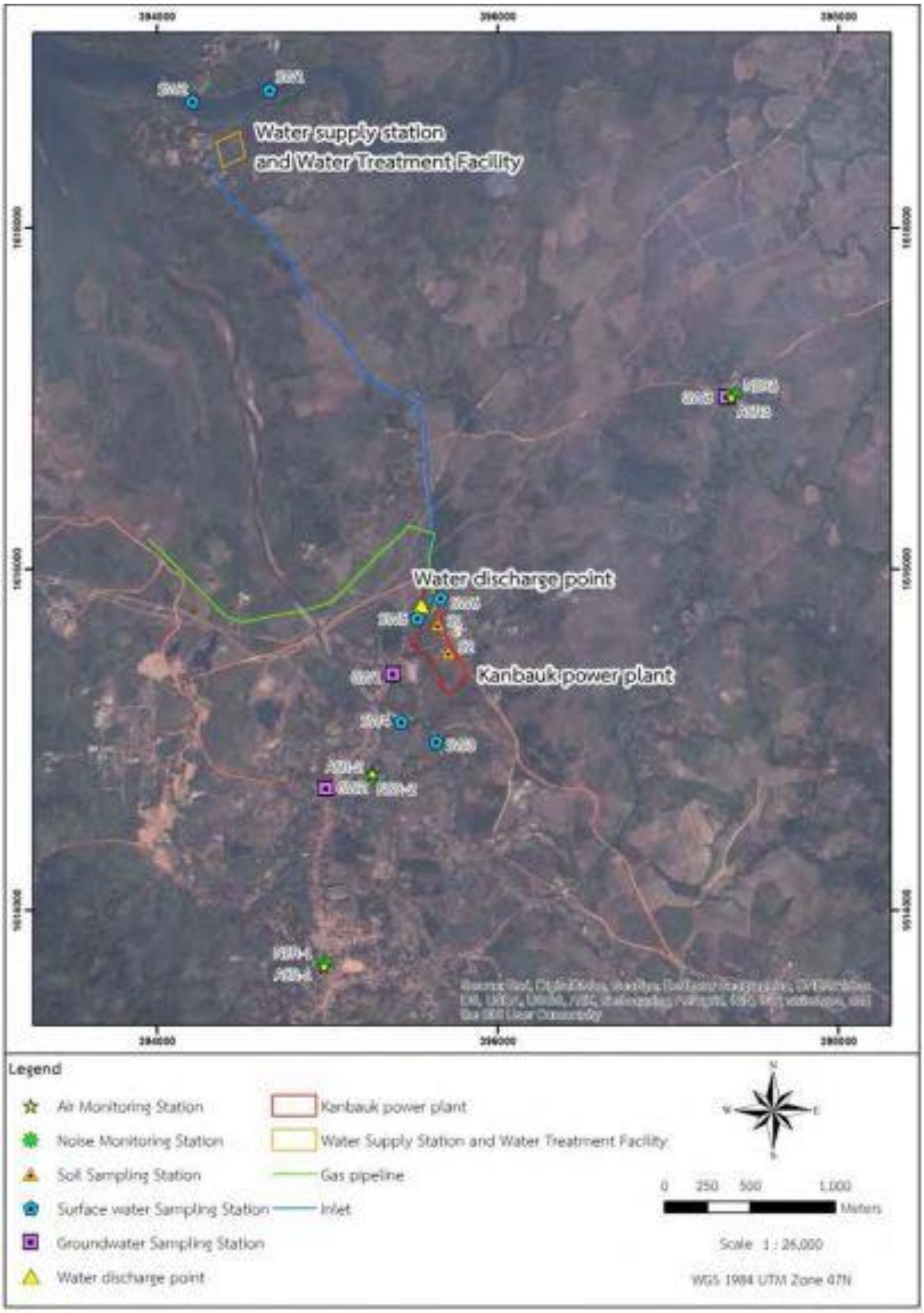


Figure 5. 29 Environmental Sampling Stations for Wet Season Survey in September 2016

Table 5. 21 Results of Soil Sampling (September, 2016)

Parameters	Unit	Detection Limit	Results				Screening Level	Protection of Ground Water	
			S1		S2		USEPA RSL Resident Soil THQ=1.0	USEPA RSLs Risk- based SSL THQ=1.0	USEPA RSLs MCL- based SSL THQ=1.0
			Top Soil	Sub Soil	Top Soil	Sub Soil			
Arsenic	mg/kg dry	0.04	28.3	142	133	255	0.680	$1.5x10^{-3}$	0.290
Barium	mg/kg dry	5.00	33.1	19.7	15.8	14.3	$1.5x10^{4}$	160	82.0
Cadmium	mg/kg dry	1.00	<1.00	<1.00	<1.00	<1.00	71.0	0.690	0.380
Chromium	mg/kg dry	2.50	30.5	40.2	28.6	46.6	-	-	$1.8x10^{5}$
Trivalent Chromium	mg/kg dry	-	28.9	38.8	26.7	44.6	$1.2x10^{5}$	$4.0x10^{7}$	-
Hexavalent Chromium	mg/kg dry	2.00	<2.00	<2.00	<2.00	<2.00	0.300	$6.70x10^{-4}$	-
Cobalt	mg/kg dry	1.00	1.19	2.09	<1.00	<1.00	23.0	0.270	-
Copper	mg/kg dry	1.50	10.5	15.26	9.77	13.1	3,100	28.0	46.0
Mercury	mg/kg dry	0.10	0.140	0.120	0.110	0.13	11.0	0.0330	0.100
Lead	mg/kg dry	5.00	27.1	31.56	21.0	26.5	400	-	14.0
Molybdenum	mg/kg dry	1.00	2.04	2.64	1.19	2.22	390	2.00	-
Nickel	mg/kg dry	2.00	<2.00	<2.00	<2.00	<2.00	670	-	-
Zinc	mg/kg dry	0.50	20.0	16.5	17.4	13.2	$2.3x10^{4}$		

5.3.5.2 Soil Properties

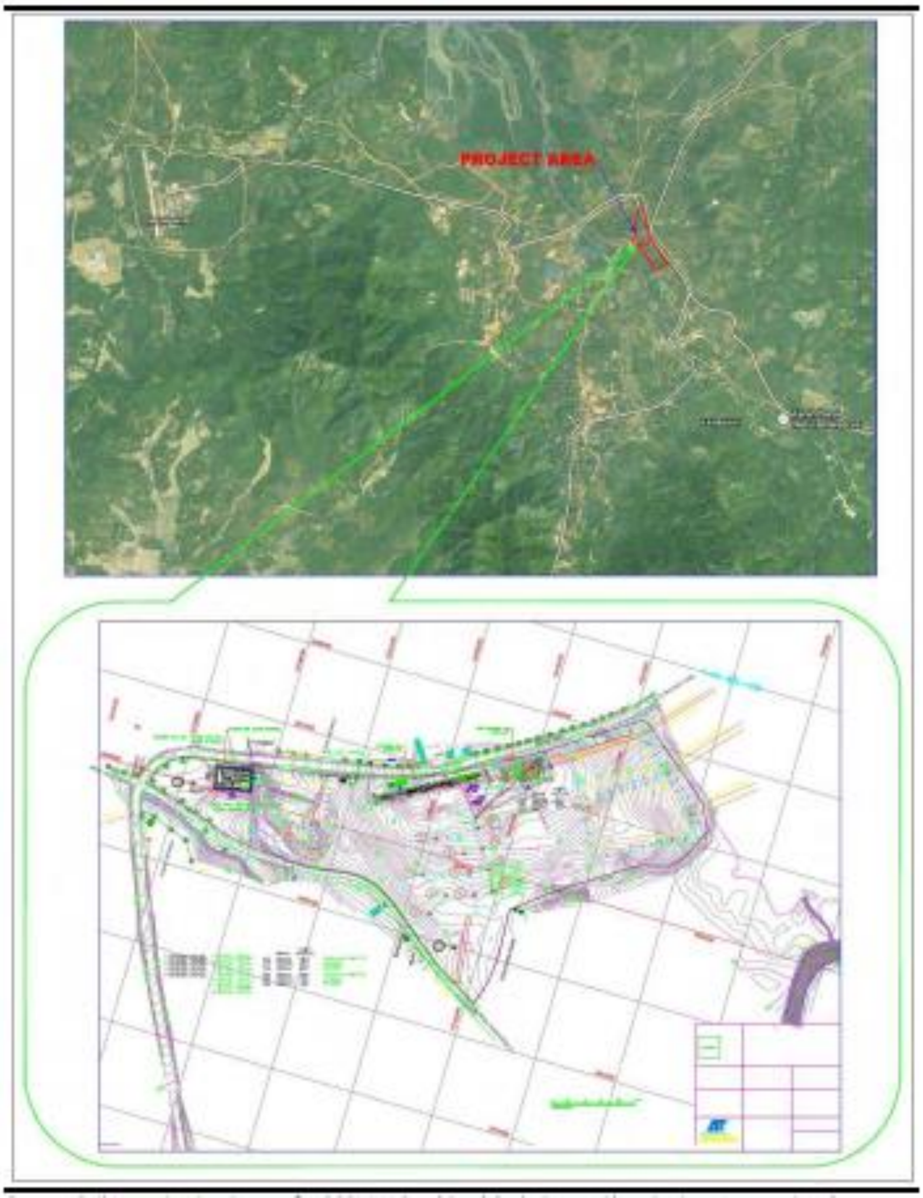
In September 2015, a soil investigation was carried out by International Integrated Services Col, Ltd. in the Project Area. The objectives of the soil investigation were as follows:

i. To investigate the In-situ and laboratory soil properties regarding subsoil conditions of the boring points for the foundation design of the proposed site.
ii. To evaluate the engineering properties of subsoil and to prepare the soil investigation report included the suggested considerations of the foundation design.

Thirteen (13) boreholes were drilled for analysis as part of the investigation. The locations of the boreholes are shown in Figure 5.30. Most of the results are relevant more to the engineering and construction planning of the Project, and will not be presented here. However, a summary of key findings relevant to this ESIA are as follows: Generally, the subsoil of the proposed Project site comprised of (7) numbers of major soil layers as following:

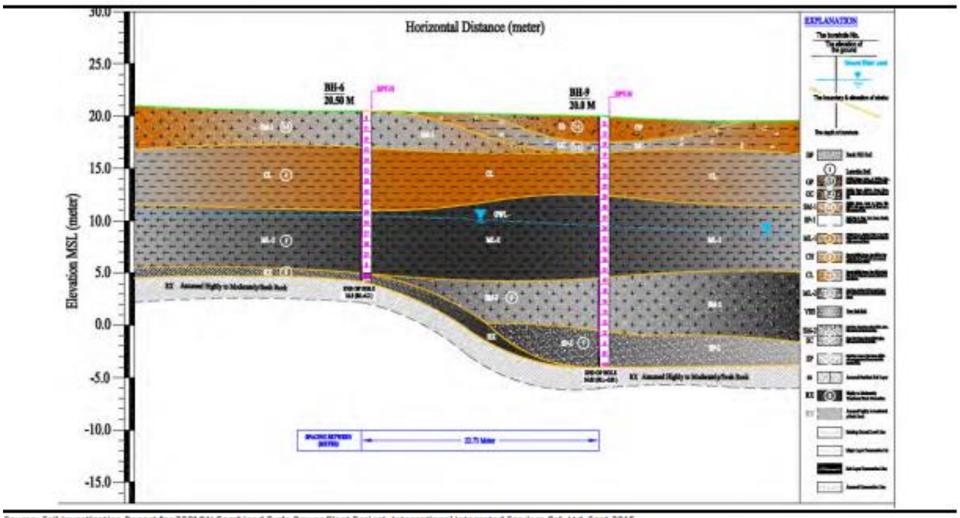
- In the first layer, the soil type is Lateritic Soil which include Reddish Brown, Loose to Medium Dense, Sandy GRAVEL with a little amount of Silt (GP), Reddish Brown, Medium Dense, Clayey GRAVEL with a little amount of Sand and Silt (GC), Reddish Brown, Loose to Dense, Silty SAND with some amount of Gravel and a little amount of Clay (SM-1) & Dark Grey to Grey, Very Dense, Gravelly SAND with trace Silt (SP-1).
- In the second layer, there exists Reddish Brown, Medium Stiff to Very Stiff, Clayey SILT with some amount of Sand and a little amount of Gravel (ML-1).
- In the third layer, its soil type is Grey to Reddish Brown, Very Stiff to Very Hard, Silty CLAY with some amount of Sand and trace Gravel (CH).
- In the fourth layer, its soil type is Grey to Reddish Brown, Very Stiff to Hard, Silty CLAY with some amount of Sand and trace Gravel (CL).
- In the fifth layer, its soil type is Dark Grey, Medium Stiff to Hard, Clayey SILT with some amount of Sand and trace Gravel (ML-2).
- In the sixth layer, soil type is Sandy Soil which include Dark Grey, Very Dense, Silty SAND with a little amount of Gravel and Clay (SM-2) & Grey, Very Dense, Clayey SAND with a little amount of Gravel and Silt (SC).
- In the seventh layer, its soil type is Dark Grey, Loose to Very Dense, SAND with some amount of Gravel and a little amount of Silt (SP).

Example of soil profiles and its sub-layers are shown in Figure 5.31.



Source: Soil Investigation Report for 200MW Combined Cycle Power Plant Project. International Integrated Services Co., Ltd. Sept 2015

Figure 5. 30 Locations of Boreholes for Soil Investigation Conducted in September 2015



Source: Soil Investigation Report for 200MW Combined Cycle Power Plant Project. International Integrated Services Col, Ltd. Sept 2015

Figure 5. 31 Example of Soil Profiles in the Project Site Location

5.4 Terrestrial and Aquatic Biodiversity

The Myanmar EIA Procedures (2015) requires the assessment of biodiversity values however the Procedure does not include guidance on the approach to assess those values. ERM has used the International Finance Corporation (IFC) *Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources* (PS6) to guide the approach of assessment. Reference is therefore made to certain requirements of IFC PS6 in this Chapter.

5.4.1 Ecoregion Description

The Project study area resides within the lowland evergreen and semi-evergreen rain forests of the western side of Arakan Yoma and Tenasserim ranges along the west coast of Myanmar. According to the World-Wide Fund for Nature (WWF) Wild finder database, it is located in the Ecoregion known as the Myanmar Coastal Rain Forests[9].

This Ecoregion is within a tropical wet climate and receives monsoonal rainfalls during April to October. The remaining periods of the year tend to be dry. The habitats contained in the Ecoregion vary from tropical rainforests to lowland forest and mangroves along the coastal areas. The Ecoregion's position means that it acts as a corridor between the Sundaic, Indochinese, and Indian sub-regions.

The Ecoregion has low endemism but contains a broad mix of flora and fauna. Protected Areas are not well represented in the Ecoregion with around 4% contained within a Protected Area.

Coastal areas of the Ecoregion are currently in a degraded state with large tracts of land cleared for agriculture. Land around the port cities of Dawei and Myeik is particularly degraded. Current threats exist from ongoing land development for agriculture and industry, forest exploitation and hunting and poaching.

The Ecoregion is currently classified as Vulnerable.

5.4.2 Key Biodiversity Areas

In Myanmar, Key Biodiversity Areas (KBAs) fall in different land management categories including protected areas, public protected forests, community-conserved forests, community forests, reserve forests and other resource and land use areas. Therefore, they accommodate

[9] WWF 2017 Retrieved from: https://www.worldwildlife.org/ecoregions/im0132

different management systems such as government, private, community-led and joint management. Within the last decade, KBAs were reviewed and updated in order to identify and prioritize investment opportunities for biodiversity conservation in Myanmar.

A total of 132 KBAs were identified for Myanmar and prioritized based on Species-based Vulnerability and Site-based Vulnerability. A total of three KBAs were identified under Alliance for Zero Extinction (AZE), one as a Ramsar site, 53 important bird areas, and six ASEAN Heritage Parks.

The Project area is located 18km SW from the Tanintharyi National Park which is an Important Bird Area (IBA) and was assessed in 2004[10]. The National Park is 259,000 ha in size. The Project area is also 30km NE from the Moscos Kyun Archipelago Wildlife Sanctuary which also an IBA. The Project area is not located within a KBA.

5.4.3 Protected Areas

Myanmar currently has a total of 57 Protected Areas (PAs), which account for only 4% of the country's total surface area (Protected Planet, 2014-15) [11].

The Project Area is located near to two Protected Areas being the Tanintharyi National Park (18km SW) and the Moscos Kyun Archipelago Wildlife Sanctuary (30KM NE). The Project Area is not located within a Protected Area.

The location of the Project Area in relation to the adjacent Protected Areas is shown in Figure 5.32.

5.4.4 Species of Conservation Significance within the Ecoregion

Species of conservation significance found within the Myanmar Coast Rainforests Ecoregion is outlined in Table 5.22. No current list of conservation significant plants is available for the Ecoregion.

Table 5. 22 Species of Conservation Significance Potentially within the Ecoregion

Scientific Name	Common Name	Conservation Status	Endemic
Manis javanica	Malayan Pangolin	EN	-
Manis pentadactyla	Chinese Pangolin	EN	-
Hapalomys longicaudatus	Marmoset Rat	EN	-
Manouria emys	Asian Brown Tortoise	EN	-
Nilssonia formosa	Burmese Peacock Softshell	EN	-

[10] BirdLife International (2017) Important Bird Areas factsheet: Tanintharyi National Park. Downloaded from http://www.birdlife.org on 07/02/2017.

[11] Wildlife Conservation Society 2013. Myanmar Biodiversity Conservation Investment Vision, Wildlife Conservation -Society, Yangon, Myanmar.

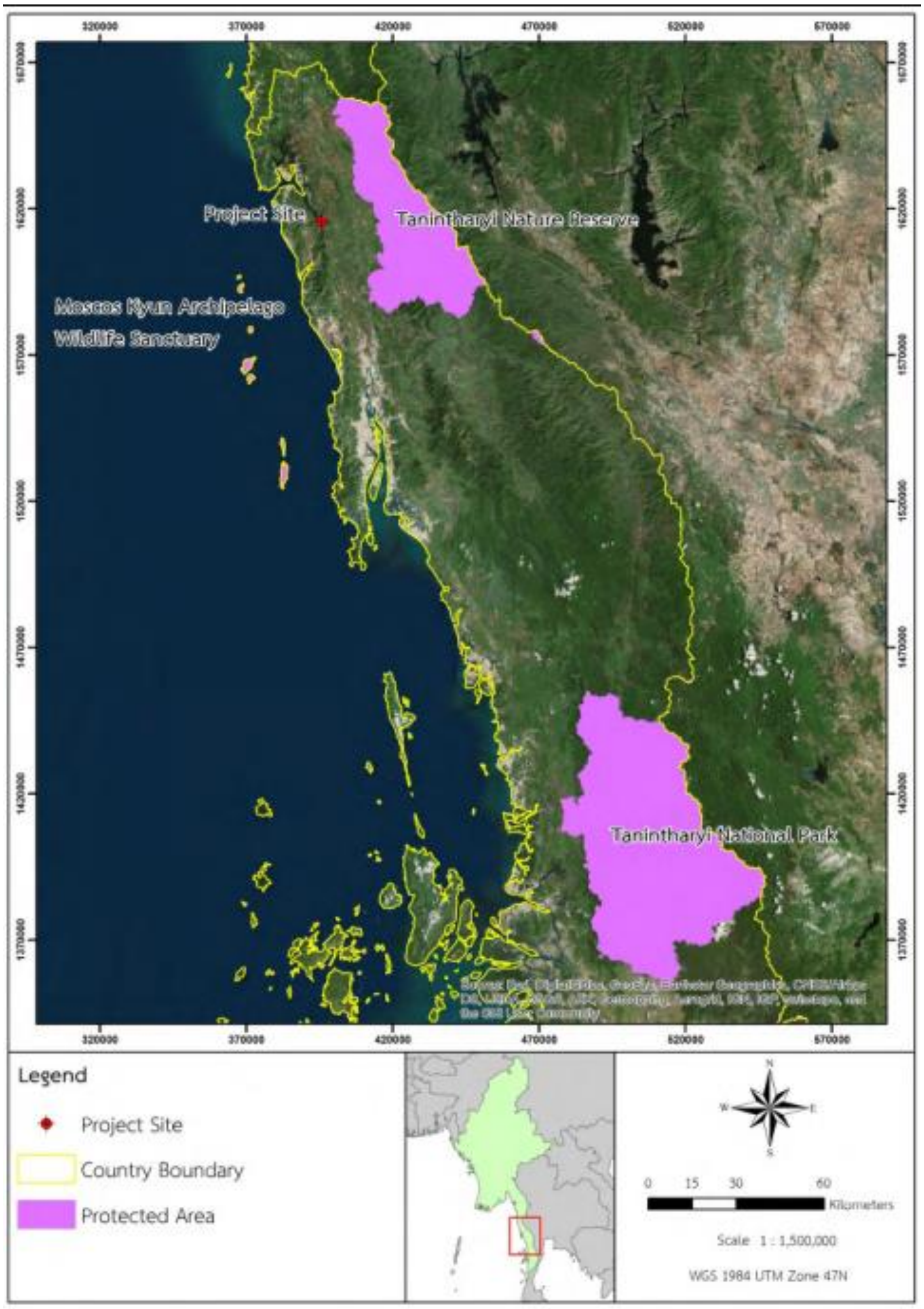


Figure 5. 32 Key Biodiversity Areas and Protected Areas adjacent to the Project Area

5.4.5 Invasive Species

Invasive species are any species that are –non-native to a particular ecosystem and whose introduction and spread causes, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health (FAO, 2013). Invasive species are naturalized species that reproduce often in large numbers and are spread over a large area, damaging native species (FAO, 2005).

Invasive species have the capacity to exacerbate their role in ecosystem degradation through combination threats by habitat change, climate change over-exploitation of ecosystem resources and pollution, which further enhances their threat to biodiversity and the human condition (Emerton and Howard, 2008).

According to the Global Invasive Species Database (GISD) (2015), 97 species have been identified as invasive species in Myanmar. A checklist of invasive species is provided in Annex D. However, the database does not specifically mention on which part of Myanmar that the invasive species are being introduced.

5.4.6 Area of Influence for Biodiversity Value

The Project Area of Influence (AoI) was defined based on a 5km radius of the Project area. The radius was determined based on the nature of the activities of the Project during construction and operation as well as identified natural areas within the vicinity of the Project area and is consistent with the Project Study Area defined earlier in this chapter. From satellite imagery interpretation, the Project area is mostly disturbed land classes (Agriculture and urban areas). Some remnant forests and coastal areas are located within the 5km radius of the Project area and may contain habitat for species of conservation significance. The Area of Influence for biodiversity values is shown in Figure 5.33.

5.4.7 Biodiversity Surveys

ERM's sub-contractor undertook site surveys during the wet and dry season on September 2016 and January 2017. These surveys were conducted to determine the location of any priority biodiversity values within the Project Area and Area of Influence. These priority values focused on Critical Habitat[12] triggers as well as species of conservation significance. The surveys consisted of a desktop assessment to identify species and habitats to be prioritized for survey; identification of sampling locations (including local villager interviews); field surveys targeting major flora and fauna groups; and taxonomy and mapping of flora and fauna records identified. Habitat assessments were also undertaken to inform Natural Habitat[13] and Modified Habitat[14] mapping as required by IFC PS6.

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[12] Critical Habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregator species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes

[13] Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

[14] Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

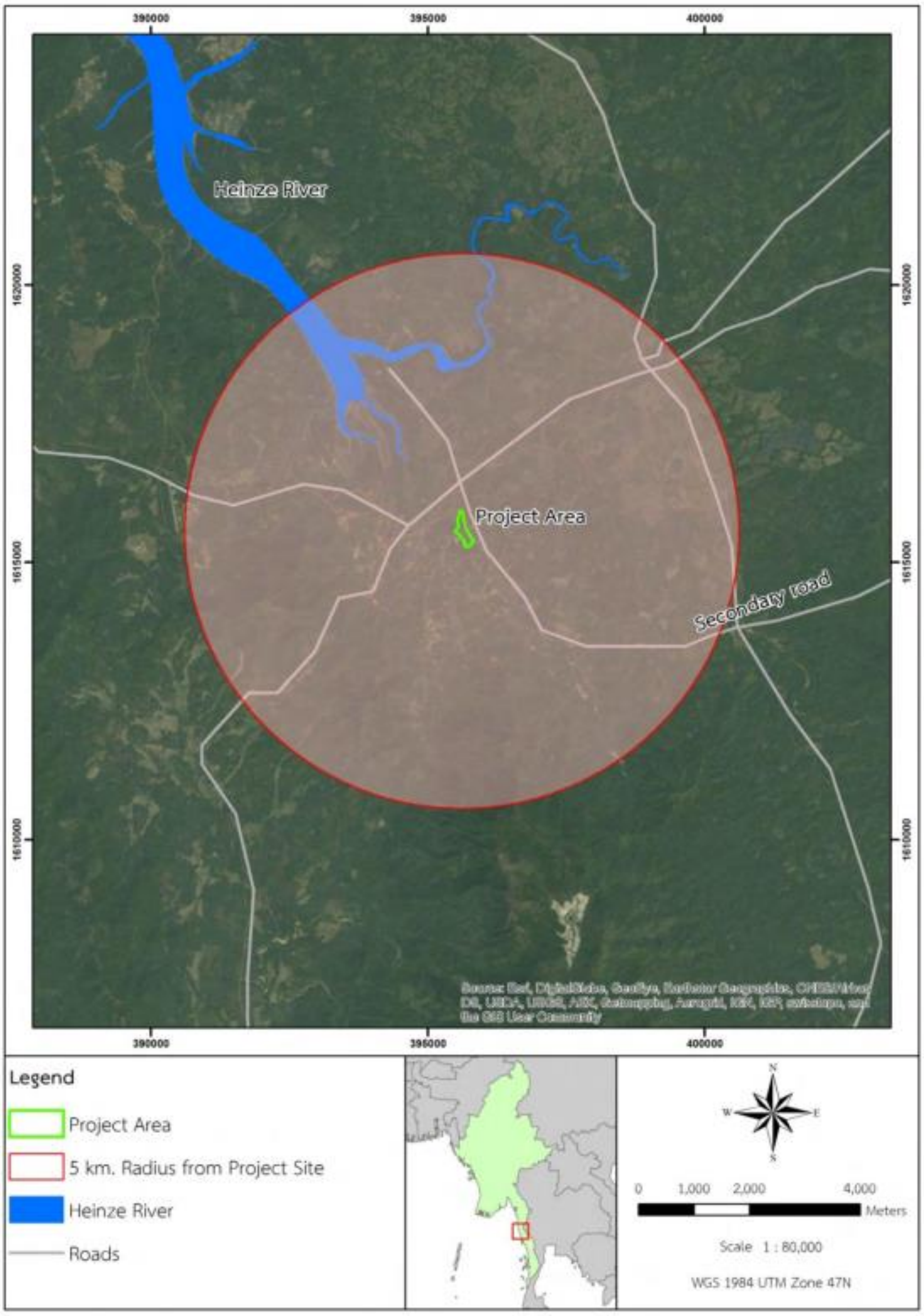


Figure 5. 33 Biodiversity Area of Influence

Figure 5.34 below shows the areas where surveys were conducted.

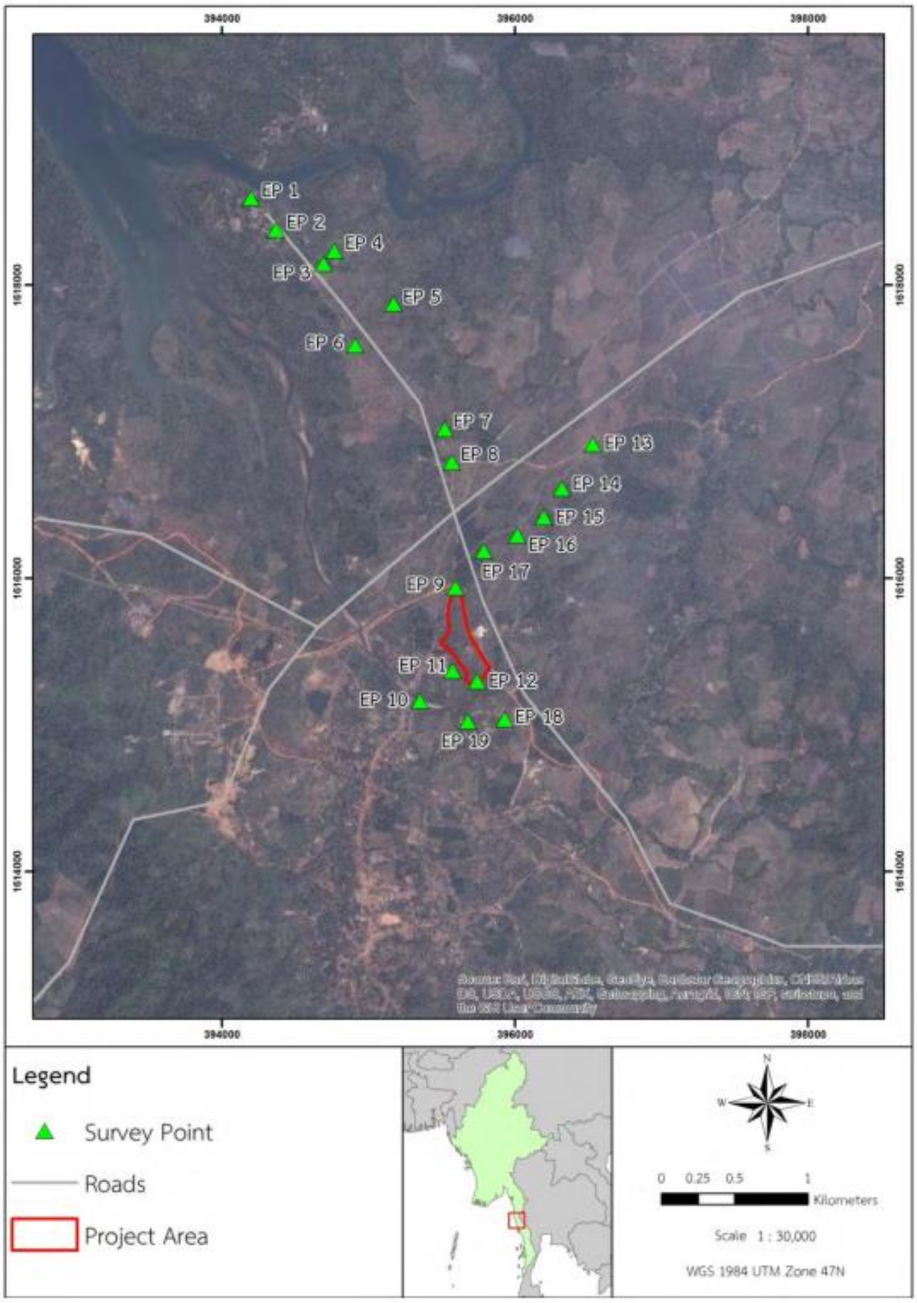


Figure 5. 34 Survey Area

5.4.7.1 Pre-Field Desktop Assessment

Publicly available sources of information were analyzed to determine likely priority biodiversity values within the Project area and Area of Influence. Aerial imagery was used to provide a spatial understanding of the pattern of vegetation communities and human uses on the site, and to map access routes and internal tracks.

Consultation occurred with local ecologists with experience of the Area of Influence to obtain information about species known to be present or previously recorded from the site, and other ecological values considered to be relevant.

5.4.7.2 Sampling Sites

The site reconnaissance targeted the following specific ecological and objectives:

- To name, describe and map vegetation communities and habitats present within the Project area at a suitable scale, using existing community nomenclature where possible;
- To identify, describe and map other ecologically sensitive areas within the Project area such as springs, watercourses and other water bodies;
- To the extent possible within the survey time frame and season, determine if species of conservation significance known or predicted likely to be present in the study area are actually present within the Project area; and
- To identify opportunities for future ecological monitoring and enhancement within the framework of the proposed Project.

In addition, where possible local people were consulted about the species known to utilize the study area, and how the study area is affected by seasonal variations (e.g. flooding levels, whether water bodies dry up in driest seasons, etc.).

5.4.7.3 Land Class Mapping

Satellite imagery was used to map the land classes identified within the Project area and Area of Influence. These land classes were field verified during the field reconnaissance visit. The major land classes identified include shrub lands, agriculture and mangrove/swamp land. Land class descriptions identified are described in Table 5.23 below. Figure 5.35 shows the distribution of the land classes within the AoI and Project area. Table 5.24 outlines the areas of land classes within the AoI and Project area.

Table 5. 23 Land Class Descriptions within the Project AoI

Land Class	Location	Description	Photograph
Shrub Land/herbland	Occurs in moist low-lying areas and along a narrow zone adjacent to streams. Occurs on floodplains, riverine wetlands, river banks and shorelines of large lakes and wetlands, and may be part of larger vegetation types such as forests, woodlands and shrub lands.	Shrub land habitats contain thickets of shrubs and young trees mixed with scattered grasses and wildflowers. Herb lands develop in habitats produced by flooding then recession of water levels, with different groups of herbs for each phase of the water regime: aquatic plants and wetland herbs develop in the wet phase while inundated; amphibious and terrestrial plants in the drying or receding phase; and terrestrial plants during the unflooded, dry phase.	
Mangrove/Swamp Land	Found in low altitude coastal and sub-coastal areas along river valleys and across watersheds.	A mangrove generally exceeds 50cm in height that normally grows above mean sea level in the intertidal zone of marine coastal environments and estuarine margins.	
Plantation	Land where one crop is specifically planted for widespread commercial sale and usually tended by resident labourers.	Plantations are usually near- or total monocultures. That is, the same species of tree is planted across a given area, whereas a natural forest would contain a far more diverse range of tree species. Plantations may include tree species that would not naturally occur in the area. They may include unconventional types such as hybrids, and genetically modified trees may be used sometime in the future.	

Land Class	Location	Description	Photograph
Secondary Forest	Biological diversity of degraded forests includes many non-tree components, which may dominate in the under- canopy vegetation.	A degraded forest is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site.	

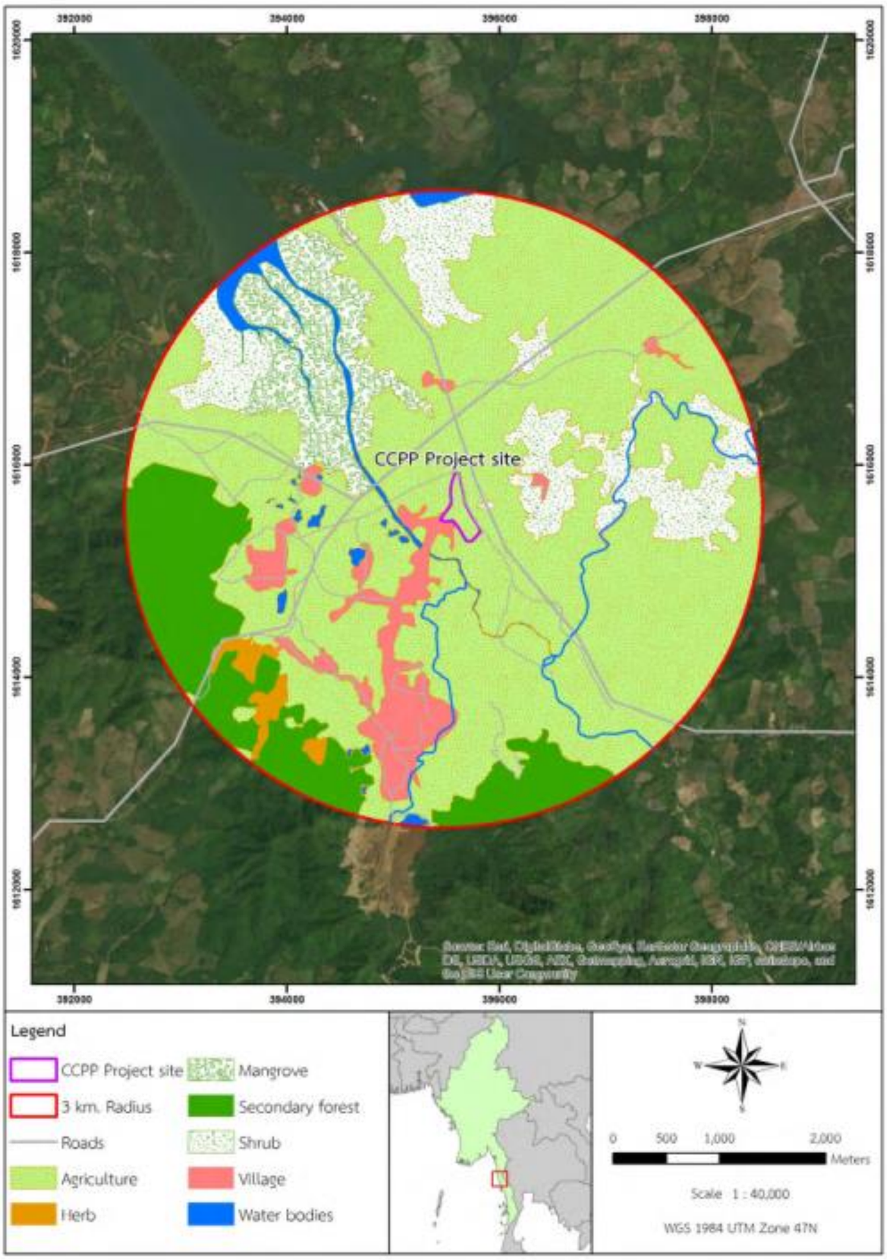


Figure 5. 35 Land Classes within the Area of Influence and Project Area

Table 5. 24 Areas of Land Class within the Project Area and Project Area of Influence

Land use	Habitat	Project Area (ha)	Area of Influence (AoI)
Agriculture	Modified Habitat	1746.67	9.64
Herb	Modified Habitat	28.98	-
Shrub	Modified Habitat	309.49	-
Village	Modified Habitat	146.55	-
Mangrove	Natural Habitat	205.29	-
Secondary Forest	Natural Habitat	333.15	-
Water Bodies	Water Bodies	54.62	-
Total		**2824.75**	**9.64**

5.4.7.4 Natural Habitat and Modified Habitat

IFC PS6 requires the assessment of the distribution of Natural Habitat and Modified Habitat in order to identify risks and mitigations to biodiversity values during the impact assessment phase. There is currently no methodology within IFC PS6 and the associated Guidance Note (GN) on the approach to assess the distribution of these habitat types.

Given the desktop and field information available on the land classes identified, a categorization of the land classes has been made based on the understanding of the history of land use, and species assemblages within each habitat. Each land class has been assigned habitat classifications according to the definitions of IFC PS6. The justification for the classification is shown in Table 5.25 below. The results of the Natural Habitat and Modified Habitat assessment are detailed in Figure 5.36. The areas of Natural Habitat and Modified Habitat within the AoI and Project area are shown in Table 5.26.

Table 5. 25 Natural and Modified Habitats within the Project Area and Area of Influence

Land Class	IFC PS Habitat Classification	Justification
Shrub Land	Modified Habitat	Features disturbed habitats where the canopy has been removed and mid-storey and ground-storey plants remain. The species mix includes both native and non-native species however it is significantly disturbed. The habitat is classed as Modified Habitat.
Herb land	Modified Habitat	Features disturbed habitats where the canopy and mid-storey plants have been removed. The remaining vegetation consists of a herb/grass layer. The species mix includes a mix of both native
Mangrove/ Swamp Land	Natural Habitat	Features natural mangroves stands along shorelines. Mudflats and swampy areas in intertidal zones are in a natural state. Vegetation structure is disturbed however native species remain. Therefore, it is classified as Natural Habitat
Plantation	Modified Habitat	Features a monoculture of rice crop and alterations of natural habitat. Mostly exotic species and little natural ecological functions remain. The habitat is classed as Modified Habitat.
Secondary Forest	Natural Habitat	Secondary forest contains mainly native species with some disturbance by humans. There is generally a lower proportion of invasive/exotic species and hence is classed as

Table 5. 26 Areas of Natural Habitat and Modified Habitat within the Project Area and AoI

Habitat Type	Project Area (ha)	Area of Influence (ha)
Natural Habitat	-	538.45
Modified Habitat	9.64	2231.70

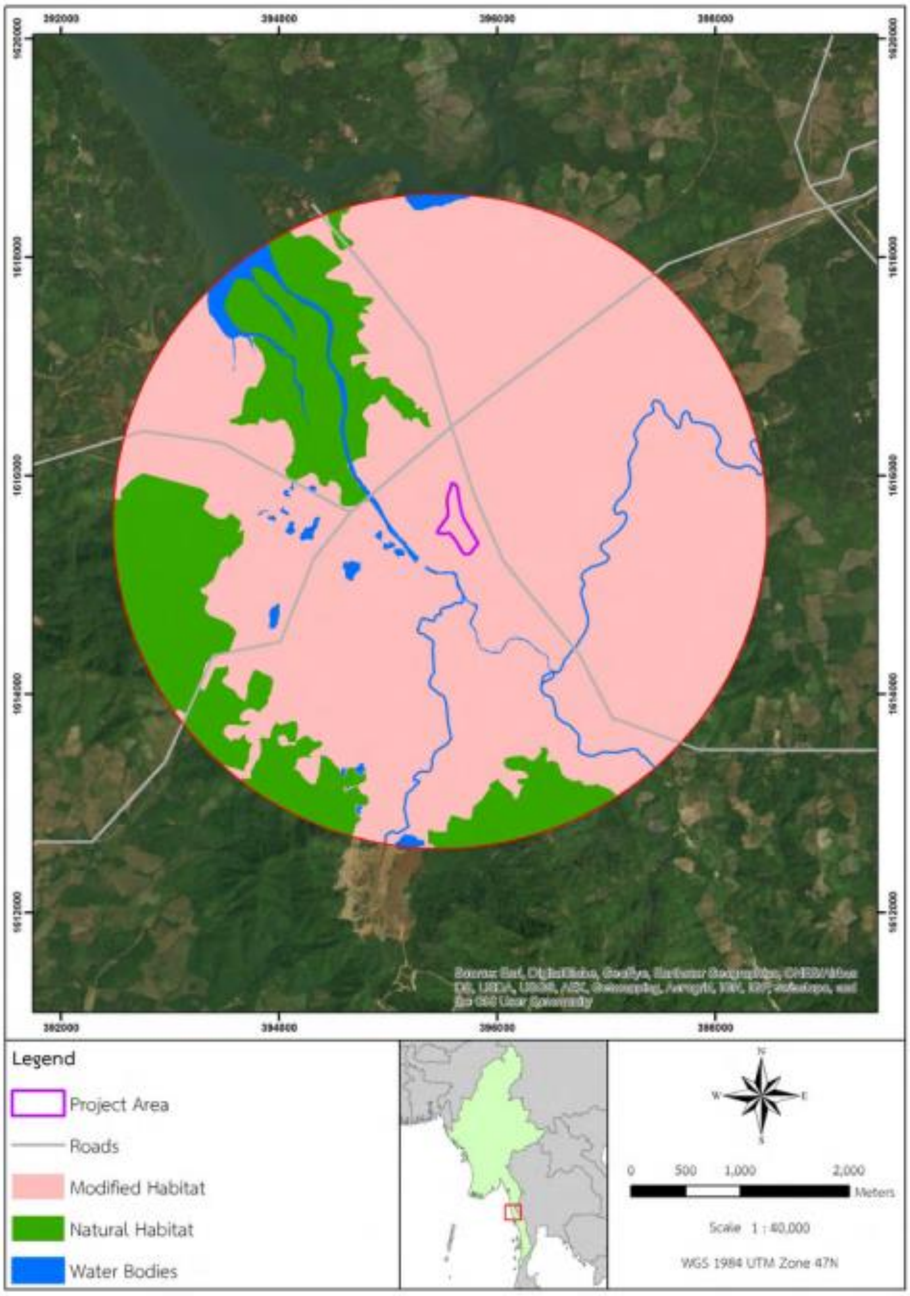


Figure 5. 36 Natural Habitat and Modified Habitat within the Project Area and Area of Influence

5.4.7.5 Flora

Survey Method

A Global Positioning System (GPS) was used to navigate and mark coordinates between sample plots around the AoI.

In order to obtain ecological data for predicting flora of shrubs and herbs, 2m x 2m quadrats were laid down and observed. In each plot every plant species was listed and counted. For the tree species 15mx15m quadrats (total 3) were subjectively chosen and observed. In each sample plot every living tree of girth at breast height (GBH) ≥10cm was measured, listed and counted. In each subplot along the belt transect every plant species were listed and counted. The layout of each transect is shown in Figure 5.37.

A mix of different elevation, slope, aspects, drainage and density gradients were observed to study the overall spectrum of species diversity. In addition, all trees, shrubs, herbs and cultivated crops were recorded and listed. The identified species were translated to scientific name with assistance of the senior researcher at Yangon University. The families were identified by using a key of the families of the flowering plants, issued by Department of Botany, Yangon University (1994). Specimen identification was performed with the use of literature by Backer et al., 1963, and Kress et al. 2003 and confirmed at Herbarium in Department of Botany, University of Yangon.

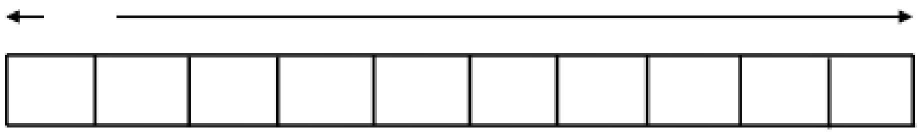


Figure 5. 37 Lay out design of the belt transect

Results

The flora surveys (September 2016 and January 2017) identified a diverse range of native and non-native flora. A total of 103 species were detected from 43 families.

Species of conservation significance identified include Sonneratia griffithii, a species of mangrove that is listed as Critically Endangered on the IUCN Red List. This species occurred within the mangrove habitat near to the Project area.

The species Juglans regia is classified as Near Threatened (NT) however the individual is likely cultivated as the species natural range is within Central Asia.   The species Dalbergia cultrata was also identified and is listed as NT. All other species were listed as Least Concern (LC) or Not Listed (NL). No endemic species were identified.

Table 5.27 lists the flora species identified during field surveys in the AoI and Project area.

Table 5. 27 Flora Species Recorded

No.	Family Name	Scientific Name	Common Name	IUCN Listing
1	Acanthaceae	*Acanthus ebracteatus*	Khaya	LC
2	Agavaceae	*Agave sisalana*	Na-nat-shaw	NL
3	Anacardiaceae	*Anacardium occidentale*	Thiho-thayet	NL
4	Anacardiaceae	*Mangifera indica*	Thayet	NL
5	Anacardiaceae	*Spondias pinnata*	Gwe	NL

No.	Family Name	Scientific Name	Common Name	IUCN Listing
6	Anacardiaceae	*Swintonia floribunda*	Shitle	NL
7	Apocynaceae	*Cerbera manghas*	Kalwa	NL
8	Areaceae	*Colocasia affinis*	Pein	NL
9	Areaceae	*Colocasisa esculenta*	Pein	NL
10	Areaceae	*Areca catecha*	Kunthi-pin	NL
11	Areaceae	*Calamus aggregatus*	Kyein	NL
12	Areaceae	*Cocos nucifera*	Ohn	NL
13	Areaceae	*Elaeis guineensis*	Si-ohn	NL
14	Areaceae	*Nypa fruticans*	Dani	LC
15	Arecaceae	*Borassus flabellifer*	Htan	LC
16	Asteraceae	*Chromolaena odorata*	Bezat	NL
17	Asteraceae	*Pluchea indica*	Khayu	NL
18	Asteraceae	*Tridax procumbens*	Hmwezok-ne-gya	NL
19	Bignoniaceae	*Dolichandrone serrulata*	Tha-khut	NL
20	Bignoniaceae	*Oroxylum indica*	Kyaung-sha	NL
21	Bignoniaceae	*Stereospermum fimbriatum*	Than-that	NL
22	Bombacaceae	*Bombax insigne*	Didok	NL
23	Boraginaceae	*Heliotropium indium*	Sin-hna-maung	NL
24	Bromeliaceae	*Ananas comosus*	Nanat	NL
25	Caesalpiniaceae	*Caesalpinia crista*	Kalein	NL
26	Caesalpiniaceae	*Cassia fistula*	Ngu	NL
27	Caesalpiniaceae	*Cassia italia*	Dan-gywe	NL
28	Caesalpiniaceae	*Cassia obtusa*	Kazaw-pok-nge	NL
29	Caesalpiniaceae	*Saraca bijuga*	Pan-sayeik	NL
30	Caesalpiniaceae	*Senna siamea*	Mezali	NL
31	Caesalpiniaceae	*Tamarindus indica*	Magyi	NL
32	Cannaceae	*Canna indica*	Budatharana	NL
33	Combretaceae	*Terminalia bellerica*	Thit-seint	NL
34	Combretaceae	*Termonalia oliveri*	Than	NL
35	Convolvulaceae	*Stictocardia tiliifolia*	Taung-kazun	LC
36	Costaceae	*Costus specious*	Phalan taung hmwe	NL
37	Dilleniaceae	*Dellenia ornata*	Zinbyun	NL
38	Diperocarpaceae	*Shorea obtusa*	Thit-ya	LR/LC
39	Dipterocarpaceae	*Dipterocarpus tuberculatus*	In	LR/LC
40	Dipterocarpaceae	*Shorea siamensis*	Ingyin	LR/LC
41	Euphorbiaceae	*Aporusa roxburghii*	Thit-khauk	NL
42	Euphorbiaceae	*Baccaurea parviflora*	Kanaso	NL
43	Euphorbiaceae	*Bridelia glauca*	Baung-baung	NL

No.	Family Name	Scientific Name	Common Name	IUCN Listing
44	Euphorbiaceae	*Cephalocroton discolor*	Pilaw-pinan-u-ywethla	NL
45	Euphorbiaceae	*Croton oblongifolius*	Thetyin-gyi	NL
46	Euphorbiaceae	*Emblica officinalis*	Zibyu	NL
47	Euphorbiaceae	*Exccecaria agallocha*	Dayaw	NL
48	Euphorbiaceae	*Excoecaria agallocha*	Tayaw	LC
49	Euphorbiaceae	*Hevea brasiliensis*	Rubber	NL
50	Euphorbiaceae	*Macaranga denticulata*	Phet-Wun	NL
51	Fabaceae	*Butea frondosa*	Pauk	NL
52	Fabaceae	*Dalbergia cultrata*	Yin-daik	NT
53	Fabaceae	*Pterocarpus macrocarpus*	Padauk	NL
54	Fabaceae	*Tadehagi triquetrum*	Lauk-thay	LC
55	Flacourtiaceae	*Homalium tomentosum*	Myauk-chaw	NL
56	Hypericaceae	*Garcinia heterandra*	Taw-mingut	NL
57	Juglandaceae	*Juglans regia*	Thit-kya	NT
58	Lechythidaceae	*Careya arborea*	Bambwe	NL
59	Lythraceae	*Lagersstroemia reginae*	Pyinma	NL
60	Lythraceae	*Sonneratia griffithii*	Lame	CR
61	Malvaceae	*Hibiscus panduriformis*	Taw-yone-padi	NL
62	Malvaceae	*Hibiscus rosa-sinensis*	Khaung-yan	NL
63	Malvaceae	*Pavonia rigida*	Wetchi-pane	NL
64	Malvaceae	*Thespesia lampas*	Palowa	NL
65	Mimosaceae	*Abrema bigemina*	Danyin	NL
66	Mimosaceae	*Acacia auriculiformis*	Malaysia-padauk	LC
67	Mimosaceae	*Acacia rugata*	Subok-nwe	NL
68	Mimosaceae	*Mimosa rubicaulis*	Biat-hti-ka-yone	NL
69	Mimosaceae	*Xylia xylocarpa*	Pyinkado	NL
70	Moraceae	*Artocarpus heterophyllus*	Peinne	NL
71	Moraceae	*Fircus glomerata*	Ye-thapan	NL
72	Moraceae	*Morus alba*	Posa	NL
73	Myrtaceae	*Eugenia bracteolata*	Thabye	NL
74	Myrtaceae	*Eugenia praetermissa*	Thabye	NL
75	Oleaceae	*Nyctanthes arbor-tristis*	Seik-hpalu	NL
76	Poaceae	*Bambusa burmanica*	Thaik-wa	NL
77	Poaceae	*Cephalostachyum pergracile*	Tin-wa	NL
78	Poaceae	*Dendrocalamus brinanicus*	Wa-bo	NL
79	Poaceae	*Dendrocalamus calostachyus*	Wa-bo	NL
80	Poaceae	*Dendrocalamus longispathus*	Waya	NL

No.	Family Name	Scientific Name	Common Name	IUCN Listing
81	Poaceae	*Dinochloa andamanica*	Wa-nwe	NL
82	Poaceae	*Thysanolaena maxima*	Tabyetsi	NL
83	Rhamnaceae	*Ziziphus jujuba*	Zi	LC
84	Rhizophoraceae	*Bruguiera cylindrica*	Saung	LC
85	Rhizophoraceae	*Rhizophora candelaria*	Pyu	NL
86	Rubiaceae	*Ixora arborea*	Ponna- yeik	NL
87	Rutaceae	*Citrus maxima*	Kywe-gaw	NL
88	Rutaceae	*Citrus medica*	Shauk	NL
89	Rutaceae	*Murraya koenigii*	Pyin-daw-thein	NL
90	Sapindaceae	*Arytera littoralis*	Lamu	LR/LC
91	Sapindaceae	*Nephelium lappaceum*	Kyetmauk	LR/LC
92	Scrophulariaceae	*Aeginetia indica*	Kauk-hlaing-ti	NL
93	Solanaceae	*Solanum indicum*	Khayan-kazaw	NL
94	Steruliaceae	*Scaphium scaphigera*	Shaw	NL
95	Steruliaceae	*Scaphium scaphigerum*	Mohbin	NL
96	Thymelaeaceae	*Aquilaria agallocha*	Thit-hmwe	NL
97	Tiliaceae	*Corchorus fascicularis*	Khwe-pilaw	NL
98	Tiliaceae	*Grewia rothii*	Tayaw	NL
99	Tiliaceae	*Microcos paniculata*	Mya-yar	NL
100	Urticaceae	*Oreocnide frutescens*	Obok	NL
101	Verbenaceae	*Clerodendrum nutans*	Ngayan-padu	NL
102	Verbenaceae	*Tectona grandis*	Kyun	NL
103	Zingiberaceae	*Cucurma petiolata*	Marlar	NL

Notes: NE - Not Evaluated (IUCN) VU - Vulnerable DD - Data Deficient (IUCN) LC - Least Concern (IUCN) NL- Not Listed

Invasive Species

During the flora survey, four (4) invasive species were identified within the Area of Influence. These species are shown in Table 5.28 below.

Table 5. 28 Invasive Species Identified within the Area of Influence

No.	Scientific Name	Common Name	Origin
1.	*Mimosa invisa; M.pigra; M. pudica L.*	Senstitive plant, Tigayon	South America
2.	*Oroxylum indicum*	Cat's tongue, kyaungsha	India
3.	*Tridax procumbens L.*	Coat button, ta-bin-shwe-htee, Hmwe zok-negya	
4.	*Ziziphus jujube L.*	Jujube, Chinese	China, Native

5.4.7.6 Fauna

Birds

Methods

Observations of bird species were undertaken during the site reconnaissance survey. Observations were made opportunistically using binoculars. Where possible, birds were identified from calls heard during the surveys.

Results

A total of 49 bird species under 31 families were observed. Among them, most species are resident birds and although the least number are winter visitor and breeding visitor. Neither Critically Endangered (CR) species nor Endangered (EN) birds were recorded. One species Psittacula alexandri (Red-Breasted Parakeet) is listed as Near Threatened (NT). All remaining species are listed as Least Concern. No species are listed as endemic or migratory. The list of bird species detected within the AoI is shown in Table 5.29.

Table 5. 29 Bird Species

No.	Scientific Name	Common Name(s)	IUCN Status
1	*Turnix suscitator*	Barred buttonquail	LC
2	*Egretta garzetta*	Little Egret	LC
3	*Bubuclus coromandus*	Eastern cattle Egret	LC
4	*Ardecola bacchus*	Chinese pond-heron	LC
5	*Dupetor flavicollis*	Black bittern	LC
6	*Elanus caeruleus*	Black-Shoulder Kite	LC
7	*Picus canus*	Grey-headed Woodpecker	LC
8	*Megalaima lineata*	Lineated Barbet	LC
9	*Halcyon smyrnensis*	White- throated kingfisher	LC
10	*Halcyon pileata*	Black-Capped Kingfisher	LC
11	*Alcedo atthis*	Common Kingfisher	LC
12	*Streptopelia chinensis*	Spotted Dove	LC
13	*Columba livia*	Rock pigeon	LC
14	*Tringa hypoleucos*	Common Sandpiper	LC
15	*Vanellus indicus*	Red-wattled Lapwing	LC
16	*Cypsiurus balasiensis*	Asian Palm Swift	LC
17	*Hirundo rustica*	Barn Swallow	LC
18	*Merops orientalis*	Little green Bee-Eater	LC
19	*Phaenicophaeus tristis*	Green-billed Malkoha	LC
20	*Centropus sinensis*	Greater Coucal	LC
21	*Eudynamys scolopaceus*	Asian Koel	LC

No.	Scientific Name	Common Name(s)	IUCN Status
22	*Psittacula alexandri*	Red-Breasted Parakeet	NT
23	*Glaucidium cuculoides*	Asian Barred Owlet	LC
24	*Chloropsis aurifrons*	Golden-fronted Leafbird	LC
25	*Corvus macrorhynchos*	Large-Billed Crow	LC
26	*Dandrocitta vagabunda*	Rufous treepie	LC
27	*Oriolus xanthornus*	Black-hooded Oriole	LC
28	*Dicrurus leucophaeus*	Ashy Drongo	LC
29	*Dicrurus remifer*	Lesser Racket-tailed Drongo	LC
30	*Dicrurus paradiseus*	Greater Racket-tailed Drongo	LC
31	*Hypothymis azurea*	Black-naped Monarch	LC
32	*Ficedula albicilla*	Tiaga	LC
33	*Copsychus saularis*	Oriental Magpie Robin	LC
34	*Copsychus malabaricus*	White-rumped Shama	LC
35	*Acridotheres tristis*	Common Myna	LC
36	*Acridotheres fuscus*	Jungle Myna	LC
37	*Pycnonotus cafer*	Red- vented Bul bul	LC
38	*Pycnonotus finlaysoni*	Stripe-throated Bulbul	LC
39	*Pycnonotus goiavier*	Yellow-vented Bulbul	LC
40	*Pycnonotus melanicterus*	Black-crested Bulbul	LC
41	*Phylloscopus fuscatus*	Dusky Warbler	LC
42	*Orthotomus sutorius*	Common Tailorbird	LC
43	*Garrulax leucolophus*	White-crested laughing thrush	LC
44	*Lonchura striata*	White-rumped Munia	LC
45	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	LC
46	*Anthreptes singalensis*	Ruby-cheeked Sunbird	LC
47	*Leptocoma brasiliana*	Van hasselt's sunbird	LC
48	*Nectarinia jugularis*	Olive-backed Sunbird	LC
49	*Motacilla alba*	White Wagtail	LC

Mammals

Methods

Mammal surveys were conducted over five (5) days and included: interviews with the local community to identify species observed within the previous 12 months; nocturnal and diurnal transects, trace surveys and opportunistically during other surveys. Information was recorded on the type of record (sighting, interview or trace), location of species and type.

Results

A total of eleven (11) mammal species belonging to eight (8) families were recorded during the survey period. Species were directly observed or resulted from villager interviews. These are two species of Chiroptera, (Bat and Flying Fox), two (2) species of Primates, three species of Carnivores, two (2) species of Artiodactyla and two species of Rodent. According to the IUCN Red List (2016 Ver.3.1), two (2) species are listed as Vulnerable (VU) including the Northern Pig tailed Macaque (Macaca leonina) and Fishing Cat (Prionailurus viverrinus). The Fishing Cat record was from a community interview. The species is out of its recorded range but may be a legitimate record given the paucity of distribution data for the species in Myanmar. The remaining eight (8) species are listed as Least Concern (LC) and one (1) species is not listed (NL). No species are listed as endemic.

The results of the mammal survey are shown in Table 5.30.

Table 5. 30 Mammal Species Recorded within the AoI

No.	Family	Scientific Name	Common Name	IUCN	Observation
1	Pteropodidae	*Pteropus vampyrus*	Large Flying -Fox	NL	Sighting
2	Cercopithecidae	*Macaca fascicularis*	Long- tailed Macaque	LC	Interviewed
3	Cercopithecidae	*Macaca leonina*	Northern Pig tailed Macaque	VU	Interviewed
4	Viverridae	*Viverra zibetha*	Large Indian Civet	LC	Faeces (sighting)
5	Viverridae	*Paradoxurus hermaphroditus*	Common Palm Civet	LC	Interviewed
6	Felidae	*Prionailurus viverrinus*	Fishing Cat	VU	Interviewed*
7	Suidae	*Sus scrofa*	Wild Pig	LC	Interviewed
8	Cervidae	*Muntiacus muntjak*	Red Muntjac	LC	Track (foot print)
9	Sciuridae	*Tamiops mcclellandii*	Western Striped Squirrel	LC	Sighting
10	Sciuridae	*Menetes berdmorei*	Indochinese Ground Squirrel	LC	Sighting
11	Rhinolophidae	*Rhinolophus affinis*	Intermediate Horseshoe Bat	LC	Sighting

Notes: NE - Not Evaluated (IUCN) VU - Vulnerable DD - Data Deficient (IUCN) LC - Least Concern (IUCN) NL- Not Listed
* Species record is out of the normal range however the species range in Myanmar is not well recorded and may indicate that the species is present

Herpetofauna

Methods

Herpetofauna surveys were conducted over five (5) days and included: interviews with the local community to identify species observed within the previous 12 months; nocturnal and diurnal transects, trace surveys and opportunistically during other surveys. Information was recorded on the type of record (sighting, interview or trace), location of species and type.

Results

A total of (17) species of herpetofauna were recorded. Ten (10) species of frog, three (3) species of skink, one (1) species of lizard, one (1) species of Snake, one (1) species of monitor and one (1) species of Gecko. According to the conservation status from the IUCN Red List only Least Concern (LC) species were recorded. No species are listed as endemic.

The results of the survey are shown in Table 5.31.

Table 5. 31 Herpetofauna Species Recorded

No	Family Name	Scientific Name	Common Name	Observation	IUCN status
Reptiles					
1	Scincidae	*Eutropis multifasciata*	Common Sun Skink	Sighting	NL
2	Scincidae	*Eulamprus luteilateralis*	Orange-Speckled Forest Skink	Sighting	LC
3	Scincidae	*Eutropis longicaudata*	Long-tailed Sun Skink	Sighting	NL
4	Varanidae	*Varanus salvator*	Asian Water Monitor	Information	LC
5	Agamidae	*Calotes versicolor*	Garden fence lizard	Sighting	NL
6	Elapidae	*Naja kaouthia*	Monocled Cobra	Sighting	LC
7	Gekkonidae	*Hemidactylus frenatus*	Asian house Gecko	Sighting	LC
Amphibian					
1	Mycrohylidae	*Kaloula pulchra*	Banded Bullfrog	Sighting	LC
2	Rhacophoridae	*Polypedates leucomystax*	Four-lined Treefrog	Sighting	LC
3	Ranidae	*Hylarana erythraea*	Common GreenFrog	Sighting	LC
4	Microhylidae	*Microhyla heymonsi*	Arcuate-spotted Pygmy Frog	Sighting	LC

No	Family Name	Scientific Name	Common Name	Observation	IUCN status
5	Dicroglossidae	*Fejervarya limnocharis*	Asian Grass Frog	Sighting	LC
6	Rhacophoridae	*Polypedates mutus*	Burmese whipping Frog	Sighting	LC
7	Bufonidae	*Leptophryne borbonica*	Hourglass Toad	Sighting	LC
8	Dicroglossidae	*Hoplobatrachus crassus*	Jerdon's Bullfrog	Sighting	LC
9	Bufonidae	*Duttaphrynus melanostictus*	Black-Spectacled Toad or Asian Toad	Sighting	LC
10	Dicroglossidae	*Limnonectes kuhli*	Kuhl's Creek Frog or Large-headed Frog	Sighting	LC

Notes: LC - Least Concern (IUCN) NL- Not Listed

Butterflies

Methods

Surveys for butterflies were undertaken opportunistically during surveys for other fauna.

Results

A total of twenty-seven (27) butterfly species, representing five (5) families under the order Lepidoptera were recorded in the study area. There are Papilionidae (3 species and 2 genera), Pieridae (8 species and 6 genera), Nymphalidae (12 species and 6 genera), Lycaenidae (1 species and 1 genus) and Hesperiidae (1species and 1 genus). The dominant families of butterfly species are Nymphalidae. All species were Not Listed (NL) with one species listed as Least Concern (LC) on the IUCN Red List. The species detected are shown in Table 5.32.

Table 5. 32 Butterfly Species Recorded

No	Family Name	Species Name	Common Name	IUCN
1	Papilionidae	*Papilio polytes*	Common mormon	NL
2	Papilionidae	*Papilio menon*	Great mormon	NL
3	Papilionidae	*Graphium evemon*	Blue jay	NL
4	Pieridae	*Gandaca harina*	Tree Yellow	NL
5	Pieridae	*Catopsilia scylla*	Orange emigrant	NL
6	Pieridae	*Catopsilia pyranthe*	Mottled Emigrant	NL
7	Pieridae	*Pieris canidia*	Cabbage White	NL
8	Pieridae	*Hebomia glaucippe*	Great Orange Tip	NL
9	Pieridae	*Eurema simulatrix*	Hill Grass Yellow	NL

No	Family Name	Species Name	Common Name	IUCN
10	Pieridae	*Eurema sari*	Chocolate Grass Yellow	NL
11	Nymphalidae	*Cupha erymanthis*	Rustic	NL
12	Nymphalidae	*Junonia almana*	Peacock Pansy	LC
13	Nymphalidae	*Junonia atlites*	Grey Pansy	NL
14	Nymphalidae	*Athyma kanwa*	Dot-dash Sergeant	NL
15	Nymphalidae	*Athyma reta*	Malay Staff Sergeant	NL
16	Nymphalidae	*Euploea crameri*	Spotted Black Crow	NL
17	Nymphalidae	*Euploea mulciber*	Striped Blue Crow	NL
18	Nymphalidae	*Euploea radamanthus*	Magpie Crow	NL
19	Nymphalidae	*Euploea tulliolus*	Dwarf Crow	NL
20	Nymphalidae	*Danaus genutia*	Common Tiger	NL
21	Nymphalidae	*Mycalesis perseus*	Dingy Bush Brown	NL
22	Nymphalidae	*Mycalesis orseis*	Purple Bush Brown	NL
23	Nymphalidae	*Ypthima horsfieldii*	-	NL
24	Nymphalidae	*Melanitis leda*	Common Evening Brown	NL
25	Nymphalidae	*Orsotriaena medus*	Dark Grass Brown	NL
26	Lycaenidae	*Megisba malaya*	The Malayan	NL
27	Hesperiidae	*Udaspes folus*	Grass Demon	NL

Notes: LC - Least Concern (IUCN) NL- Not Listed

Fish

Methods

Fishing survey was undertaken by interviews with local fishermen and surveys including using nets and fishing lines.

Results

A total of twenty-nine (29) species from twenty (20) families were recorded during surveys. The most abundant species were Selar crumenophalmus and Nemipterus japonicas. Species were listed as Not Listed (NN), Data Deficient (DD) or Least Concern (LC).

Table 5. 33 Fish Species Recorded during the Survey Period

No	Family	Species	Common Name	IUCN
1	Chirocentridae	*Chirocentrus nudus*	Whitefin wolf -herring	NL
2	Pristigasteridae	*Pellona ditchela*	Indian pellona	NL
3	Engraulidae	*Coilia ramcarati*	Herring	NL
4	Megalopidae	*Megalops cyprinoides*	Indo-pacific tarpon	NL
5	Carangidae	*Atropus atropus*	Cleftbelly- trevally	NL
6	Carangidae	*Megalaspis cordyla*	Torpedo scad	NL
7	Carangidae	*Scomberoides tol*	Slender queen fish	NL
8	Carangidae	*Selar crumenophalmus*	Big eye scad	NL

No	Family	Species	Common Name	IUCN
9	Latidae	*Lates calcarifer*	Giant sea perch	NL
10	Drepaneidae	*Drepane longimana*	Banded sicklefish	NL
11	Carangidae	*Formio niger*	Black pomfret	NL
12	Gerreidae	*Gerres filamentosus*	Threadfin silverbiddy	NL
13	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	NL
14	Haemulidae	*Eleutheronema tetradactylum*	Indian salmon	NL
15	Scatophagidae	*Pomadasys maculatus*	Saddle Grunt	LC
16	Sciaenidae	*Scatophagus argus*	Spotted scat	LC
17	Sciaenidae	*Chrysochir aureus*	Reeve's croaker	NL
18	Sciaenidae	*Johnieops vogleri*	Sharp toothed hammer croaker	NL
19	Sciaenidae	*Johnius coitor*	Big-eyed jewfish	LC
20	Sciaenidae	*Nibea soldado*	Soldier croaker	NL
21	Scombridae	*Scomberomorus guttatus*	IndoPacific	DD
22	Trichiuridae	*Lepturacanthus savala*	Small-head hairtail	NL
23	Cynoglossidae	*Paraplagusia blochi*	Bloch's tonguesole	NL
24	Soleidae	*Euryglossa harmandi*	Harmand's sole	NL
25	Ariidae	*Arius burmanicus*	Manila sea catfish	LC
26	Clariidae	*Clarias batrachus*	Walking catfish Magur	LC
27	Plotosidae	*Plotosus canius*	Gray eel- catfish	NL
28	Tetraodontidae	*Xenopterus naritus*	Golden puffer	NL
29	Tetraodontidae	*Monotertus cutcutia*	Pufferfish	LC

Notes: DD - Data Deficient (IUCN) LC - Least Concern (IUCN) NL - Not Listed

5.4.8 Critical Habitat Screening Assessment

5.4.8.1 Criterion for Critical Habitat

The Critical Habitat assessment comprised an analysis of biodiversity values within the project area and area of influence, habitats of high biodiversity value, species of conservation concern and general flora and fauna assemblages. This involved GIS analysis; desk-based data collection including a review of previous EIAs, and targeted field surveys at karst surface and cave habitats.

Critical Habitat criteria are defined in PS6 Guidance Note 6 (GN6), Paragraphs GN69 to 97. Table 5.34 provides detail of the qualifying requirements for Criteria 1 to 3 (i.e. thresholds), while details of the likely qualifying interests for Criterion 4 and 5 will be defined based on research and expert opinion. The criteria listed have been used to complete this assessment.

Table 5. 34 Criteria Habitat Criteria

Criteria	Tier 1	Tier 2
Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	a) Habitat required to sustain ≥10 % of the global population of a CR or EN species/sub/Species and where there known regular	c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of

Criteria	Tier 1	Tier 2
	occurrences of the species and where habitat could be considered a discrete management unit for the species. b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	Red-listed EN species where that habitat could be considered as a discrete management unit for the species/subspecies. d) Habitat of significant importance to CR/EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long- term survivability of the species. e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	a) Habitat known to sustain ≥ 95 % of the global population of an endemic or restricted- range species where that habitat could be considered a discrete management unit for that species.	b) Habitat known to sustain ≥ 1 % but < 95 % of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	(a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % but < 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment. (c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 % of the global population for both terrestrial and marine species. (e) Source sites that contribute ≥ 1 % of the global population of recruits.
Criterion 4: Highly threatened and/or unique ecosystems; and/or	Criterion 4 has no tiered system although recent publication (*Keith et al*, 2013) may introduce this. This criterion must include one of the following a) the ecosystem is at risk of significantly decreasing in area or quality; b) has a small spatial extent; and /or c) contains unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long-term trend, rarity, ecological condition, and threat.	
Criterion 5: Areas associated with key evolutionary processes	The criterion is defined by: a) the physical features of a landscape that might be associated with particular evolutionary processes; and/or	

Criteria	Tier 1	Tier 2
	b) sub-populations of species that are phylogenetically or morpho genetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes evolutionarily significant units and evolutionarily distinct and globally endangered species.	

Note: (1) No Tier system is in place for Criterion 4 and Criterion 5

With regard to Criterion 2, it should be noted that an endemic and restricted range species is defined by the IFC as one that possesses an extent of occurrence of 50,000 km2 (pers. comms). Plant species may qualify as endemic if has ≥95% of its global range inside the country or region of analysis.

5.4.8.2 Critical Habitat Triggers (Criterion 1-3)

The five criteria are ‘triggers’ in that if an area of habitat meets any one of the criteria, it will be considered Critical Habitat irrespective of failing to meet any other criterion (1). Therefore, Critical Habitat can be determined through a single criterion or where a habitat holds biodiversity meeting all five criteria. This approach is generally more cautious but is used more widely in conservation (2). Critical Habitat criteria therefore have two distinctive characteristics. First, components of biodiversity are essentially assigned to only two levels of conservation significance, those that trigger Critical Habitat and those that do not (Tier considerations being secondary to this primary Critical Habitat determination). Second, each criterion is applied separately and not in combination, meaning that the scores are not cumulative.

5.4.8.3 Critical Habitat Candidate Species

For Criterion 1 to 3, this exercise has used species identified as threatened species to evaluate if habitats from which they are found in could qualify as Critical Habitat under IFC PS6. Threatened species refer to species evaluated as CR or EN on IUCN status or have been conferred national protection status, are endemic or restricted range species, and are migratory or congregatory species (IFC GN6, 2012). The evaluations were carried out in consideration of the threats facing these identified species and their habitat requirements.

Candidate species from the Project area and Area of Influence were identified from previous EIAs and field surveys.

Table 5.35 outlines the CH triggers for Criterion 1 to 3 within the Project area and Area of Influence.

Table 5. 35 Critical Habitat Candidate Species (Criterion 1 to 3) within Project area and Area of Influence

S/N	Scientific Name	Common Name	IUCN Listing	Criterion
1	*Sonneratia griffithii*	Lame	CR	1

5.4.8.4 Potential Critical Habitat Species (Criterion 1 to 3)

The CH Screening Assessment preliminarily identified one (1) species that is potential CH species under Criterion 1. No species have been identified to be potential CH species under Criterion 2 or 3. Table 5.36 provides further information on this species and rationale for assessment.

Table 5. 36 Potential Critical Habitat Species (Criterion 1 to 3)

S/N	Scientific Name	Common Name	IUCN Listing	Criterion 1	Species Information	CH Rationale
1	*Sonneratia griffithii*	Lame	CR	Tier 2	This species is a mangrove (plant) and is found in the downstream estuarine zone in the lower intertidal zone. This species has a restricted distribution in South Asia, and is considered very rare or is locally extinct in many parts of its range. In this region, there has been an estimated population decline of 80% based on loss of mangrove area due to coastal development and extraction since the 1950s, primarily due to the clearing of mangroves for rice farming, shrimp aquaculture and coastal development. This species is locally extinct in a number of areas throughout its range. Less than 500 mature individuals of this species are left in India and it is considered very rare in West Malaysia. Over 20-year period (1980 - 2000), there has been a 26 % loss (950 km² per year) of mangrove area within this species range. However, case studies within the region have recorded higher declines since the 1950s.	The species is considered rare and has had a major reduction in population across its range. Several individuals of the species were identified within the Area of Influence of the Project, being the intertidal zone. The Habitat would trigger Criterion 1, Tier 2 as the habitat supports the regular occurrence of a single individual of a CR species. A discrete management unit (DMU) for the species/subspecies would coincide with the mangrove community along the shoreline of the Area of Influence. An estimated DMU for the species is shown in Figure 5.38.

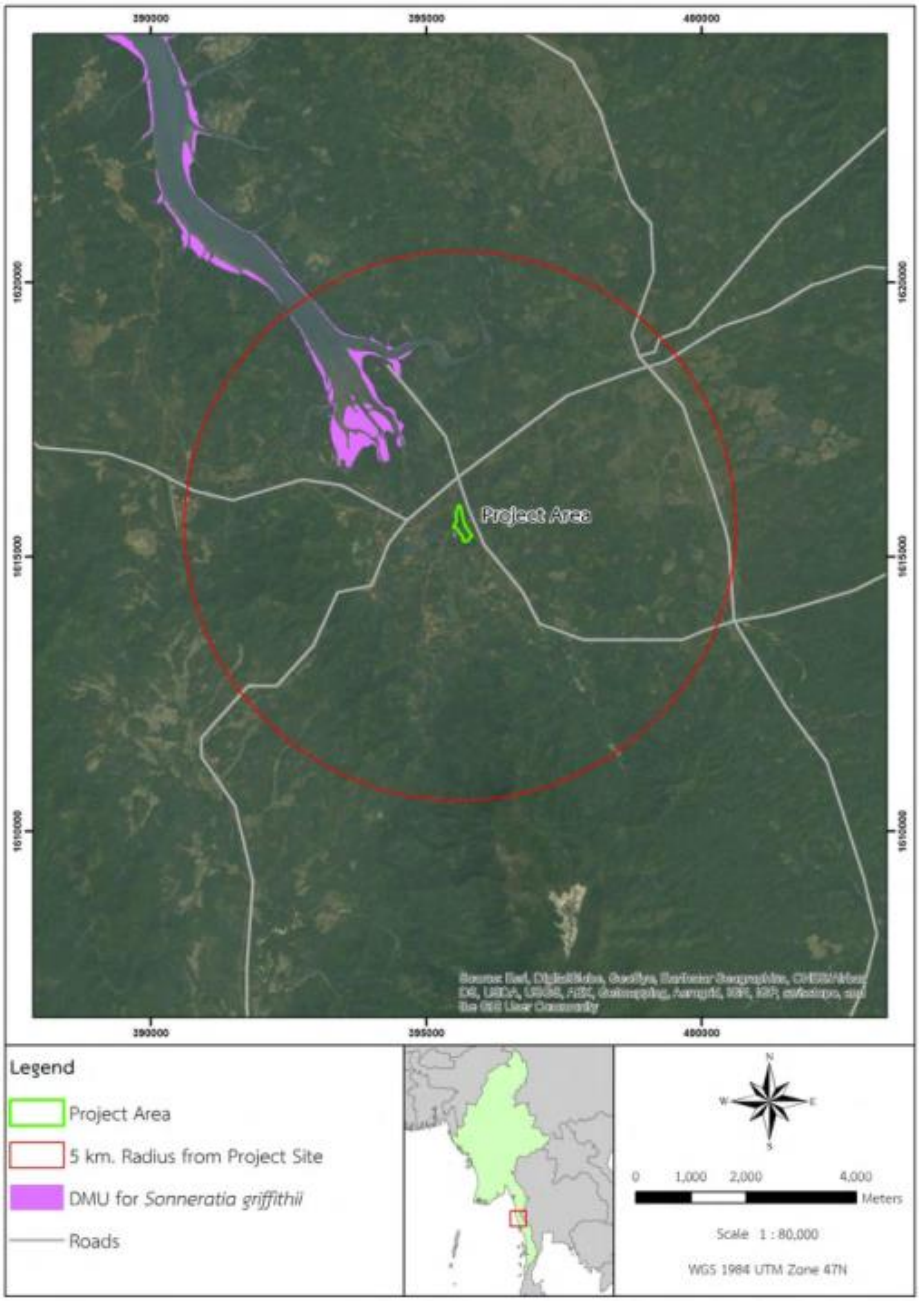


Figure 5. 38 Discrete Management Unit for Sonneratia griffithii

5.4.8.5 Criterion 4 – Highly Threatened and/or Unique Ecosystems

Highly threatened and unique ecosystems as defined by the IFC are those that are a) under significant threat; b) small in size; and/or c) have unique species assemblages. An assessment of the presence of habitats within the project area which meet these criteria and relevant discussions are provided below.

Ecosystems at Risk of Significantly Decreasing in Area or Quality

The ecosystems in the AoI are generally widely distributed. Mangrove communities however have been identified as reducing in area and quality within the region. While large areas of mangrove forests remain, the deforestation rates of these forests have been increasing due to anthropogenic influences such as economic pressures to overexploit and expand the aquaculture and agricultural industry. However, the area of mangrove community within the project area is small compared to the distribution of mangrove communities within Myanmar and SE Asia. The area of mangroves within the Area of Influence and Project area are not considered to be significant and hence would not trigger Critical Habitat under Criterion 4.

Ecosystems with a Small Spatial Extent

All ecosystems present within the AoI and Project area are generally widely spread throughout Myanmar.

Ecosystems Containing Unique Assemblages of Species Including Assemblages or Concentrations of Biome-Restricted Species

All ecosystems present within the AoI and Project area are not unique or contain assemblages of biome restricted species.

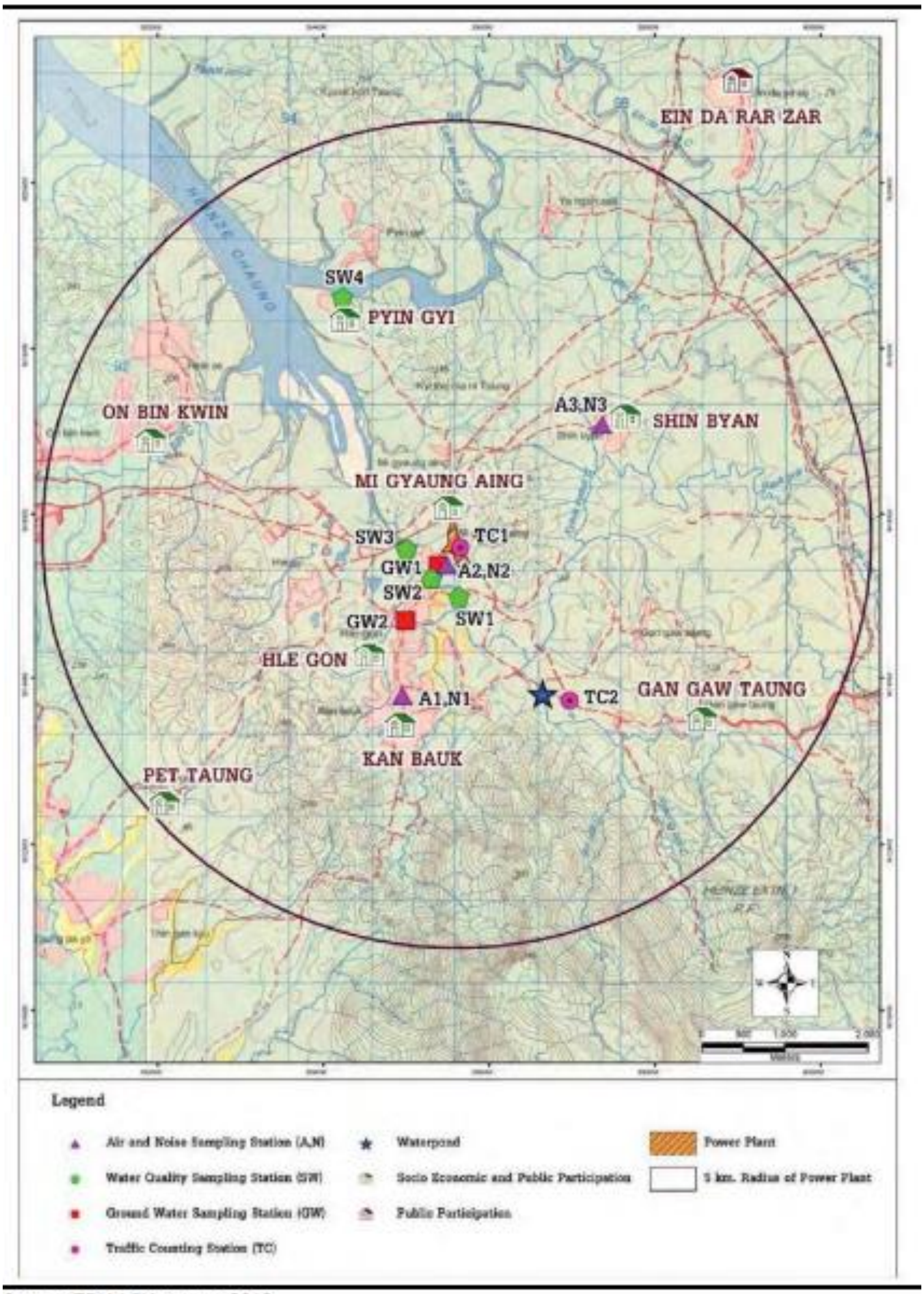
5.4.8.6 Criterion 5 – Key Evolutionary Processes

Criterion 5 recognizes the attributes of a region that that can influence evolutionary processes and give rise to regional configuration of species and ecological properties. Examples can include isolated areas where populations are phylogenetically distinct, areas of high endemism, environment gradients or ecotones and biological corridors.

No key evolutionary processes have been identified within the ecosystems within the Area of Influence or Project area.

5.4.9 Plankton and Benthos Survey

Aquatic ecology study was conducted through sampling at 4 stations within 5 km of the Project during 7-19 June, 2013. All four sampling stations were located on the Heinze Chaung River, the main water resource for local people in the area and the power plant for the cooling system. The locations of the surface water quality monitoring stations are shown in Figure 5.39.



Source: TEAM EIA report, 2013

Figure 5. 39 Environmental Sampling Stations for Surveys Conducted by TEAM Consulting, 2013

Table 5. 37 Location of Aquatic ecology study Sampling Station by TEAM

Sampling Station	Projected Coordinates (Datum WGS 84)		
	UTM	East (X)	North (Y)
Aung Dong Bridge	47P	0395634	1615001
Mi Gyaung Aing Bridge	47P	0395305	1615223
Heinze Bridge	47P	0395003	1615579
Pyin Gyi Village	47P	0394229	1618623

Plankton survey was carried out by collecting 30 liters of water from designated sampling station and pouring it through the 60 gm. mesh size plankton net. The retained plankton was transferred into storage bottle and preserved with 5%neutral formalin solution.

Benthic sampling was performed by Eckman dredge with grabbing area of % ft^2. Two (2) replicates were performed at each station. For each grab sample, observations were made on texture, cohesiveness and composition of sediments and recorded. Benthic fauna was then washed and sorted through a series of wire sieves. Retained fauna were kept in storage bottle and preserved in 5% neutral formalin solution. In stations that had gravel substrate, gravels in sampler were washed and sessile organism collected. The same person was employed to collect all samples in order to minimize possible error in the data as a result of inconsistent technique that may be caused by different persons.

Identification and analysis of species composition and abundance were performed in Laboratory of Faculty of fisheries, Kasetsart University, Thailand.

Figure 5. 40 Aquatic Ecology Sampling Activities

5.4.9.1 Results of the Study Phytoplankton

AQ 1: Aung Dong bridge

A total of 17 taxa of plankton comprising 10 taxa from 4 divisions of phytoplankton and 7 taxa from 3 phylum zooplankton were identified from sample of Heinze Chaung River at Aung Dong bridge. Total density of plankton was 326,300 cell/m3 from which phytoplankton and zooplankton density were 175,700 cell/m3 and 150,600 cell/m respectively.

Dominant species of phytoplankton and zooplankton were Spirigyraweberi (Chlorophyta) and Centropyxis ecornis (Protozoa) which made up 28.57% and 41.50% of phytoplankton and zooplankton respectively.

AQ 2: Mi Gyaung Aing bridge

A total of 12 taxa of plankton comprising 7 taxa from 4 divisions of phytoplankton and 5 taxa from 2 phylum of zooplankton were identified from sample of Heinze Chaung River at Mi Gyaung Aing. Total density of plankton was 207,200 cell/m^3 from which phytoplankton and zooplankton density were 129,500 cell/m^3 and 77,700 cell/m respectively.

Dominant species of phytoplankton and zooplankton were Nitzchia sigma (Chromophyta: Diatom) and Arcella vulgaris (Protozoa), which accounted for 30.00% and 33.33% of phytoplankton and zooplankton respectively.

AQ 3: Heinze bridge

A total of 11 taxa of plankton comprising of 7 taxa from 3 divisions of phytoplankton and 4 taxa from 2 phylum of zooplankton were identified from sample of Heinze Chaun River at Heinze bridge. Total density of plankton was 161,200 cell/m from which phytoplankton and zooplankton density were 111,600 cell/m3 and 49,600 cell/m respectively.

Dominant species of phytoplankton was Oscillatoria sp. (Cyanophyta: Blue-green algae) which accounted for 33.33% of all phytoplankton collected at this station. For zooplankton, all 4 taxa, Tintinnopsis brevicollis, Leucophrya sp., Mytilina ventralis and Lepadella rhomboids were made up equally at 25%.

AQ 4: Pyin Gyi

A total of 15 taxa of plankton comprising 10 taxa from 3 divisions of phytoplankton and 5 taxa from 2 phylum of zooplankton were identified from the sample of Heinze Chaung River at Pyin Gyi villag. Total density of plankton was 409,600 cell/m3 from which phytoplankton and zooplankton density were 166,400 cell/m and 243,200 cell/m3 respectively.

Dominant species of zooplankton was nauplius of copepod (Arthropoda) which accounted for 78.95 of total zooplankton collected at this station while there were three dominant species of phytoplankton including Oscillatoria sp. (Cyanophyta: Blue-green algae), Coscinodiscus sp. (Chromophyta: Diatom) and Peridinium sp. (Chromophyta: Dinoflagellate), which were present in equal proportion at 15.38%.

Table 5. 38 Results of Plankton Samplings and Analysis

Plankton	Density of plankton (cell/m^3)			
	Aung Dong bridge	Mi Gyaung Aing	Heinze bridge	Pyin Gyi
Phytoplankton				

Plankton	Density of plankton (cell/m^3)			
	Aung Dong bridge	Mi Gyaung Aing	Heinze bridge	Pyin Gyi
Division Cyanophyta				
Class Cyanophyceae (blue green algae)				
Oscillatoria sp.	12,550	12,950	37,200	25,600
Rhaphidiopsis sp.	-	-	12,400	-
Microcysti saeruginosa	12,550	12,950	-	-
Division Chlorophyta				
Class Chlorophyceae				
Spiriura weberi	50,200	-	-	-
S. crassa	12,550	-	-	-
Closterium ralfsii	12,550	12,950	-	-
Dictyosphaerium pulchellum	-	-	-	12,800
Mougeotias calaris	-	12,950	-	-
Oedogonium crispum	12,550	25,900	-	12,800
Micrasteriasfoliacea	-	-	-	12,800
Pandorina morun	-	-	-	12,800
Class Euglenophyta (euglenoids)				
Euglenaacus	-	-	-	12,800
Division Chromophyta				
Class Bacillariophyceae (diatom)				
Cyclotella sp.	-	-	12,400	-
Coscinodiscus sp.	-	-	-	25,600
Fragilaria capucina	12,550	12,950	-	-
Frustulia vulgaris	-	-	-	12,800
Nitzschia sigma	12,550	-	-	-
N. filiformis	25,100	-	-	-
N. longissima	12,550	-	-	-

Plankton	Density of plankton (cell/m^3)			
	Aung Dong bridge	Mi Gyaung Aing	Heinze bridge	Pyin Gyi
Pleurosigma sp.	-	-	12,400	-
Surirellarobusta	-	38,850	-	-
Synedra ulna	-	-	12,400	-
Class Dinophyceae (dinonagellate)				
Peridinium sp.	-	-	12,400	25,600
Total species of Phytoplankton	10	7	7	10
Total density of Phytoplankton	175,700	129,500	111,600	166,400
Zooplankton				
Phylum Arthropoda				
Subclass Copepoda				
*Nauplius stage	12,550	-	-	192,000
Order Cyclopoida				
*Cyclopoids copepods	-	-	-	12,800
Phylum Protozoan (Protozoa)				
Centropyxis ecornis	62,750	12,950	-	-
Arcella vulgaris	25,100	25,900	-	12,800
Diffugialebes	12,550	-	-	-
Tintinnopsis brevicollis	12,550	-	12,400	12,800
Phylum Protozoan (Protozoa)				
Actinophry's sol	-	12,950	-	-
Ogdeniella elegans	-	12,950	-	-
Leucophrya sp.	-	-	12,400	-
Codonellopsis sp.	-	-	-	12,800
Phylum Rotifera (Rotifer)				
Filiniater minaris	12,550	-	-	-

Plankton	Density of plankton (cell/m^3)			
	Aung Dong bridge	Mi Gyaung Aing	Heinze bridge	Pyin Gyi
Poluarthra vulgaris	12,550	-	-	-
Colurellacolurus	-	12,950	-	-
Mytilina ventralis	-	-	12,400	-
Lepadella rhomboides	-	-	12,400	-
Total species of Zooplankton	7	5	4	5
Total density of Zooplankton	**150,600**	**77,700**	**49,600**	**243,200**

Source: Sampling by TEAM Consulting Engineering and Management Co., Ltd., 19 June 2013.

5.4.9.1 Results of the Study Benthos

AQ 1: Aung Dong bridge

Only one taxa of benthos in family Tubificidae were found in this station with density of 44 individuals/m^2.

AQ 2: Mi Gyaung Aing bridge

Benthic fauna not found in the sample of this station.

AQ 3: Heinze bridge

Benthic fauna was not found in the sample of this station.

AQ 4: Pyin Gyi

There were three taxa from two phylum of benthic animal found in this station including one taxa of freshwater worm in family Tubificidae (Annelida: Oligochaeta) and two taxa of Mollusk, one was Ceriths, Cerithidae sp. (Gastropoda: Family Potamididae) and another one was Donax, Donax sp. (Bivalvia: Family Donacidae). All taxa contained the same density at 22 individuals/m^2. Total density of benthos in this station was 66 individuals/m^2.

Benthos samples in cach station are shown in figure 5.39.

Table 5. 39 Results of Benthos Samplings and Analysis

Benthic fauna	Density of benthic fauna (individuals/m^2)			
	Aung Dong bridge	Mi Cyaung Aing	Heinze bridge	Pyin Gyi
PHYLUM ANNELIDA Class Oligochaeta Family Tubificidae	44	-	-	22

Benthic fauna	Density of benthic fauna (individuals/m^2)			
	Aung Dong bridge	Mi Cyaung Aing	Heinze bridge	Pyin Gyi
PHYLUM MOLLUSCA Class Gastropoda Family Potamididae *Cerithidea sp.*	-	-	-	22
Class Bivalvia Family Donacidae *Donax sp.*	-	-	-	22
Total taxa of Benthic fauna	1	-	-	3
Total Density of Benthic fauna	44	-	-	66

Source: Sampling by TEAM Consulting Engineering and Management Co., Ltd., 19 June 2013.

Aung Dong Bridge (AQ 1)

Mi Gyaung Aing Bridge (AQ 2)

Heinze Bridge (AQ 3)

Pyin Gyi Village (AQ 4)

Figure 5. 41 Benthos Samples in Each Station Within Project Study Area

CHAPTER 6 DESCRIPTION OF THE ENVIRONMENT– SOCIO-ECONOMIC BASELINE

This Chapter provides an overview of the socio-economic conditions of the Project area.

6.1 Data Collection

The information presented in this Section was gathered through a desktop review of publicly available sources and secondary data collected from the General Administrative Department of the Yebyu Township. To provide a more precise understanding of the socio-economic conditions in the Project area, primary data have been collected during the initial site visit in August 2016 and in parallel of the first Public Consultation session between November 15th and November 19th 2016. Primary data was collected through key informant interviews (i.e. village leaders, health professionals, and teachers), focus groups with key stakeholder groups (youth, women, fishermen, village committee members, elderly) within the local villages, and household surveys. A total of 150 household questionnaires as well as 15 Focus Group Discussions and 21 Key Informant Interviews have been administered in Kanbauk, Mi Gyaung Auing, Gant Gaw Taung, Pyin Gyi, Phet Taung and Ohn Pin Kwin villages. Examples of the tools used for primary data collection for social baseline are included in **Annex E**.

The collection of secondary and primary data provided an opportunity to triangulate the data to confirm the accuracy of the information presented. Given the limited secondary data available at the local level, it also ensured a more robust baseline against which the likely impacts associated with the Project could be assessed.

The Study area is defined as the area within 5 km around the Project site which also include a 500m area each side of the water intake pipeline.

6.2 Social Receptors

The baseline focuses on the receptors that may be impacted or influenced by the Project due to their proximity to the Project site and/ or Project associated infrastructure. This includes people living in:

- Mi Gyaung Auing village. The village is located directly next to the Project site. The village is also located along the road that connects the Project site to Kanbauk;
- Hle Gone village. The village is located approximately 0.6 km south west of the Project site;
- Kanbauk village. The village is located approximately 2.1 km south west of the Project site;
- Shin Byan village. The village is located approximately 2.5 km north east of the Project site;
- Pyin Gyi village. The village is located approximately 3.3 km north west of the Project site and next to the Water Intake Pumping facility;
- Gan Gaw Taung village. The village is located approximately 3.3 km south east of the Project site;
- Pet Taung village. The village is located approximately 4.5 km south west of the Project Site;

- On Bin Kwin village. The village is located approximately 4.5 km north west of the Project Site;
- Ya Ngan village. The village is located approximately 3.9 km north east of the Project Site;

There is also a restaurant and a monastery located directly next to the Project site. Monks, worshipers and staff of the restaurant are potential receptors. Engagements have also been conducted in Ein Da Rar Zar, located outside the study area. This is because Ya Ngan village is under administrative jurisdiction of Ein Da Rar Zar.

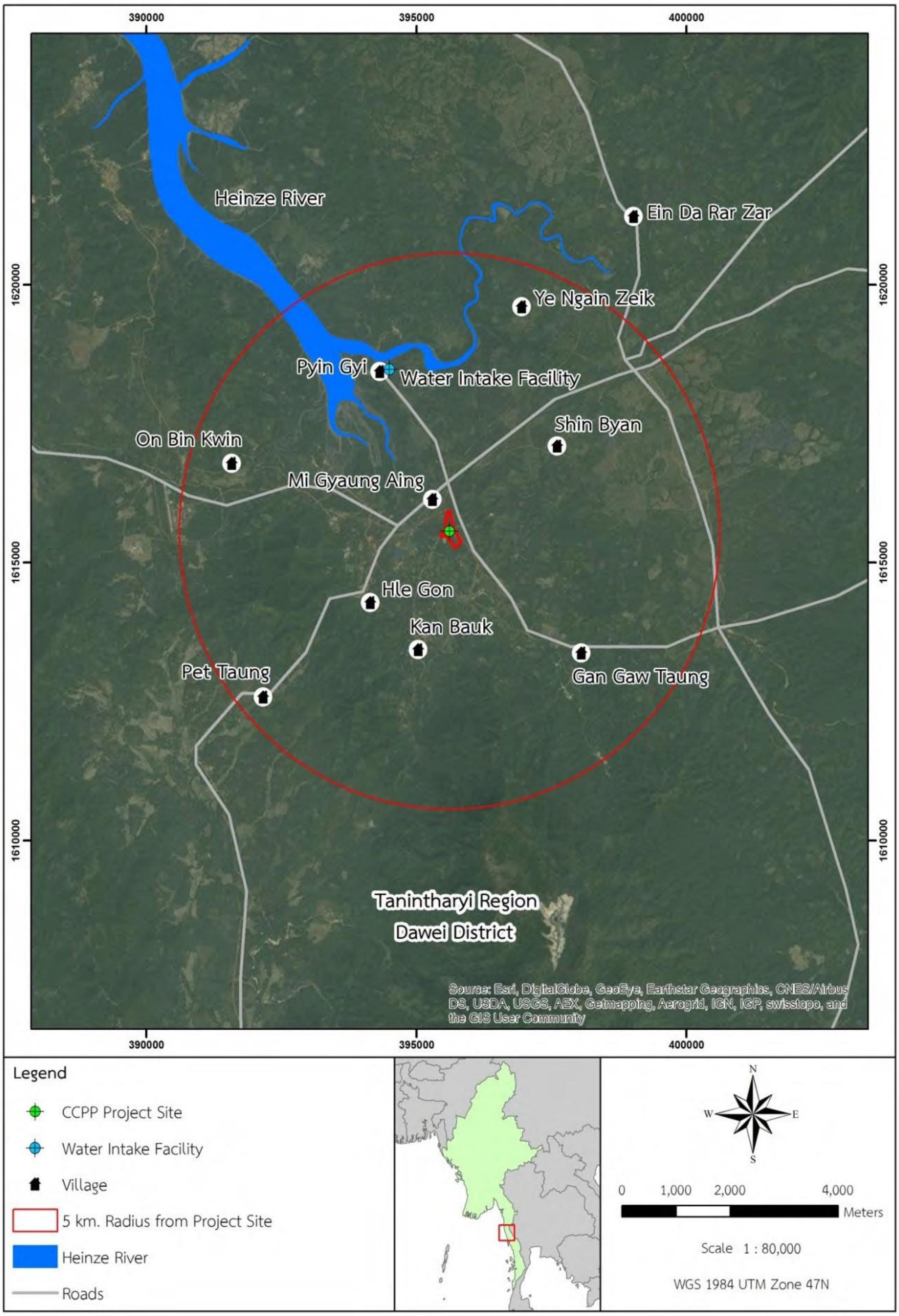


Figure 6. 1 Social Receptors

Source: ERM, 2016

6.3 INTRODUCTION

Myanmar is located in Southeast Asia. The country is bordered to the east by Thailand and Laos, to the north by China and to the west by India. Myanmar has a lengthy coastline that extends for approximately 2,400 km along the Andaman Sea and Bay of Bengal.

There are a number of mountain ranges and river systems, which run north to south through the country – creating natural divisions. There are three distinct seasons in Myanmar. The cold and dry season runs from November to February, while the hot season is March and April, and the rainy season extends from May to October. During the rainy season monsoons can occur, causing flooding and landslides.

Myanmar is split into number of States and Regions (sometimes also referred to as Divisions), which are further divided into Townships for administrative or governance purposes. The Project site is located in the Yebyu Township in the Tanintharyi Region near the Heinze River.

6.4 DEMOGRAPHIC PROFILE

As of January 2017, it was estimated that the population of Myanmar was approximately 57 million[15], with an annual growth rate of approximately 1%[16]. The population in the Tanintharyi Region was estimated to be 1.4 million, divided into 3 districts and 16 townships in 2014[17].

Much of the population in Myanmar lives in rural areas. As of 2016, it was estimated that 65.7% of the population lives in rural areas, while 34.3% of the population resides in urban areas. For the Tanintharyi region, the percentage of people living in rural area was approximately 75%. Yebyu Township has a population of approximately 100,760 people, most of whom (approximately 96%) live in rural areas. Male/Female ratio in Myanmar is 0.9 male per female, compare to the same ratio in Tanintharyi region of 0.98 and 0.91 in the study area (see **Table (6.1)** below)

The population density in Myanmar is approximately 76.1 people per km^2. The Tanintharyi Region has a density at 32.5 people per km^2.

There are approximately 135 ethnic groups in Myanmar. The largest group is the Burmans, which make up more than half of the population (68%). This is followed by Shan (9%), Karen (7%), Rakhine (4%), Chinese (3%), Indian (2%), Mon (2%), and other (5%) (CIA 2016).

The official language is Myanmar. However, there are over 100 languages and dialects spoke within the country. These languages largely fall into one of four language families, namely, the Sino-Tibetan, Tai-Kadai, Austro-Asiatic and Indo-European, of which the Sino-Tibetan is the dominant group.

[15] http://www.livepopulation.com/country/myanmar.html. 2017

[16] https://www.cia.gov/library/publications/the-world-factbook/geos/bm.html. 2016

[17] The 2014 Myanmar Population and Housing Census. Tanintharyi Region. Department of Population, Ministry of Immigration and Population. May 2015.

In terms of religion, the majority of the population is Buddhist (89%). However, other religions are represented. This includes Christian (4%), Muslim (4%), Baptist (3%), Catholic (1%), Animist (1%) and other (2%) (CIA 2016).

In terms of the villages located in the Project area, the largest village is Kanbauk, with a population of approximately 9,976 people, while the smallest village is Phet Taung, with a population of approximately 125 people. The villages in terms of ethnicity, language and religion, reflect the broader Myanmar population – i.e. are Buddhist Burmans that speak Myanmar, but Kanbauk also house a Hindu temple and a Mosque.

Table 6. 1 Village Overview

Village Tract	Villages	Total Population	Male	Female
Kanbauk	Kanbauk	9976	4598	5378
Kanbauk	Mi Gyaung Aing	600	230	370
Eindra Yarzar	Pyin Gyi	350	200	150
Kanbauk	Phet Taung	125	45	80
Kanbauk	Hle Kone	1378	857	521
Ohn Pin Kwin	Ohn Pin Kwin	2542	1221	1321
Total			7151	7820

Table 6. 2 Social Profiles of Villages

<table>
<tr><th>No.</th><th>Description</th><th>Mi Gyaung Aing Village</th><th>Kanbauk Village</th><th>Gan Gaw Taung Village</th><th>Pet Taung Village</th><th>Hle Gone village</th><th>Pyin Gyi Village</th><th>Ya Ngan village</th><th>Shin Byan village</th><th>Ohn Pin Kwin Village</th></tr>
<tr><td>1.</td><td>Distance to the Project Area</td><td>Directly next to the project area</td><td>Approximately 2.1 km southwest of project area</td><td>Approximately 3.3 km southeast of project area</td><td>Approximately 4.5 km southwest of project area</td><td>Approximately 0.6 km southwest of the Project site</td><td>Approximately 3.3 km northwest of project area</td><td>Approximately 3.9 km northeast of the Project Site</td><td>Approximately 2.5 km northeast of the Project site</td><td>Approximately 4.5 km northwest of the Project site</td></tr>
<tr><td>2.</td><td>Population</td><td colspan="5">KanBauk Village Tract
Total Population - 11531
Male - 5943
Female - 5588</td><td colspan="2">Eindra Yarzar Village Tract
Total Population - 2621
Male - 1335
Female - 1286</td><td colspan="2">Ohn Pin Kwin Village Tract
Total Population - 7904
Male - 4532
Female - 3372</td></tr>
<tr><td>3.</td><td>Morbidity</td><td colspan="9">In terms of morbidity, there are communicable and non-communicable diseases which are raised by hypertension, diabetes, acute respiratory infection, stoke and common fever.</td></tr>
<tr><td>4.</td><td>Mortality</td><td colspan="9">The most usual cause of mortality is resulted from the malaria, hypertension, and liver diseases but the fatality rate of traffic accident is increasing. However, there is no data for sexually transmitted infections like HIV/AIDS, but stroke and cerebral haemorrhage are listed as common.</td></tr>
<tr><td rowspan="2">5.</td><td rowspan="2">Access to Water</td><td>Surface Water – Mountain Torrent Ground Water - Well</td><td>Surface Water – Mountain Torrent Ground Water - Well</td><td>-</td><td>Ground Water - Well</td><td>Surface Water – Mountain Torrent Ground Water - Well</td><td>Ground Water - Well</td><td>-</td><td>-</td><td>Surface Water – Mountain Torrent Ground Water - Well</td></tr>
<tr><td colspan="9">Even though the drinking water in study area is mainly taken from well as ground water by using filtering and boiling methods, the mountain torrent as surface water is also used by storing method. Pyin Gyi uses water from Heinze river for domestic use and the availability of water is enough for all villages throughout the year except in Phet Taung in dry season.</td></tr>
<tr><td>6.</td><td>Sanitation</td><td colspan="9">Three different types of latrines such as pour flush, dry pit and flush are most common in villages except in Phet Taung where open defecation type is used.</td></tr>
<tr><td>7.</td><td>Alcohol Use</td><td colspan="9">As behavioral factors, chewing betel nut is the most frequent use in project area villages and tobacco used by small number of villagers is followed but alcohol consumption is not raised as problem by villagers.</td></tr>
</table>

<table>
<tr><th>No .</th><th>Description</th><th>Mi Gyaung Aing Village</th><th>Kanbauk Village</th><th>Gan Gaw Taung Village</th><th>Pet Taung Village</th><th>Hle Gone village</th><th>Pyin Gyi Village</th><th>Ya Ngan village</th><th>Shin Byan village</th><th>Ohn Pin Kwin Village</th></tr>
<tr><td>8.</td><td>Healthcare Facilities</td><td colspan="9">There are rural healthcare centers in Kanbauk, Ein Der Ya Zar and Ohn Pin Kwin villages and there are also private clinics provided by Total in Ohn Pin Kwin and Pyin Gyi Villages. Other villages have not had their own healthcare facilities and they usually go to the rural healthcare center in Kanbauk. Although Kanbauk healthcare center provides awareness and prevention related with health problems, there is no plan for improvement of healthcare services. Moreover, Villagers can get healthcare care services from Yebyu General Hospital for major health problems. It takes approximately two hours to drive to Yebyu.</td></tr>
<tr><td>9.</td><td>Agriculture</td><td colspan="9">As main part of income source, household can earn by cultivating main cash crops such as rubber, betel, palm, cashew, jack fruit, rambutan, cane and durian which are sold at Dawei Market. According to the result of field surveys 2016, Kanbauk village has the largest average income per household per year and Phet Taung Village has the smallest income among villages. Both men and women are actively involved in agricultural activities either in crop productions or as day laborers, but men can earn more average money per day than women. However, a small number of people operate own businesses like shops, restaurants, sewing, hair dressing and beauty salon.</td></tr>
<tr><td>10.</td><td>Livestock</td><td colspan="9">Another source of income had got from raising livestock including pig, goat, duck, buffalo, sheep, and poultry. Livestock is also reared for personal consumption by both men and women and there is a veterinary service like vaccination.</td></tr>
<tr><td>11.</td><td>Forest</td><td colspan="9">Although the study area has no forest reserve areas and forestry activities, villagers collect forest products like wood for cooking nearby agricultural properties.</td></tr>
<tr><td>12.</td><td>Fisheries</td><td colspan="9">Pyin Gyi, Mi Gyaung Auing and Oh Pin Kwin villages mainly practice fishing by boats, gillnetting, drift netting, hook and line, hand and crab trap in Heinze river. They undertake fishing under rules and regulations from Ministry of Fisheries and Livestock.</td></tr>
<tr><td>13.</td><td>Industry</td><td colspan="9">South of Kanbauk is a tin and tungsten mine operated by Delco since 1911 and fully privatised in 2007.</td></tr>
<tr><td>14.</td><td>Education and School</td><td colspan="9">From aspect of education, the literacy rate in Tanintharyi Region was 92.8% in 2014 which is lower than a literacy rate of 96.6% in Yangon. In study area of the project, there are only one high school in Kanbauk and each village has a primary school except in Pet Taung.</td></tr>
<tr><td>15.</td><td>Access to Energy</td><td colspan="9">For access to energy, villages except Phet Taung in the study area get access to electricity for 24 hours, 3 hours or 10 hours per day but during summer, there is an electricity shortage. The energy used for household work get by purchasing gas from Kanbauk and charcoal from Min Thar Village.</td></tr>
<tr><td>16.</td><td>Transportatio n</td><td colspan="9">The types of vehicle ownership are motorcycles and bicycles. And villagers can travel to the other villages and Dawei by shuttle buses every day.</td></tr>
<tr><td>17.</td><td>Land Use</td><td colspan="9">Field survey for land use is marked within a 3km buffer zone around the proposed project site. Approximately 60% total land use is agricultural land for rubber tree plantation, 25% is for degraded natural forest and 15% is for constructed area. Moreover, 50% of the project site is for constructions, 25% is covered with shrubs and the rest is cleared of vegetation.</td></tr>
<tr><td>18.</td><td>Cultural Heritage</td><td colspan="9">According to the site visit survey, there are no identified archaeological sites like ruined buildings, structures, and walls although the constructions of buildings and roads can decrease the chances of finding archaeological sites within the study area.</td></tr>
</table>

No.	Description	Mi Gyaung Aing Village	Kanbauk Village	Gan Gaw Taung Village	Pet Taung Village	Hle Gone village	Pyin Gyi Village	Ya Ngan village	Shin Byan village	Ohn Pin Kwin Village
		After desk-based study and site visit, there are no religious, government and residential buildings, infrastructures, artificial landscape features known as ancient above ground resources. As living cultural heritage sites, there are a few pagodas and monasteries which are opened throughout the day in the project area because most of the population in Myanmar is Buddhism. In addition, one Hindu Temple and one Mosque are found in Kanbauk but Churches are located in Shin Byan and Ein Da Ra Zar.								

6.5 Community Health

The life expectancy in Myanmar is 64 years of age for men and 68 years of age for women (***Table (6.3)***). Between 2000 and 2012, the life expectancy increased by 3 years for both males and females; however, during this same time the average increase in life expectancy in Myanmar's neighboring countries was 5 years (WHO 2015).

Table 6. 3 Key Health Indicators

Indicator	Myanmar	Thailand	Laos
Total population (2013)	53 million	67 million	6.7 million
Life expectancy at birth (2013)	64 males 68 females	71 males 79 females	65 males 68 females
Total expenditure on health per capita (2013)	37	658	95
Total expenditure on health as % of GDP (2013)	1.8	4.6	2.0
Total fertility rate (2014)	2.29	--	--
Infant mortality rate (deaths per 1,00 live births) (2014)	62	--	--
Under five mortality rate (deaths per 1,000 live births)	72	--	--

6.5.1 Morbidity

Morbidity is the state of being in poor health and encompasses both acute and chronic diseases. Many of the leading causes of morbidity in Myanmar are associated with communicable diseases and pregnancy/ child birth (**Table (6.4)**).

Table 6. 4 Leading Causes of Morbidity in Myanmar (2012)

No.	Causes	Percent
1.	Other injuries of specified, unspecified and multiple body regions	10.0
2.	Other complications of pregnancy and delivery	6.9
3.	Single spontaneous delivery	6.0
4.	Diarrhoea and gastroenteritis of presumed infectious origin	5.8
5.	Other viral diseases	3.8
6.	Other pregnancies with abortive outcome	2.6
7.	Gastritis and duodenitis	2.4
8.	Malaria	2.4
9.	Cataract and other disorders of lens	2.4
10.	Other acute upper respiratory infections	2.0
11.	Pneumonia	1.8
12.	Other conditions originating in the perinatal period	1.7
13.	Toxic effects of substances chiefly non-medicinal as to source	1.6
14.	Fractures of other limb bones	1.5
15.	Disease of appendix	1.5
	All other causes	47.6
	Total	**100.0**

Source: Ministry of Health 2014

Although not reflected in **Table (6.4)** considerable focus has been given to tuberculosis (TB) over the past few years as it is considered a major public health problem in Myanmar. Myanmar is one of the world's 22 high tuberculosis (TB) burden countries, with a TB prevalence rate three times higher than the global average and one of the highest in Asia. In 2013, the estimated TB prevalence[18] and incidence was 473 and 373 per 100,000 people respectively. Rates of TB are only marginally lower in the Tanintharyi Region compare with the national average and TB is considered an issue of concern (**Table (6.5)**). To address the rates of TB, the Myanmar Government has established the National Tuberculosis Program, which focuses largely on improving detection. The National TB Program (NTP) is implementing a National Strategic Plan for TB control, 2011-2015, based on evidence from a 2009-2010 nationwide TB prevalence survey, and in line with the World Health Organization's (WHO) Stop TB Strategy (WHO 2015).

Table 6. 5 Diseases under Myanmar National Surveillance (2012)

Regions / States	**Diarrhoea**		**Malaria**		**TB: sputum +ve**		**TB: sputum -ve**		**TB: Extra pulmonary**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Kachin	916.3	0.4	2,374.2	3.8	44.	1.0	80.0	1.9	58.6	0.2
Kayah	1,388.0	6.7	1,858.6	0.7	12.0	0.0	26.2	0.7	5.6	0.0
Kayin	907.5	0.0	970.0	1.4	74.1	0.1	155.7	0.1	8.4	0.0
Chin	1,803.1	5.4	2,613.6	1.9	23.2	0.4	58.3	0.6	78.5	0.0
Sagaing	846.9	0.9	1,085.6	1.6	46.7	0.3	55.0	0.4	36.0	0.1
Tanintharyi	**862.3**	**0.3**	**2,166.9**	**1.2**	**56.5**	**0.2**	**182.9**	**1.2**	**88.0**	**0.5**
Bago	549.0	0.2	484.5	0.6	48.6	0.5	98.9	0.9	13.0	0.1
Magway	714.9	0.4	322.1	0.1	40.2	0.4	46.9	0.4	35.5	0.1
Mandalay	547.5	0.1	279.5	0.1	54.0	0.4	44.9	0.3	42.6	0.1
Mon	755.3	0.2	362.2	0.6	66.0	0.8	173.2	1.8	18.7	0.1
Rakhine	1,150.4	0.4	1,752.8	0.6	43.9	0.7	47.1	0.5	16.8	0.1
Yangon	255.0	0.4	25.4	0.0	109.4	0.6	114.6	0.6	36.4	0.1
Shan (S)	672.4	1.1	845.3	1.5	39.2	0.6	47.2	0.4	21.9	0.2
Shan (N)	697.0	1.4	934.6	1.1	63.1	0.1	58.5	0.3	70.1	0.0
Shan (E)	1,015.1	0.5	209.5	0.0	101.7	0.7	160.9	0.2	37.6	0.0
Ayeyarwady	523.8	0.3	361.3	0.6	49.1	0.4	61.4	0.6	28.5	0.1
Naypyitaw	476.4	0.2	250.3	0.1	59.6	0.0	38.6	0.2	36.9	0.1
Union	**670.5**	**0.5**	**686.0**	**0.7**	**58.0**	**0.5**	**78.6**	**0.6**	**33.7**	**0.1**

Source: Ministry of Health 2014

Note: (1) Number of cases per 100,000 populations. (2) Number of deaths per 100,000 populations.

Malaria is considered to be another health issue. The cities of Yangon and Mandalay and areas above 1000 metres in elevation are considered to be malaria-free, making malaria largely an issue in rural areas of the country, and in particular in Tanintharyi where the incidence is 3.5 per 100 persons[19]. The issue is compounded by the increasing presence of the multi-drug

[18] Prevalence is the proportion of cases in the population at a given time, while incidence is the rate of occurrence of new cases.

[19] http://www.themimu.info/census-data. 2016

resistant form of malaria, which is now widespread along much of the Myanmar-Thailand border.

Other vector borne diseases common in Myanmar include dengue fever and Chikungunya virus, which are spread by two species of day-time feeding mosquitoes - *Aedes aegypti* and *Aedes albopictus*. Unlike the mainly rural-dwelling mosquitoes that spread malaria, the *Aedes* mosquitoes thrive in cities as well as rural areas.

In terms of morbidity in the villages in the Project area, based on interview with public health officer, communicable and non-communicable diseases are present. Leading causes of morbidity appear to be hypertension, diabetes, acute respiratory infection (ARI), stroke and common fever linked to influenza are observed as most occurring diseases.

Pregnancy and/ or child birth is not considered by health officers as being a health issue in the study area with a maternal mortality rate of 0.2 per 1000 birth and infant mortality rate of 0.18 per 1000 birth, similar to the number at the regional level.

6.5.2 Mortality

Mortality is the measure of deaths per population over time, and is a key indicator of population health. Mortality rates in 2014 were 173.6 for adult female and 229.4 for adult male (per 1000 female/male adults) in constant decline since 1960[20].

The leading cause of mortality in Myanmar is human immunodeficiency virus (HIV)/ acquired immune deficiency syndrome (AIDS) (a communicable disease) (**Table (6.6)**).

Myanmar has one of the highest rates of HIV / AIDS infection in Southeast Asia. In 2013, the number of people living with HIV in Myanmar was estimated to be around 190,000; while an estimated 11,000 people died of AIDS in 2013 (UN AIDS 2015). (There is often a correlation between TB and HIV/ AIDS – as TB, worldwide, is the leading cause of death in people living with HIV.) This may change in the future, as recent data shows that rates of HIV/ AIDS have begun to decline.

Table 6. 6 Leading Causes of Mortality in Myanmar

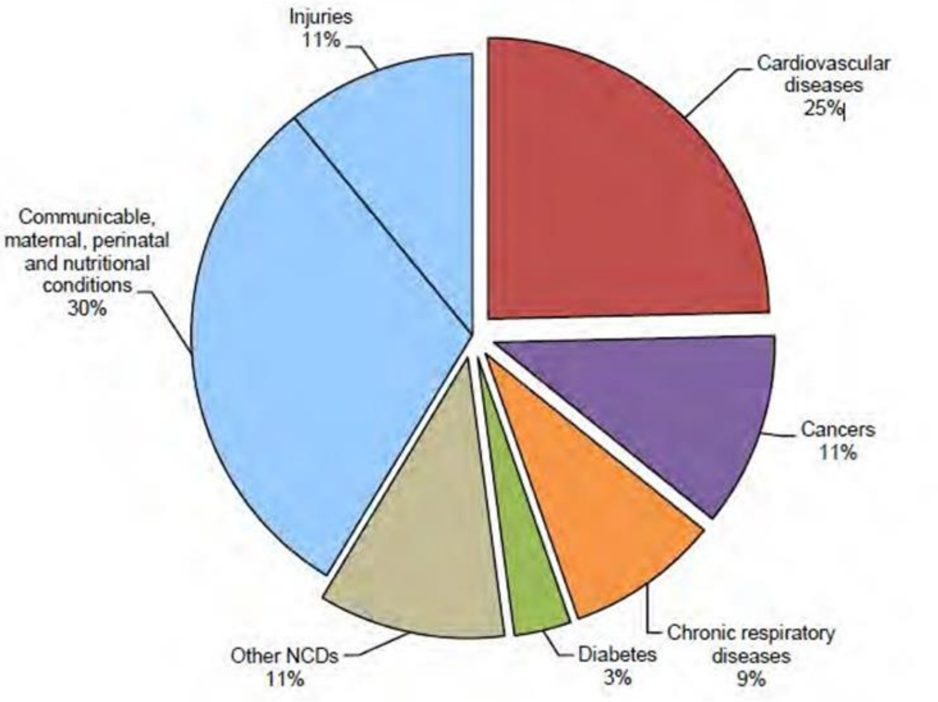
No.	Causes	Percent
1.	Human immunodeficiency virus (HIV) / Acquired immune deficiency syndrome (AIDS)	6.6
2.	Septicaemia	6.1
3.	Other injuries of specified, unspecified and multiple body regions	5.4
4.	Slow foetal growth, foetal malnutrition and disorders related to short gestation and low birth weight	4.6
5.	Other diseases of the liver	4.0
6.	Other disease of respiratory system	3.7
7.	Intrauterine hypoxia and birth asphyxia	3.4
8.	Heart failure	3.3
9.	Respiratory tuberculosis	3.2
10.	Intracranial haemorrhage	2.9
11.	Other heart diseases	2.8
12.	Intracranial injury	2.7

[20] University of California, Berkeley, and Max Planck Institute for Demographic Research. Human Mortality Database

No.	Causes	Percent
13.	Malaria	2.6
14.	Pneumonia	2.6
15.	Stroke, not specified as a haemorrhage or infarction	2.5
	All other causes	43.6
	Total	100.0

Source: Ministry of Health 2014

Although communicable diseases top the list of causes of mortality, there are a number of non-communicable diseases that also contribute. The World Health Organisation estimated that in 2014 non-communicable diseases accounted for 59% of all deaths in Myanmar (**Figure (6.2)**).



Source: WHO 2014

Figure 6. 2 Proportional Mortality (2014)

At the village level, malaria, hypertension, liver diseases and accident (traffic) were all mentioned as the most usual cause of mortality. There has been a reduction of death due to malaria in the recent years while the number of fatalities related to traffic accident has been increasing, although there were discussions within the local villages and Health practitioner regarding issues associated with sexually transmitted infections – such as HIV/ AIDS no data was available. In addition, sexually transmitted infections were not raised as an issue of concern by villagers but Stroke and Cerebral Hemorrhage have been listed as common.

6.5.3 Access to Water and Sanitation

In terms of water use, approximately, 89% of water withdrawn in Myanmar is used for agricultural purposes, while the remainder is used by municipalities (10%) and industry (1%). Approximately 91% of the total water withdrawn is from surface water, while 9% is from groundwater. The groundwater that is withdrawn is largely used for domestic purposes (FAO 2011).

According to MICS (Multiple Indicator Cluster Survey 2009-2010) by UNICEF, the Ministry of Health and the Ministry of National Planning and Economic Development, overall, 82.3% of the population use an improved source of drinking-water, 93.2% in urban and 77.6% in rural areas but only 4.1% of households in Myanmar have piped water into the dwelling. This number reaches 11.1% in Tanintharyi region.

Water treatment at home is estimated to be carried out by 34.5% of the population: treatment by cloth is carried out by 76.2%, boiling by 1.4%, and water filter by 0.6%. It is also estimated that 12.2% of the population does not use water treatment, and unsafe drinking water coverage is 33.1%.

Improved sanitation access over all is estimated to be 77%—84% in urban and 74% in rural areas in Myanmar. In both urban and rural areas, most toilet facilities are slab and pit, with 53.5% in urban and 69.8% in rural areas. Among them, 51.8% are in the richest households, but only 0.2% in the poorest.

In the Tanintharyi Region, proportion of the population with access to improved water source in 2010 was 56.4% while 75% of the population had access to improved sanitation in 2011.

In the study area, ground water (**Table (6.7)** and **Figure (6.3)**) is the main source of drinking water along with stored water from streams (**Figure (6.4)**). Water from the Heinze river is also used by villagers from Pyin Gyi to some extent for domestic use but not as drinking water. Filtering and boiling methods are both used to purify water from private or common wells which can be found in the villages. Water is available all year round except in Phet Taung during the dry season. Head of villages also confirmed that there has been no flood event in the recent years except for an accidental event linked to the mine located south of Kanbauk.

Table 6. 7 Source of Drinking Water in the Villages

Village	Surface water	Ground Water
Oo Bin Kwin	Mountain Torrent	Well
Pet Taung	--	Well
Pyin Gyi	--	Well
Kanbauk	Mountain Torrent	Well
Hle Gone	Mountain Torrent	Well
Mi Gyaung Auing	Mountain Torrent	Well

Figure 6. 3 Typical Ground Water Well

Figure 6. 4 Typical Stored Water

In general, Pour Flush Latrine is used as well as the dry pit latrine, flush latrine. Open defecation has been listed only in Phet Taung. Wastewater is discharged into the ground or in open streams.

The garbage and wastes are thrown to the stream, outside the villages, and within the compounds. Some are burned in the household compound and waste dump sites are also found in those villages.

6.5.4 Behavioral Factors

Behavioral factors, such as tobacco and alcohol use, diet and physical activity, are often seen as being key determinants of health.

In Myanmar, most of the population abstains from consuming alcohol. The World Health Organization estimates that approximately 92.1 percent of the population (over 15 years of age) abstains from drinking alcohol. The rate of abstinence is considerably higher in Myanmar when compared to other nearby countries.

Table 6. 8 Alcohol Use

Indicator	Population	Male	Female
Abstainers over past 12 months (15+)	92.1	87.6	96.2
Lifetime abstainers (15+)	84.1	91.1	76.5
Former drinks (15+)	8.0	11.1	5.2
Alcohol use disorders	1.5	2.7	0.5
Alcohol dependence	0.7	1.3	0.2

Source: Health Grove

In terms of the villages located in vicinity of the Project area (within the study area), drugs have been identified as an issue in Ohn Pin Kwin and Mi Gyaung Auing villages. Alcohol is consumed in Hle Gone and Pyin Gyi villages but have not been raised as problem by villagers.

Betel nut use is prevalent in most of the Project area villages. Chewing betel nut can have a number of health consequences, including discoloration of teeth and gums, mouth and stomach ulcers, gum disease, oral cancers, and heart disease. Tobacco is used by a small number of villagers in all the villages.

6.5.5 Healthcare Facilities

According to the Ministry of Health, in 2014, Myanmar had 1,056 public hospitals with a total of 56,748 beds (**Table (6.9)**). As of 2014, there were 31,542 doctors. This includes 13,099 doctors in the public sector and 18,443 doctors based in cooperatives/ private sector (**Table (6.10)**). These numbers are increasing regularly since 1988 due to investment made by the government to reach better health care standards.

In addition to existing health facilities, the use of traditional medicine exists, and often forms an integral part of the country's health services.

Table 6. 9 Health Facilities in Myanmar

Health Facilities	2010-2011	2011-2012	2012-2013	2013-2014
Hospitals (Public Sector)	924	987	1010	1056
Total No. of Hospital Beds	43,789	54,503	55,305	56,748
No. of primary and Secondary Health Centres	86	87	87	87
No. of Maternal and Child Health Centres	348	348	348	348
No. of Rural Health Centres	1,558	1,556	1635	1684
No. of school Health Teams	80	80	80	80
No. of Traditional Medicine Hospitals	14	14	16	16
No. of Traditional Medicine Clinics	237	237	237	243

Source: Ministry of Health 2016

Table 6. 10 Health Personnel in Myanmar

Health Manpower	2010-2011	2011-2012	2012-2013	2013-2014
Total No. of Doctors	26,435	28,077	29,832	31,542
- Public	10,927	11,460	12,800	13,099
- Co-operative &private	15,508	16,617	17,032	18,443
Dental Surgeon	2,562	2,770	3011	3219
- Public	813	848	802	782
- Co-operative &private	1,749	1,922	2209	2437
Nurses	25,644	26,928	28,254	29,532
Dental Nurses	287	316	344	357
Health Assistants	1.899	1,536	2013	2062
Lady Health Visitors	3,344	3,371	3397	3467
Midwives	19,556	20,044	20,617	21,435
Health Supervisor	2,621	2,330	2527	5650
Traditional Medicine Practitioners				

- Public - Private	890 5,737	885 5,867	875 5979	1048 5915

Source: Ministry of Health 2014

Most of the villages in the Project area do not have their own health care facility (**Table (6.11)**). Most of local people in Kanbauk village tract usually go to Kanbauk rural Healthcare center and private clinic. Yebyu General Hospital is used for difficult health issues.

Table 6. 11 Village Healthcare Facilities

Village	Description of Healthcare Facilities
Kanbauk	General Hospital Rural Health care centre Private clinic In case of an incident or serious disease, most people go to Yebyu Hospital. It is approximately a 2 hours' drive to Yebyu Villagers also use traditional medicine Pharmacy
Ein Der Ya Zar	Rural Health care centre In case of an incident or serious disease, most people go to Kanbauk or Yebyu Hospital. It is approximately a 2 hours' drive to Yebyu Villagers also use traditional medecine
Ohn Pin Kwin	Rural health centre Private clinic provided by Total In case of an incident or serious disease, most people go to Kanbauk or Yebyu Hospital. It is approximately a 2 hours' drive to Yebyu Villagers also use traditional medecine
Pyin Gyi	Private clinic provided by Total In case of an incident or serious disease, most people go to Kanbauk or Yebyu Hospital. It is approximately a 2 hours' drive to Yebyu Villagers also use traditional medicine Ambulance available Doctor and nurses come once a month
Other villages	No health centers In case of an incident or serious disease, most people go to Yebyu Hospital. It is approximately a 2 hours' drive to Yebyu Villagers also use traditional medicine Doctor and nurses come once a month

Source: ERM field surveys 2016

According to the public health officers, prevention and awareness are provided by Kanbauk Healthcare center but there is no plan to improve access to healthcare services in the area.

Child deliveries mostly take place at home with the assistance of the nurse and more rarely at the general hospital. Vaccinations are provided at birth and approximately 90% of newborns are vaccinated.

6.6 Economy And Livelihoods

In 2015, Myanmar's gross domestic product (GDP) was estimated to be $62.6 billion[21]. The per capita GDP was approximately $1,160 - one of the lowest in Southeast Asia and lower than the previous year.

Myanmar is in a transition from a centrally directed economy to a market-oriented economy. This has been supported by a reform program launched by the government in 2011.

6.6.1 Agriculture

Traditionally, Myanmar has been reliant on the agricultural sector (and to a lesser extent forestry and fishing). Even with recent effort to diversify, the agricultural sector still accounts for approximately 37% of GDP (as of 2014), while the services sector accounts for 41.6% and the industrial sector accounts for 21.3%[22].

It is estimated that, as of 2014, approximately 21.1 million people worked in the agricultural sector. This means that approximately 65.8% of the labour force is employed in the agricultural sector in Myanmar[23]. This includes a large number of people considered to be 'landless' - who work as seasonal farm labourers and migrate to urban areas during non-planting and /or harvesting times to find temporary employment. It also includes women – as women play a substantial role in crop production in farming households in Myanmar (in part because women are typically seen as responsible for meeting the food security needs of their families).

Approximately half of all agricultural land in Myanmar, representing approximately 20% of land area, is devoted to cereal crops, such as rice. Other agricultural products include beans, sesame, groundnuts, sugarcane, and hardwood.

The Myanmar Government has 170 irrigation projects across the country - covering an area of approximately 928,599 ha. The Tanintharyi Region has only one government irrigation project and the percentage of beneficial area is not known (**Table (6.12)**).

Table 6. 12 Government Irrigation Projects

State/Division	Government Irrigation Projects	Beneficial Area (ha)	Percentage of Beneficial Area
Kayah	2	1,275	0.14
Kayin	1	40	0.01
Chin	1	202	0.02
Sagaing	18	149,714	16.12
Tanintharyi	**1**	**Water Supply**	**-**
Bago	40	253,731	27.32
Magway	31	118, 712	12.78
Mandalay	42	135,392	14.58
Mon	7	25,820	2.78
Rakhine	4	182	0.02
Yangon	14	90,449	9.74
Shan	2	44,858	4.83

[21] The World Bank databank: http://data.worldbank.org/country/Myanmar

[22] CIA World FactBook Website. Data from 2015. Consulted Feb 2017

[23] Myanmar country profile. FAO. 2015.

Ayeyarwady	7	108,224	11.66
Total	**170**	**928,599**	**100.00**

Source: FAO AQUASTAT Survey 2011

The agricultural sector is the primary employer in the Project area (**Table (6.13)**). Some people are self-employed (i.e. produce crops on their own land), while others earn money as day laborers.

Table 6. 13 Income from Agriculture

Village	Income* Kyats / year
Kanbauk	3,700,000
Mi Gyaung Aling	3,525,000
Phet Taung	560,000
Hle Gone	1,600,000
Pyin Kyi	1,000,000
Oo Bin Kwin	2,580,000

*Average income per Household

Source: ERM field surveys 2016

The crops cultivated in Ye Byu Township are paddy, sesame, crane and corn. In addition, rubber, oil palm, betel and coconut are cultivated as long-term plantation.

The main cash crops are rubber, betel, palm, cashew, jack fruit, rambutan, cane and durian. Other crops are pineapple and pepper. Cashew and betel nuts are sold at Dawei Market. Most of the household also own an orchard but few own a paddy rice field.

Source: ERM field surveys 2016

Figure 6. 5 Agricultural Practices in the Project Area

Both men and women are actively involved in crop production in the Project area villages – either running their household crop production activities or taking up roles as day laborers.

(Crop production is led by women in some instances.) For day laborers, men tend to earn more (on average 1,000 kyats more) per day when compared to women.

6.6.2 Livestock

In addition to crops, livestock rearing is another source of income in Myanmar. A variety of animals are raised, including duck, cattle, water buffalo, goats, sheep, chickens, and pigs. In 2014/2015, duck was the most commonly raised livestock, with 18.3 million, followed by cattle and chicken.

In the Tanintharyi Region, the most commonly raised livestock is duck, followed by chicken (**Table (6.14)**).

Table 6. 14 Livestock Population by State and Region (2014-2015)

No.	State /Region	Number of Animal Population in lakh (100,000 unit)							
		Buffalo	Cattle	Sheep/ Goat	Pig	Chicke n	Duck	Turkey/ Geese/ Muscovy	Quail
1	Nay Pyi Taw	0.68	2.29	-	0.14	2.32	0.86	0.05	-
2	Kachin	2.67	3.58	-	0.62	8.9	2.61	0.56	-
3	Kayah	0.34	0.9	-	0.03	1.24	0.2	0.08	-
4	Kayin	0.92	3.56	-	0.82	3.7	3.4	0.47	-
5	Chin	0.48	1.68	-	0.94	3.58	0.35	0.09	-
6	Sagaing	4.67	23.99	2.07	3.69	11.15	2.85	0.6	3.95
7	Tanintharyi	**1.55**	**1.58**	**-**	**0.35**	**2.05**	**5.17**	**0.29**	**-**
8	Bago	3.12	14.91	-	0.64	9.68	71.75	1.36	-
	Bago (East)	2.59	7.42	-	0.3	6	63.03	0.81	-
	Bago (West)	0.53	7.49	-	0.34	3.68	8.72	0.55	-
9	Magway	1.49	26.07	5.73	24.43	25.64	2.96	0.15	-
10	Mandalay	0.7	21.86	2.36	10.9	6.74	4.45	0.57	3.97
11	Mon	0.91	4.9	-	1.05	3.88	14.4	0.8	-
12	Rakhine	3.88	11.02	-	3.11	3.13	3.64	1.27	-
13	Yangon	1.52	6.34	-	1.01	10.51	31.74	2.48	2.72
14	Shan	7.91	14.93	-	0.86	18.17	4	0.72	0.2
	Shan (South)	3.2	7.89	-	0.21	5.11	1.29	0.43	-
	Shan (East)	1.57	1.45	-	0.19	3.14	1.73	0.11	-
	Shan (North)	3.14	5.59	-	0.46	9.91	0.97	0.18	0.2
15	Ayeyarwady	2.34	12.33	-	1.05	14.98	34.94	3.79	0.18
16	**Union**	**33.18**	**149.93**	**10.16**	**49.65**	**125.67**	**183.32**	**13.28**	**11.02**

Source: Livestock Sector, Ministry of Livestock, Fisheries and Rural Development

In terms of the Project area, villages raise a variety of livestock, including pig, goat, duck, buffalo, sheep and poultry. However, more households are involved in crop production, than livestock rearing and even more in fishing.

In many instances the livestock are reared for personal consumption and in limited occasion, sold to the market. Both men and women are involved in the rearing of livestock. This includes fodder collection, dung cake preparation, milking and selling of milk or taking it to cooperatives, and vaccination and other veterinary services.

Figure 6. 6 Village Livestock Practices

6.6.3 Forestry

Approximately 48% of Myanmar was covered by forest in 2011, but According to the FAO, between 2010-2015, Myanmar lost 3.2 million hectares of forests, about 10.8 per cent of its forest cover. In 2011, the forestry sector contributed approximately 0.5% to GDP, and employed approximately 36,000 people but the government has agreed a temporary national logging ban between August 2016 and March 2017, closing the forests for one complete logging season.

The Myanmar Timber Enterprise (MTE), a government-owned company, manages the timber industry within the country. The focus is largely on teak and other hardwoods.

The dragging of logs is done mainly by elephants and, to a lesser extent, water buffalo. This process is referred to as skidding. The use of animals in log extraction is considered to have a lower impact on the environment than other methods.

In addition to the timber industry, many people in rural areas of Myanmar are dependent on forest products, especially for fire wood and fodder for livestock. Often poorer farmers and agricultural labourers supplement their incomes by cutting wood for fuel.

According to the land Record Department, the majority of the Yebyu Township is covered by forest land with 527,883 acres of forest reserves. Gurjan, Karen wood, Dropping fig, Shiral, Dog fruit, Kalod, Bumese ironwood are the species the most commonly observed.

There is no forest reserve in the villages located in the study area and no villages have declared being involved in the forestry activity. The collection of forest products on the other hand is widely developed for household consumption in particular to collect wood for cooking. Villagers in the study area use wood for cooking. The wood is collected from areas close to the villages – e.g. nearby agricultural properties.

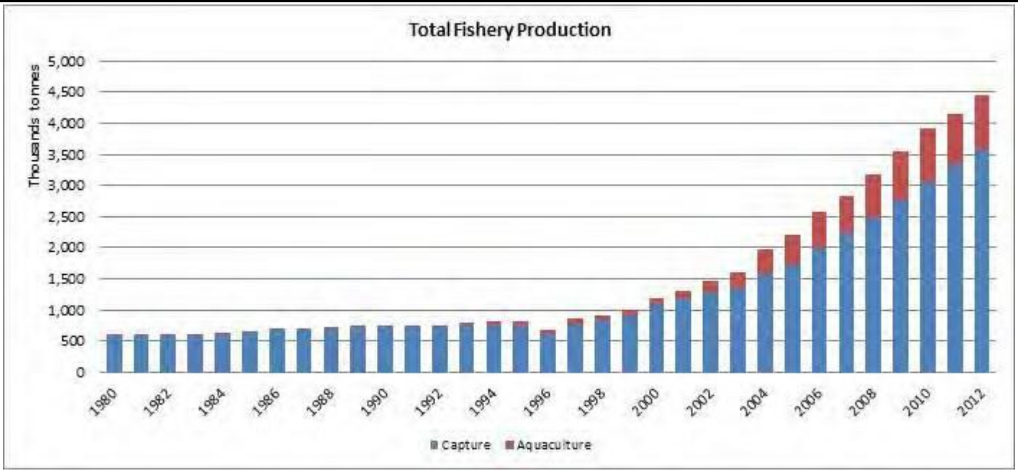
6.6.4 Fisheries

The fishing industry contributes approximately 8% to GDP. The industry is separated into three components – inland fisheries, marine fisheries and aquaculture. The marine sector makes up approximately 52% of the industry, followed by inland fisheries (28%) and aquaculture (20%).

Myanmar's total fish production was estimated at 3.84 million tonnes in 2010 (**Figure (6.7)**). Capture fisheries contributed 3.06 million tonnes and aquaculture 0.78 million tonnes. Some 32,920 fishing vessels were reported of which 52 percent were not equipped with an engine.

The fishery and aquaculture sector provided direct employment to 3.16 million people, 22 percent full-time jobs and the rest part-time and occasional works[24].

Fisheries exports were valued at USD 497 million in 2010. Although the volume of fishery exports has steadily increased since Cyclone Nargis in 2008, per unit export prices have fallen following the global financial crisis.



Source: Ministry of Livestock and Fisheries 2014

Figure 6. 7 Total Fishery Production

Fishery products are a staple diet, a major source of animal protein and its per capita consumption of 42.5 kg/year in 2007 is one of the highest in the world. It is anticipated that approximately 10-15% of monthly household expenditure for food is on fish or fish products.

Even though fishing is popular in some villages in the study area, it is generally not the primary livelihood in the study area. Fishing is significant especially in Pyin Gyi, Mi Gyaung Auing and Oh Pin Kwin and mainly takes place in Heinze river. The types of boats used in fishing are usually 5 metres long and the motor capacity is 5/6 hp. The boats' carrying capacity is about 300 kilos. Gillnetting, Drift Netting, Hook and Line, Hand and Crab trap are widely used for fishing in the studied area.

The major fish species caught in the study area are Lobster, Crab, Catfish, Mullet, Croaker, Snapper, Indian Pike Conger, Cuttlefish and Shrimp/Prawn. Fishing is performed in September, October, November, December, January, February, March, April and May but not in rainy season like June, July, August. Fishermen have to hold fishing license distributed from Ministry of Fisheries and Livestock but there is no tax paying for fishing.

[24] Fishery and Aquaculture Country Profiles: The Republic of the Union of Myanmar. FAO. 2012

Source: ERM field survey, 2016

Figure 6. 8 Fishing Practices in the Study Area

6.6.5 Industry

The key industries of Myanmar are: agricultural processing; wood and wood products; copper, tin, tungsten, and iron; cement and construction materials; pharmaceuticals; fertilizer; oil and natural gas; garments; and gems (CIA 2017). Many of the industries that exist or are being developed in the Myanmar are directly related to the availability of Myanmar's natural resources, such as oil and gas, copper, and tin.

In terms of the Project area, although the majority of people are involved in the agricultural sector, a small number of people own and operate businesses. This includes a range of shops – like restaurants, sewing, hair dressing and beauty salon.

South of Kanbauk is a tin and tungsten mine operated by Delco. The mine has been in operation since 1911 but was fully acquired and privatized in 2007.

Figure 6. 9 Local Businesses

6.7 COMMUNITY INFRASTRUCTURE AND PUBLIC SERVICES

The limited access to and the poor state of existing infrastructure and services have been identified as impediments to development in Myanmar. This includes the provision of basic health and education services, as well as other infrastructure such as roads, telecommunications, drinking water and waste management (World Bank 2015).

The following section provides an overview of key existing infrastructure and services. (Note that healthcare infrastructure and drinking water and sanitation are covered in the section on community health.)

6.7.1 Education and Schools

As of 2014, the adult literacy rate in Myanmar was 92.8%. However, the rate differs between men and women – with literacy being higher amongst males. The male literacy rate is 95%, while the literacy among females is 90.7%[25].

The literacy rate in the Tanintharyi Region was 92.8% in 2014. Again, the rate was higher amongst males (94.5%) when compared to females (91.2%). These rates are lower than Yangon, which has a literacy rate of 96.6% - the highest in the country.

The Tanintharyi region had 1007 primary schools, 142 middle schools and 102 high schools in 2014-2015. The literacy rate for youth of 15 to 24 years of age is higher than overall literacy rate at 95.8% with a higher rate amongst female than male.

In the Region, the net enrolment ratio in primary school in 2010 was 85.2% (with a completion rate of 72.3%) and in middle school 54.5%. This can be partially explained by the drop in

[25] United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics

proportion of population with access to a secondary school compare to primary school, from 70.8% to 36.5%.

Aside from Pet Taung, every village in the study area has a primary school. Only one high school is available at Kanbauk.

Figure 6. 10 Village Schools

In most instances, villagers obtain a primary school education, while some continue on to middle school and/ or high school. A small number of villagers have obtained a university education.

6.7.2 Waste Management

In Myanmar, it is anticipated that approximately 0.45 kilograms of waste is produced per capita per day[26]. This includes organic waste, commercial waste and paper and plastic waste.

It is estimated that nearly 65% of the waste generated is organic waste. This is attributed to the size of the agricultural sector, as the agricultural sector largely generates organic waste.

In most major cities – such as Yangon – household waste is collected and disposed of for a small fee. However, outside major cities, waste disposal is typically the responsibility of the household. In both instances, solid waste is often disposed of at open dump sites, in other words uncontrolled sites. In a small number of cases, composting and recycling is carried out.

In terms of waste in the study area, wastewater is largely directed back into the ground (**Figure (6.11)**) or into the nearest stream. Solid waste disposal is the responsibility of each household. Specific disposal areas exist in Kanbauk, Hle Gone and Mi Chaung Aing but there is no collective system or collect organised. Burning within the compound, dump in waste dump site or discharge into the nearest stream are common practice. (**Figure (6.12)**).

[26] Solid Waste Management in Least Developed Asian Countries – A Comparative Analysis. Glawe et al. 2004

Figure 6. 11 Wastewater Discharge

Figure 6. 12 Solid Waste Disposal

6.7.3 Electricity and Energy

In Myanmar, most of the population is reliant on firewood for cooking (**Table (6.15)**). This practice is contributing to the increasing rates of deforestation seen within the country.

Table 6. 15 Access to Energy

Source	Cooking	Source	Lighting
Electricity	16.4%	Electricity	32.4%
LPG	0.4%	Kerosene	8.1%
Kerosene	0.2%	Candle	20.7%
Biogas	0.3%	Battery	17.0%
Firewood	69.2%	Generator	9.3%
Charcoal	11.8%	Water mill	1.6%
Coal	0.3%	Solar system	8.7%
Other	1.4%	Other	2.2%

Source: The 2014 Myanmar Population and Housing Census

In terms of lighting, a range of sources are available. The most commonly used are electricity, candle, and batteries. The access to electricity is likely to change in the future given the investment that the Myanmar government is making in the power sector; a number of new power plants are being developed in order to provide an increasing number of people with electricity.

Most of the household in the study area have access to the electricity. Among these almost half of them get 24 hours service. Some villages only get electricity for 3 hours while the norm seems to be 10 hours per day. However, electricity shortage occurs frequently especially in the peak time during summer. For domestic energy, most of the household use gas and charcoal. People can purchase gas at Kanbauk and for charcoal they can buy the charcoal within the village which is imported from Min Thar Village.

Table 6. 16 Village Energy Sources

Village	Description of Energy Sources
Kanbauk	Electricity, Charcoal, Gas
Mi Gyaung Auing	Electricity, Charcoal, Gas, Wood
Pyin Gyi	Electricity, Charcoal, Gas, Wood
Phet Taung	Charcoal, Wood, Candle, Solar
Hle Kone	Electricity, Charcoal, Gas
Ohn Pin Kwin	Electricity, Charcoal, Gas, Wood
Kanbauk	Electricity, Charcoal, Gas
Mi Gyaung Auing	Electricity, Charcoal, Gas, Wood

Village	Description of Energy Sources
Pyin Gyi	Electricity, Charcoal, Gas, Wood
Phet Taung	Charcoal, Wood, Candle, Solar
Hle Kone	Electricity, Charcoal, Gas
Ohn Pin Kwin	Electricity, Charcoal, Gas, Wood
Kanbauk	Electricity, Charcoal, Gas

Source: ERM field surveys 2016

Source: ERM Field survey 2016

Figure 6. 13 Village Energy Sources

6.7.4 Transportation

A variety of transport methods are used in Myanmar, including roads, rail, air and water. In some areas the modes of transport are well developed, while in other areas they are quite limited.

South Myanmar, where the Project is located, has a poorly developed transport system but which is being improved. In terms of roads, most urban areas in Myanmar are accessible only by road. However, nearly half of all roads are not passable during the monsoon season (World Bank 2015) – limiting access to key areas within the country.

Traffic accidents in Myanmar increased between 2013 and 2014 (**Table (6.17)**). The overall number of accidents, injuries and fatalities in 2014 were 10,818, 18,621 and 3,064 respectively. For the Tanintharyi Region, the statistics are 252, 406 and 97 respectively.

Table 6. 17 Road Traffic Accidents by States and Regions in Myanmar (2013-2014)

No.	State/Region	2014 January to October			2013 January to October		
		Accident	Injury	Fatality	Accident	Injury	Fatality
1.	Naypyitaw	279	472	143	306	450	172
2.	Kachin	352	507	136	259	445	109
3.	Kayah	102	140	33	95	150	20
4.	Kayin	313	629	96	294	537	62

No.	State/Region	2014 January to October			2013 January to October		
		Accident	Injury	Fatality	Accident	Injury	Fatality
5.	Chin	69	146	30	57	109	24
6.	Sagaing	1,241	2,302	312	530	881	144
7.	Tanintharyi	252	406	97	3,16	624	76
8.	Bago	1,163	2,193	340	1,208	2,108	288
9.	Magway	923	2,060	221	785	1,610	179
10.	Mandalay	1,116	1,960	354	988	1,603	300
11.	Mon	434	712	193	456	723	203
12.	Rakhine	263	465	76	215	334	69
13.	Yangon	2,295	3,231	425	2,177	3,210	324
14.	Shan	401	742	137	341	665	106
15.	Shan (Lashio)	307	402	169	235	396	84
16.	Shan (Kyaington)	137	287	73	139	257	65
17.	Ayeyarwady	1,171	1,967	229	875	1627	190
	Total	10,818	18,621	3,064	9,276	15,729	2,415

Source: Road Transport and Administration Department 2014

In terms of modes of transport, the most commonly owned vehicles are motorcycles and bicycles, with higher levels of ownership in urban areas compared to rural areas (**Table (6.18)**).

Table 6. 18 Vehicle Ownership

Method	Total	Urban	Rural
Car/ truck/ van	3.1%	8.1%	1.2%
Motorcycle/ moped	38.7%	41.2%	37.7%
Bicycle	35.9%	46.9%	31.7%
4-Wheel tractor	2.5%	1.4%	2.9%
Canoe/boat	3.9%	0.6%	5.1%
Motor boat	2.25%	0.5%	2.8%
Cart	21.6%	2.5%	29.1%

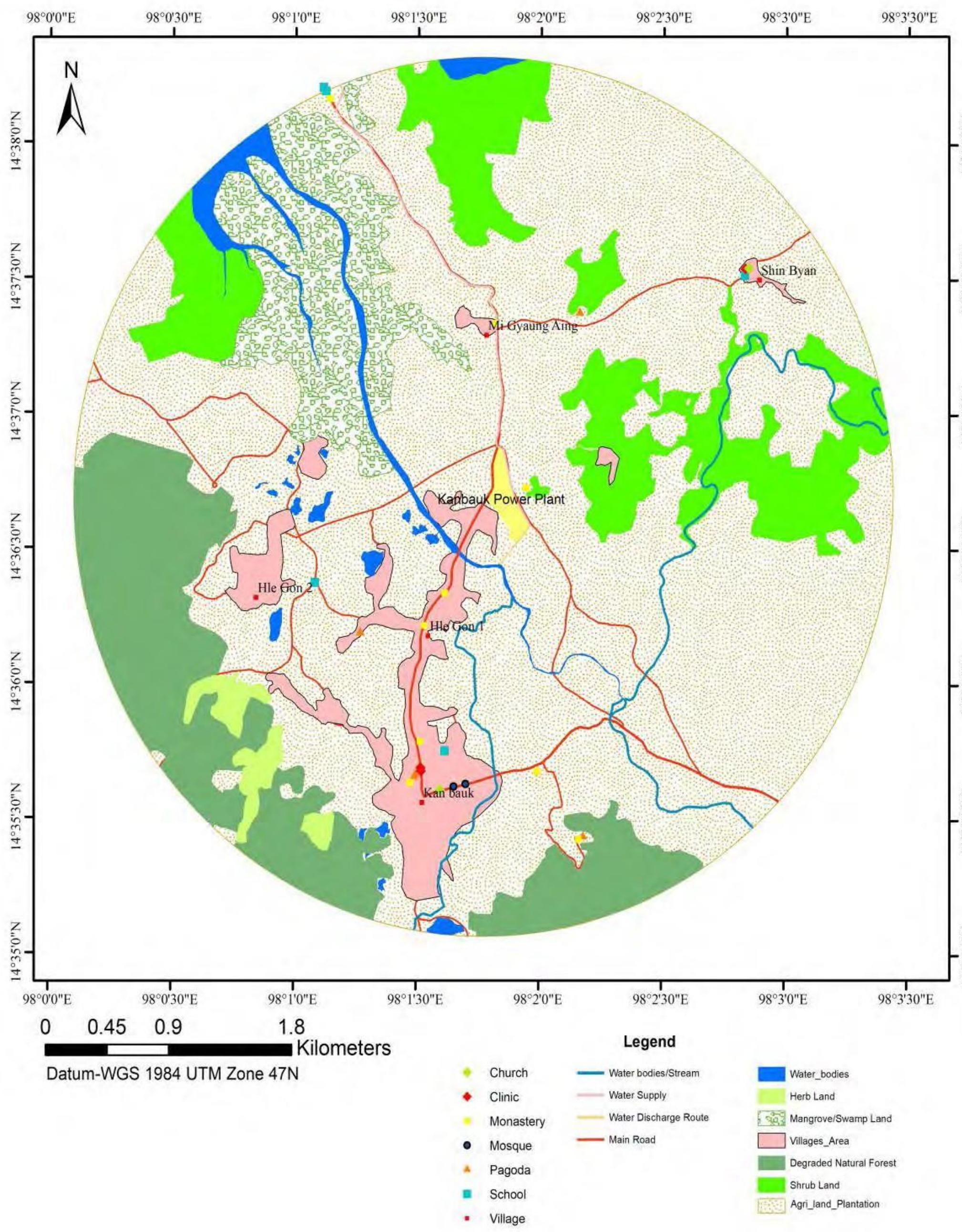
Source: Road Transport and Administration Department 2014

Within the Project area, the main transportation mode is motorbike. Moreover, there are shuttle buses not only to other villages but also to Dawei. Most of the respondents travel to other villages almost every day. The roads in the study area are well maintained except the road between Kanbauk and Pet Taung.


Figure 6. 14 Village Vehicle Ownership

6.8 LAND USE

Land use information was collected within a 3km buffer zone around the proposed Project site as shown in **Figure (6.15)**.



Source: ERM field survey 2017

Figure 6. 15 Land Use Mapping Around Proposed Project Site

Most of the land area occupied within the study area is agricultural land which comprises approximately 60% of total land use. The agricultural land is mainly represented by plantation and in particular rubber tree plantation. Degraded natural forest, shrub land and mangrove cover approximately 25% of the study area, the last 15% being occupied by constructed area.

The area along the water intake pipeline is only agricultural land with the exception of constructed area at the crossing of the road to Shin Byan while land around the water intake facility is a mix of agricultural land (young rubber trees and palm plantation), mangrove and water body, with a couple of houses and a monastery located in close proximity.

The Project site for the CCPP itself is partially a brownfield (50% of the land is already modified and/or occupied by constructions). Approximately 25% is still covered with shrubs, the rest having been already cleared of vegetation.

6.9 CULTURAL HERITAGE

This section provides an overview of the cultural heritage resources known to be present or potentially located in the Study area. The Protection and Preservation of Cultural Heritage Regions Law (PPCHRL), which was amended in 2009, is the principal piece of cultural heritage legislation in Myanmar. The PPCHRL defines cultural heritage as an ancient[27] monument or ancient site that is required to be protected and preserved by reason of its historical, cultural, artistic, or anthropological value. This includes:

- Archaeological resources (e.g. sites, artifacts, ruins);
- Ancient above ground resources (e.g. monuments, buildings, structures, and facilities over 100 years old); and
- Living heritage sites (e.g. temples, Pagoda, cemeteries, shrines, and sacred sites).

6.9.1 Archaeological Sites

Archaeological sites are places (or groups of physical sites) in which evidence of past activity is preserved. Research in the Tanintharyi region has identified archaeological sites dating from up to the 8th Century. However, none of the identified archaeological sites are located within the study area. This was supported by the site visit, which did not identify any standing or ruined buildings, structures, or walls indicative of a large, complex archaeological site within the study area. The study area has been modified (e.g. used for plantations or buildings and roads), which reduced the chance of finding archaeological sites. In addition, the presence of buried pipeline increases the chances of archaeological sites having already been discovered by these previous projects.

6.9.2 Ancient Above Ground Resources

Ancient above ground cultural heritage resources are immovable structures, groups of structures, monuments, or facilities with historic and/or artistic value to stakeholders. Historic significance can stem from association with important persons, events, or periods in local, regional, or national history. Artistic importance can result from the form, uniqueness, aesthetic value, or association with a local, regional, or nationally important artist.

Examples of ancient above ground resources include temples, stupas, mosques, churches, places and government buildings, residential buildings, commemorative monuments or markers, infrastructure such as roads and bridges, city-walls, moats and forts, and artificial landscape features irrigation canals and ponds. No ancient above ground resources were found in the study area through the desk-based study or site visit.

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[27] "Ancient" is defined by the Protection and Preservation of Cultural Heritage Regions Law, as amended, as any monument or site over 100 years old at the time of its investigation or evaluation by the Department of Archaeology

6.9.3 Living Heritage Sites

Living heritage sites are structures or natural features that are part of a living cultural tradition. These often include structures, buildings, important locations, or natural landscape features that have religious, sacred, ritual, or cultural significance to stakeholders. Potential types of living heritage sites in the study area include: churches, mosques, cemeteries, temples, shrines, pilgrimage sites, ritual sites, stupas, and monasteries.

Since the majority of the population in Myanmar practices Buddhism, including those living in the villages in the study area, Buddhist living heritage sites are type of living cultural heritage sites most likely to be found in the study area. The Buddhist stupa, also known as pagoda, is one of the most common types of living cultural heritage sites found across Myanmar. There are four principal types of stupas:

- Sarirka: stupas containing body relics of the Buddha, his disciples, or arahants;
- Paribhagika: stupas housing objects used by the Buddha or his disciples;
- Votive: stupas erected by mostly wealthy devotees; and
- Uddesika: stupas built on locations of significant events in the Buddha’s life.

In addition to stupas, Buddhist phayas or temples and monasteries are commonly found in Myanmar. Similar to stupas they can be located either within population centers or in more isolated locations associated with significant places or landscape features. Depending on their age, temples and monasteries may also represent ancient above ground resources.

There are a number of pagodas and monasteries in the Project area. There is also a Mosque and a Hindu temple in Kanbauk, a Church in Shin Byan and one in Ein Da Rar Zar.

Table 6. 19 Religious Building in the Study Area

Village	Pagoda	Monastery	Hindu Temple	Church	Mosque
Oo Bin Kwin	2	1			
Pet Taung	1	1			
Pyin Gyi	1	1			
Kanbauk	1	4	1		1
Hle Gone	1	1			
Mi Gyaung Auing	5	2			
Shin Byan				1	
Ein Da Ra Zar				1	

The monasteries are open throughout the day and worshipers are able to visit and perform rites at any time.

Source: ERM field survey 2016

Figure 6. 16 Living Cultural heritage of Villages within the Study Area

6.9.4 Intangible Cultural Heritage

A range of national festivals and ceremonies (i.e. intangible cultural heritage) are held throughout Myanmar. Examples include the Water Festival and Myanmar New Year. Pagoda complexes and monasteries are often at the center of these festivals and ceremonies.

During interviews with local population in the study area during the social baseline, it was described that there are a number of religious festivals such as Pouring water at the Sacred Banyan Tree Festival which is usually held in the Full Moon Day of Kason (May), Float Down Alms Bowls Festival which refers to Shin Upagutta in the Full Moon Day of Thadingyut (October) and the Procession of 28 Buddha Images Festival.

CHAPTER 7 IMPACT ASSESSMENT METHODOLOGY

7.1 INTRODUCTION

This Chapter presents the methodology used to conduct the EIA. The EIA methodology follows the overall approach illustrated in Figure 7.1. The EIA has been undertaken following a systematic process that evaluates the potential impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment; identifies preliminary measures that the Project will take to avoid, minimize/reduce, mitigate, offset or compensate for potential adverse impacts; and identifies measures to enhance potential positive impacts where practicable.

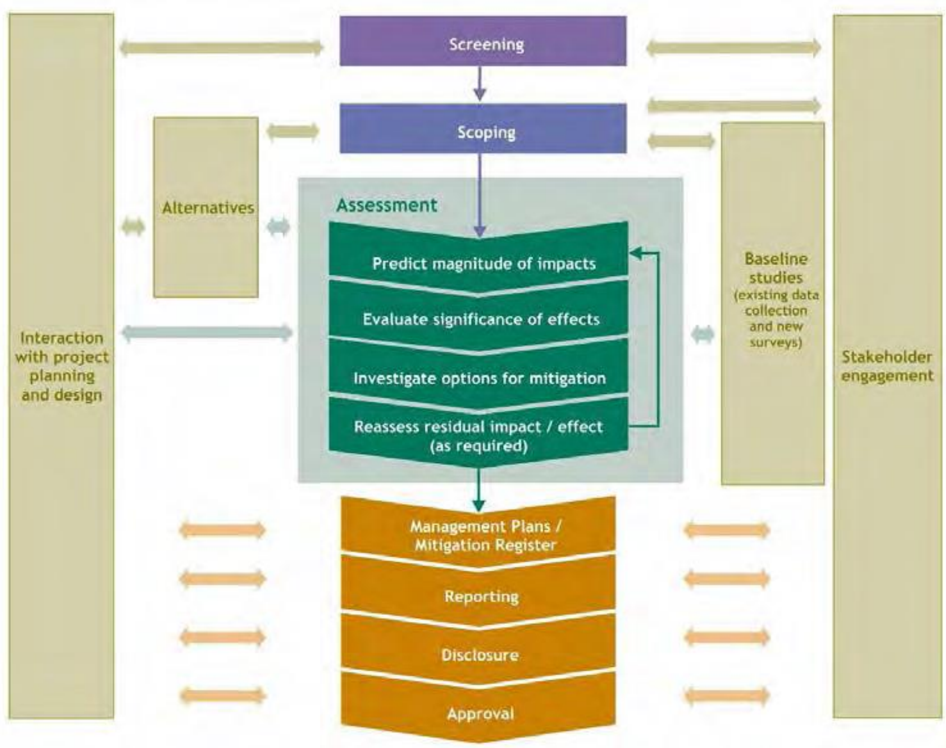

Figure 7. 1 Overall Impact Assessment Process

This section also details the methodology applied in the collection and analysis of primary and secondary data used in this report. Primary and secondary information from MUPA, government sources, non-government organizations (NGOs) and other Project-related stakeholders have been collected to support the preparation of this report.

7.2 SCREENING

At the initial stage of the EIA, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilizing a high-level description of the Project and its associated facilities.

7.3 SCOPING

The Scoping study was undertaken as a means to ensure that there is a focus on the issues that are most important for Project planning, decision-making and stakeholder interests. During the scoping study, potential interactions between the Project, environmental and human resources/receptors were identified, and prioritized in terms of their potential to cause impacts of concern. Table 7.1 presents the resources/receptors considered in the scoping stage, together with the changes that might indicate a potential Project-related impact.

In addition, it shall be noted that the Scoping Report for this Project has been prepared and submitted to ECD on 27th December 2016.

Table 7. 1 Resources/Receptors and Potential Impacts Considered in Scoping

Resources/ Receptors	Changes that May Indicate Potential Impacts
Environmental	
Geology	Changes to geology, geomorphology, topography
Soil	Changes to physical and chemical properties and soil ecology
Surface Water	Changes to physical, chemical or biological quality of rivers and other surface water bodies; Introduction of exotic species, changes in habitat quality, abundance, diversity; Effluent discharge
Groundwater	Contamination of shallow or deep groundwater resources, change in ground water resources
Fisheries	Changes in fisheries productivity
Vegetation	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species, food chain effects
Wildlife	Changes to wildlife assemblages, impact on endangered and economic species, food chain effects
Air	Emissions of NOx, SOx, PM, CO, VOC, greenhouse gases (CO_2, CH_4, and N_2O), ozone, TSP etc.
Noise and Vibration	Change in noise or vibration levels
Aesthetics	Physical presence of facilities, increased night time light
Waste	Generation of wastes – hazardous and non-hazardous
Social/ Socio-Economic	
Population and physical displacement	Changes in total population, gender ratio, age distribution. Physical displacement from residence as a result of Project land take, or activities
Social and Cultural Structure	Disruption in local authority and governance structure; change in social behaviours; alterations to social and cultural networks; intra and inter-ethnic conflict
Economy and employment	Change in national/local economy, employment, standard of living, occupation

Resources/ Receptors	Changes that May Indicate Potential Impacts
Resource ownership and use	Temporary or permanent restriction for accessing or using land or water, changes in livelihood activities based on natural resources; changes in ownership of such resources.
Cultural Resources	Physical disturbance of shrines, burial grounds, archaeological resources or other desecration or change in access to cultural resources, rituals or celebrations carried out in their premise.
Education and skills	Change in availability or quality of education or skills provision, supply and demand in certain skill sets etc.
Infrastructure and public services	Improvement or pressure on existing urban/rural infrastructure or services including: transportation; power, water, sanitation, security, waste handling facilities etc.
Community Health and Safety	
Mortality and Key Health Indicators	Change in the mortality profile of the community; changes in life expectancy, birth rates, death rates, maternal mortality rates etc.
Environmental Change	Decreased air quality (e.g. NOx, SOx, VOC, CO, PM), contamination of surface waters and potable ground water, increased vibration and noise, increased night time light beyond acceptable limits, changes to the visual environment.
Communicable and Non-Communicable Diseases	Change in incidence and /or prevalence of communicable and non-communicable diseases or disease-causing factors
Vector Borne Diseases	Changes in the incidence and or prevalence of vector borne diseases, the density of these vectors and their breeding grounds.
Sexually Transmitted Diseases	Changes in the incidence and /or prevalence of sexually transmitted diseases and the factors that contribute to this (external workforce, transport routes etc.)
Nutritional Status	Changes to nutritional status and food security
Health Care/ Recreational Facilities	Changes in availability of and access to health care and recreational facilities including green space
Psychosocial /Lifestyle Factors	Drug use/abuse, prostitution, communal violence, crime, suicide and depression; changing expectations of quality of life
Community Safety	Risk to community safety from gas leaks from the gas supply pipeline

7.4 Project Description

In order to set out the scope of the Project features and activities, with particular reference to the aspects which have the potential to impact the environment, a Project Description has been prepared. Details of the Project facilities' design characteristics, as well as planned and possible unplanned Project activities, are provided in Chapter 4 of this EIA Report.

7.5 Baseline Conditions

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social / socio-economic and cultural conditions that would be expected to prevail in the absence of the Project is presented. The Baseline includes information on all resources/receptors that were identified during scoping as having the potential to be significantly affected by the Project.

The baseline characterization is reported in Chapter 5 and Chapter 6 of this Report.

7.6 Stakeholder Engagement

An effective EIA Process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be considered in the prediction and evaluation of impacts.

Stakeholder Engagement activities have been undertaken for this Project and these are presented in Chapter 20 of this Report.

7.7 Assessment

Impact identification and assessment starts with scoping and continues through the remainder of the EIA Process covering all phases of the Project from Pre-construction to post-closure. The principal EIA steps are summarized in Figure 7.2 and comprise:

- **Impact Prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;
- **Impact Evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;
- **Mitigation and Enhancement:** to identify appropriate and justified measures to mitigate potential negative impacts and enhance potential positive impacts; and
- **Residual Impact Evaluation:** to evaluate the significance of potential impacts assuming effective implementation of mitigation and enhancement measures.

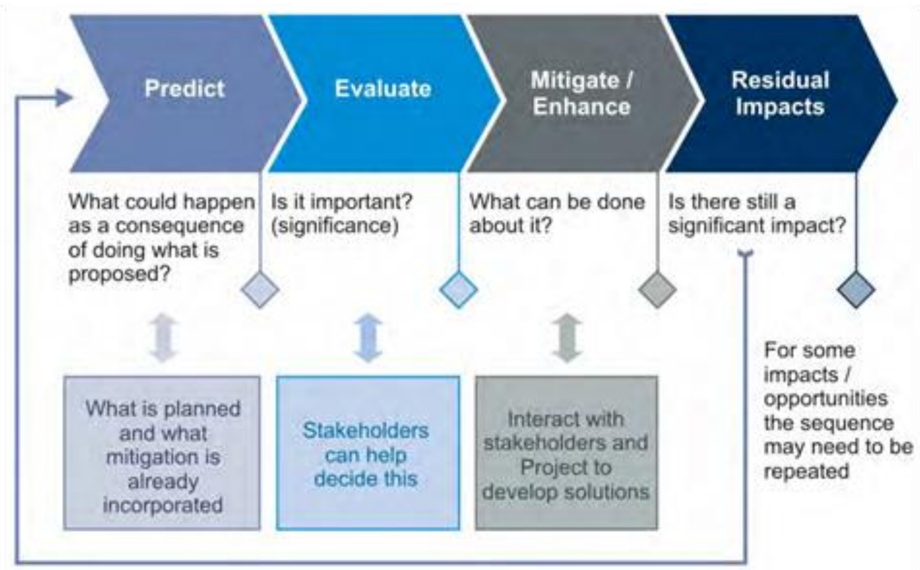

Figure 7. 2 Impact Assessment Process

7.7.1 Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse range of potential impacts considered in the EIA process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

7.7.2 Evaluation of Impacts

Once the prediction of potential impacts is complete, each potential impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology and designations used to describe impact characteristics are shown in Table 7.2**.**

Table 7. 2 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the potential impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the potential impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The time period over which a resource / receptor is potentially affected.	Temporary Short-term Long-term
Scale	The size of the potential impact (e.g., the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.).	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the potential impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the *type* designations are shown in Table 7.3**.** Definitions for the other designations are resource/receptor-specific, and are discussed in the resource/receptor-specific impact assessment chapters presented later in this Report.

Table 7. 3 Impact Type Definitions

Type	Definition
Direct	Potential impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Potential impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).

Type	Definition
Induced	Potential impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood*. The *likelihood* of an unplanned event occurring is designated using a qualitative scale, as described in Table 7.4.

Table 7. 4 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

Once impact characteristics are defined, the next step in the impact assessment phase is to assign each potential impact a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (for unplanned event).

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the potential impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor. The universal magnitude designations are:

- Positive;
- Negligible;
- Small;
- Medium; and
- Large.

In the case of a potential *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the EIA to indicate that the Project is expected to result in a potential *positive* impact, without characterizing the exact degree of positive change likely to occur.

In the case of potential impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilized. However, the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterizing the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity/vulnerability/importance of the impacted resource/receptor. There are a range of factors to be considered when defining the sensitivity/vulnerability/importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered, such as legal protection, government policy, stakeholder views and economic value. As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis.

The sensitivity/vulnerability/importance designations used herein for all resources/receptors are:

- Low;
- Medium; and
- High.

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterized, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in Table 7.5.

Table 7. 5 Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/importance designations that enter into the matrix. Table 7.6 provides a context for what the various impact significance ratings signify.

It is important to note that impact prediction and evaluation consider any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the EIA Process). This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Table 7. 6 Context of Impact Significances Box A: Context of Impact Significances

- An impact of **negligible** significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
- An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
- An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its' effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
- An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of EIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholder to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

7.7.3 Identification of Mitigation and Enhancement Measures

Once the significance of a potential impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this EIA, ERM has adopted the following Mitigation Hierarchy:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);
- **Abate on Site:** add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping);
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site);
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures; and
- **Compensate in Kind, Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries

access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the potential impact (i.e., to avoid or reduce the magnitude of the potential impact from the associated Project activity), and then to address the resultant effect to the resource/ receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

7.7.4 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the EIA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

7.8 Management, Monitoring And Audit

The final stage in the EIA Process is definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A Register of Commitments, which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/health performance for the Project, is also included as part of this report (Chapter 19). The Register of Commitments includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

CHAPTER 8 AIR QUALITY

8.1 Introduction

This air quality impact assessment considers the potential impacts on ambient air quality as a result of the construction, operation and decommissioning of the proposed 200MW Combined Cycle Power Plant (CCPP) and its associated infrastructure including the water intake pumping station, water treatment facility, and the water intake pipeline.

The assessment of potential air quality impacts associated with the development considers:

- sources, nature and quantity of emissions to air;
- detailed atmospheric modelling of process emissions;
- assessment of impacts on air sensitive receivers; and
- management, mitigation and monitoring measures needed to make sure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP) for the Project.

The air quality impact assessment has been undertaken in line with guidelines set out by the International Finance Corporation (IFC) and in line with international best practice as advocated by the IFC guidance.

8.2 Assumptions And Limitations

The assessment of potential impacts related to Air Quality in this section is based on the environmental baseline data (presented within Chapter 5), and the information available from the Project Proponent at the time of writing. Judgements and assumptions, where necessary, have been made based on professional knowledge and experience.

8.3 Assessment Methodology

8.3.1 Overview

As discussed in Section 8.1, the IFC Environmental, Health and Safety (EHS) standards and guidelines are considered throughout the assessment and provide the overarching guidance and principles for undertaking the assessment. The key documents considered are as follows:

- IFC (2007) Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality [28] ;
- IFC (2007) Environmental, Health, and Safety General Guidelines; and
- IFC (2008) Environmental, Health, and Safety Guidelines for Thermal Power Plants [29];

With regard to air quality, there is no project specific approach for determining magnitude

[28] International Finance Corporation (IFC) (2007) Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines: Air Emissions and Ambient Air Quality [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+manage ment/ehsguidelines [Accessed 22 March 2017]

[29] International Finance Corporation (IFC) (2008)) Environmental, Health, and Safety Guidelines for Thermal Power Plants [Online] Available at: http://www.ifc.org/wps/wcm/connect/dfb6a60048855a21852cd76a6515bb18/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&id=1323162579734 [Accessed 22 March 2017]

and significance of impacts. There is, therefore, a need to make specific consideration of the guidance set out by the IFC when defining the magnitude and significance of impacts.

The significance criteria to be used for the air quality impact assessment are therefore discussed in the following section.

8.3.2 Air Quality Assessment Significance Criteria

The magnitude of impact during the construction and operational phase was quantified using predictive techniques based on detailed dispersion modelling. The magnitude of the impact was ascertained by means of comparison of predicted ground level ambient air quality concentrations to air quality standards and guidelines (presented in Chapter 3) and is based upon whether or not the impacts result in air quality standards being exceeded or contribute a 'significant' proportion of airborne pollutants in the local airshed. Magnitude is based on both the process contribution; this is the impact arising solely from project related emissions, and the predicted environmental concentration; this is the process contribution added to the existing baseline (i.e. the cumulative impact).

In order to determine the significance of those impacts, consideration is then required to the sensitivity of the area in question, based on sensitivity of human health within the general population, and the sensitivity of ecological areas (see ***Section 8.3.3***).

The IFC make a differentiation in the significance of impacts, based upon the existing baseline. Essentially, this is whether air quality standards are exceeded or not due to baseline concentrations.

The IFC General EHS Guidelines state:

"Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

- *Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources.*
- *Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed [i.e. in a non-degraded airshed]".* And
- *"An airshed should be considered as having poor air quality [degraded] if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly".*

The IFC guidelines further state:

- *"Facilities or projects located within poor quality airsheds, and within or next to areas established as ecologically sensitive (e.g. national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment."*

The significance of impacts is therefore defined in terms of the magnitude of impacts (i.e. the predicted environmental concentration), the sensitivity of the receptors, and whether the baseline pollution concentrations are above or below the air quality standards (refer to Chapter 3). Using this approach, the significance criteria for air quality have been defined. Based upon these considerations the magnitude and significance of impacts for non-degraded and degraded airsheds has been derived and presented in Table 8.1 and Table 8.2 respectively.

Table 8. 1 Magnitude Criteria for Assessment of Air Pollutants

Magnitude of impact	**Non-degraded airshed (i.e. baseline < AQS)**	**Degraded airshed (i.e. baseline > AQS)**
Negligible	PC <25% of AQS	PC <10% of AQS
Small	PC between 25% and 50% of AQS and PEC <100% of AQS	PC between 10% and 30% of AQS
Medium	PC between 50% and 100% of AQS, and PEC <100% AQS; or	PC between 30% and 50% of AQS
	PC between 25% and 50% of AQS, and PEC	
Large	PC > 100% of AQS; or	PC > 50% of AQS
	PC > 50% of AQS, and PEC >100% of AQS	

PC: Process Contribution
PEC: Predicted Environmental Concentration
AQS: Air Quality Standard

Table 8. 2 ***Determination of Significance***

Magnitude	**Sensitivity**		
	Low	***Medium***	***High***
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

8.3.3 Receptor Identification and Sensitivity

8.3.3.1 Human Health

A review of the study area indicates that a number of sensitive human receptors exist in the proximity of the power plant and its associated infrastructure. Considering the nature of activities during the construction and operation phases, a study area of 500m and 5,000m has been established for the respective assessments.

The approach taken in this air quality impact assessment will be to assume that the sensitivity for human health within the general population is ‘medium’. As the air quality standards (presented within Chapter 3) are set to protect the most vulnerable individuals in society, there is inherently a margin of safety incorporated into the standards. There are a small number of specific cases where the sensitivity may be defined as ‘high’; these include hospitals where there are intensive care units or high dependency wards. In general, the approach used in this assessment assumes that sensitivity within the general human population is 'medium'. Under no circumstances is the sensitivity for human health described as 'low'.

A number of human air sensitive receivers have been identified in the respective study areas and are presented in Figure 8.1 and Figure 8.2. Due to the nature of the impact assessment methodology for the construction and operation phase (refer to Section 8.6.2 and Section 8.6.3) the air sensitive receivers have been identified as representative areas and specific points respectively.

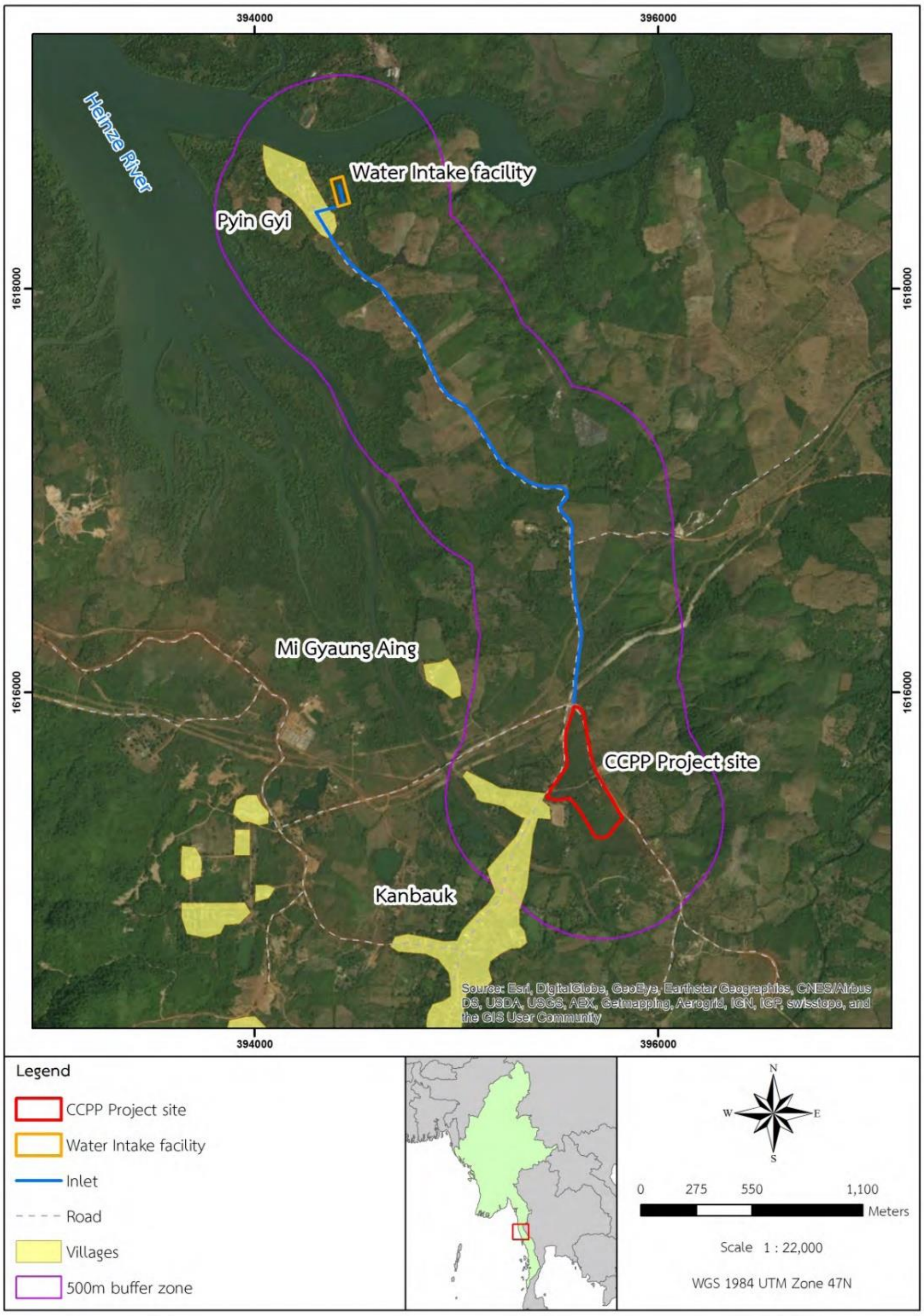

Figure 8. 1 Human Air Sensitive Receivers within 500m of the Site Boundary

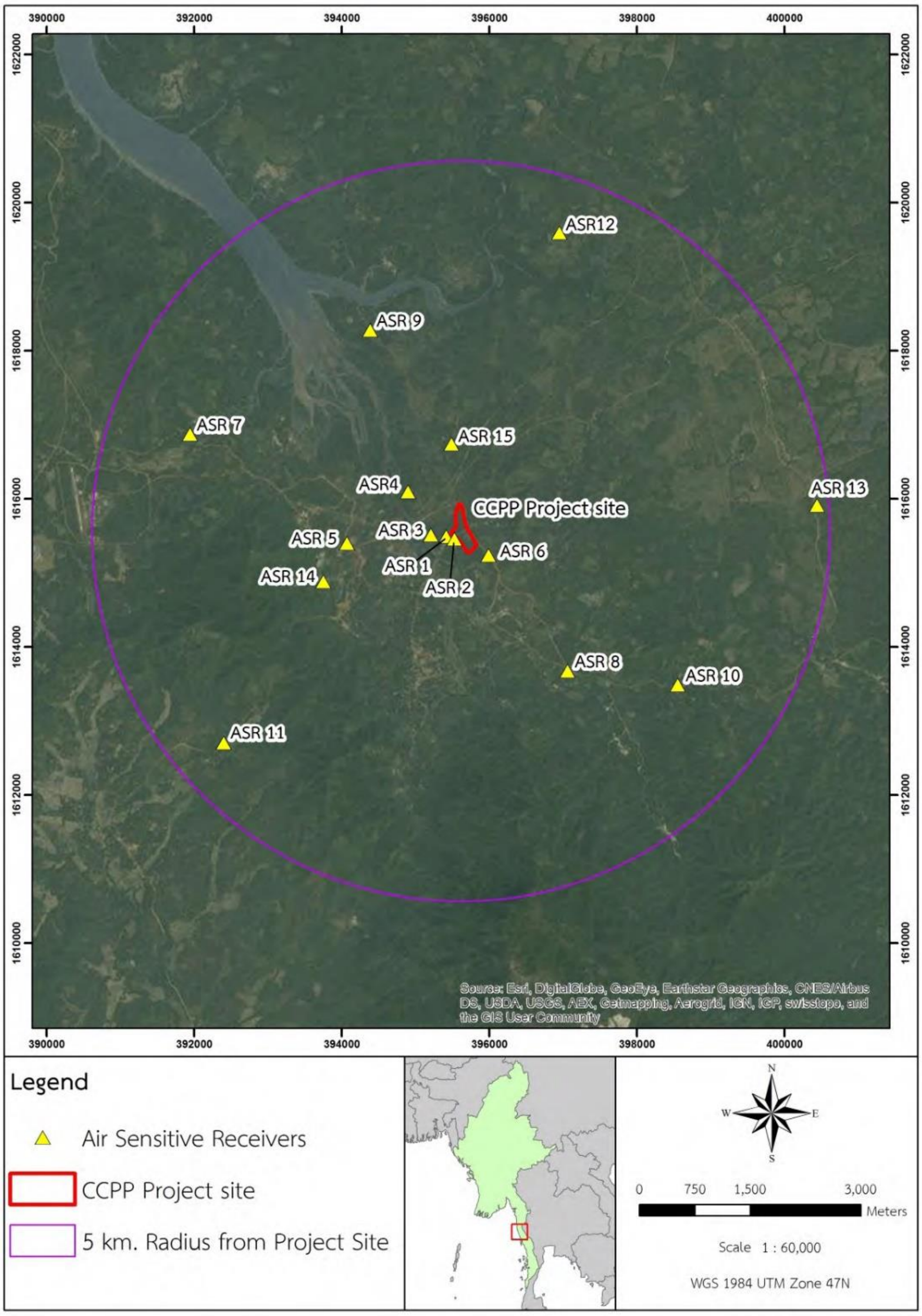

Figure 8. 2 Representative Human Receptors within 5,000m of the Combined Cycle Power Plant Site Boundary

8.3.3.2 Ecology

The sensitivity of ecological air sensitive receivers is defined on the basis of their designated importance as an ecological resource. Typical examples of the definitions of sensitivity designations for ecological receptors are as follows:

- High sensitivity defined as internationally designated sites (e.g. RAMSAR);
- Medium sensitivity defined as nationally designated sites; and
- Low sensitivity defined as locally designated sites including areas of specific ecological interest, not subject to statutory protection.

Following a review of the study area it is apparent that no sensitive ecological air sensitive receivers exist within the study area. It is noted, however, that a number of agricultural areas exist, which may be affected by Project related emissions to air. For the purpose of this air quality impact assessment, the significance of the impact to agricultural air sensitive receivers has been defined based on a receptor sensitivity of ‘low’.

8.4 Summary Of Baseline Conditions

A project specific air quality baseline survey for substances of concern associated with the Project processes over time was undertaken and the detailed methodology and subsequent findings from that survey are presented in Chapter 5 and summarized below in Table 8.3.

Table 8. 3 Baseline Findings and Airshed Classification

Substance	Averaging Period	Baseline Concentration ($\mu g/m^3$)	Air Quality Standard ($\mu g/m^3$)	Airshed Classification
NO_2	1-hour	169	200	Non-degraded
	Annual	7.92	40	Non-degraded
SO_2	24-hour	30.0	20	Degraded
	10-minute (1)	*n/a*	500	*n/a*
$PM_{2.5}$	24-hour	40.0	25	Degraded
	Annual	18.0	10	Degraded
PM_{10}	24-hour	80.0	50	Degraded
	Annual	28.0	20	Degraded

(1) Screened out of quantitative assessment therefore not relevant to baseline – see Section 8.6.3.

8.5 Proposed Project Activity

Based on the scoping study, the administrative framework (presented in ***Chapter 3***) and the Project description (presented in ***Chapter 4***), the key potential impacts on air quality identified arise from the activities presented in this section.

8.5.1 Construction Phase

The main construction phase will occur over a period of 36 months and the activities identified as having a potential impact on air quality during this time include:

- vehicle movements over unpaved surfaces within construction areas and on unpaved roads;
- earthworks including site clearance, site formation and levelling involving excavation and spoil dumping;
- concrete batching;
- construction of the main buildings and infrastructure at the power plant and the water intake facilities including the pumping station, the water treatment facility and the water intake pipeline; and

- air emissions from construction vehicles and non-road machinery within the construction site boundaries and on access roads.
- The construction of a gas pipeline, including associated compressor stations, can lead to air emissions, particularly during construction and maintenance activities. These emissions may include nitrogen oxides (NOx), volatile organic compounds (VOCs), particulate matter, and greenhouse gases such as methane. The use of gas compressors can further contribute to air pollution, depending on their efficiency and maintenance practices. The gas pipeline, which spans 2.6 km from the existing MOGE gas receiving station to the combined cycle power plant, is buried underground. Due to its short length, the construction phase is anticipated to have minor impacts post-mitigation, with continuous real-time monitoring of fugitive dust throughout the construction period.

8.5.2 Operation Phase

The key emission sources associated with the operation of the Project are stack emissions from the combustion of natural gas during plant start up, normal combined cycle operation; and from the combustion of diesel from the backup generator during emergency conditions.

The main substances of concern for a gas-fired combined cycle power plant and diesel generators include oxides of nitrogen (NO_X), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matters (PM) including respirable suspended particulates (PM_{10}) and fine suspended particulates ($PM_{2.5}$)[30] .

The operation of a gas pipeline, including associated compressor stations, can lead to air emissions, particularly during maintenance activities. These emissions may include nitrogen oxides (NOx), volatile organic compounds (VOCs), particulate matter, and greenhouse gases such as methane. The use of gas compressors can further contribute to air pollution, depending on their efficiency and maintenance practices. The gas pipeline, which spans 2.6 km from the existing MOGE gas receiving station to the combined cycle power plant, is buried underground. Due to its short length, the construction phase is anticipated to have minor impacts post-mitigation, with continuous real-time monitoring of fugitive dust throughout the construction period.

Whilst emissions of SO_2, PM_{10} and $PM_{2.5}$ are likely from the combustion of natural gas, they are expected to be minimal provided that the combustion process is efficient and the hydrogen sulfide (H_2S) content of the gas remains low.

8.5.3 Decommissioning

The activities and subsequent emissions to air associated with the decommissioning of the plant are similar in nature to those for the construction phase discussed in Section 8.5.1.

[30] PM_{10}: shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM10, EN 12341, with a 50 %efficiency cut-off at 10 µm aerodynamic diameter; $PM_{2.5}$: shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM2.5, EN 12341, with a 50% efficiency cut-off at 10 µm aerodynamic diameter. Definition from the European Union Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

8.6 ASSESSMENT OF IMPACTS

8.6.1 Overview

This section sets out the assessment of the impacts associated with the construction and operation of the proposed Project. The detailed approach to assessing the potential impacts is discussed and those impacts presented in terms of their significance as defined in Section 8.3 of this chapter.

8.6.2 Impacts to Air Quality during Construction Phase

Overview

The construction of the Project has the potential to generate dust and particulate matter (Total Suspended Particulate (TSP), PM_{10} and $PM_{2.5}$) to air as a result of material transfer, soil movements, stockpiling materials and the use of construction vehicles on unmade access roads. Fugitive dust and particulate matter (PM) have the potential to cause health impacts on air sensitive receivers in the vicinity of construction activities if not managed accordingly.

Dust emissions from the Project site may also result in nuisance issues when depositing onto surfaces, for example, property, vehicles and washing. In addition, dust deposition can affect sensitive vegetation due to the soiling of leaves hindering photosynthesis and the blockage of leaf pores. There is very little information available on the sensitivity of specific plants to dust soiling; however, the information that is available suggests that the guidelines for identifying the deposition rate at which nuisance at human sensitive receptors may occur is also appropriate for use as a metric for assessing the point at which significant impacts on plants may arise [31].

The following section qualitatively addresses the potential impacts from dust and PM emissions associated with construction phase activities including, but not limited to, earthworks, material handling, vehicle movements over unpaved surfaces and stockpiling. Where activities are considered likely to result in generation of dust with potential to impact ambient air quality, mitigation has been identified so that those impacts are reduced to an acceptable level.

Assumptions and Limitations

Other emission to air with the potential to adversely impact air quality during the construction phase includes those associated with exhaust emissions from construction vehicles and temporary power generation, for example. The IFC specify that operators with fleets of 120 units or more of heavy-duty vehicles, or 540 or more from light duty vehicles within an airshed should consider additional ways to reduce potential impacts. The exact number of units required during the construction phase is not known however given the scale of the Project it is not expected to exceed the IFC recommended guidelines discussed previously. Therefore, whilst it is acknowledged that exhaust emissions will have some impact on air quality, the emissions are considered negligible based on their short term and transient nature and with reference made to the IFC guidelines. On this basis, the potential impacts have been scoped out of this assessment and have not been considered further.

Impact Assessment Methodology

[31] Farmer, A, M. (1993). The Effects of Dust on Vegetation – A Review. Environmental Pollution. 79, 63-75.

The Institute of Air Quality Management (IAQM)[32] provide guidance for defining the significance arising from construction sites based on the magnitude of the change and the sensitivity of the receptors identified. The risk of dust and particulate matter emissions is defined using a number of variables including, but not limited to the activities being undertaken, the duration of activities, the size of the site and the specific meteorological conditions at the time of the activity. The guidance further provides screening criteria of 350m and 50m from the construction site and access road respectively beyond which impacts are not considered likely. The premise of the guidance is that with the implementation of effective site-specific mitigation measures, the environmental effect will not be significant in most cases. However, as the guidance is primarily developed for use in the UK, consideration is given to its applicability in Myanmar due to the dissimilar climate and differing construction working practices. On this basis, further evidence has been explored such as that undertaken by the Desert Research Institute (2010) [33] which states:

"*Based on gravitational setting velocities that apply to particles with aerodynamic diameters >~2μm (Slinn, 1982), ... half of the 10μm particles mixed within the first meter are removed after ~3.5 minutes, and that half of the 2.5μm particles in this layer are gone after an hour. Less than 10% of the 10μm particles remain after 12 minutes, with 90% of the 2.5μm particles depleted after 3.5 hours. A 1m/s wind speed results in a transport distance of 3.6km/hr. In an average 5m/s wind, only 10% of the 10μm particles uniformly mixed through a 10m depth would travel more than 36km from the source within two hours after suspension, while 10% of the 2.5μm particles could achieve distances of nearly 600km*".

This evidence suggests that any dust generated by the Project can remain airborne and travel considerable distances from the source under certain climatic conditions.

In terms of dust emissions from open surfaces (i.e. exposed construction areas, disturbed land, stockpiles), the USEPA [34] present evidence which suggests that at wind speeds of less than 5.3 m/s and where rainfall exceeds 0.25mm over a 24-hour period, dust is unlikely to be lifted and emissions will therefore be negligible. Statistical analysis of the meteorological data generated for this air quality impact assessment indicates that between 2012 and 2016, the wind speed is less than 5.3m/s for 84% of the time, and rainfall is more than or equal to 0.25mm over a 24- hour period approximately 58% of the time, therefore the periods where dust emissions are likely are limited. Furthermore, wind speed generated using the WRF model is provided at a height of 10m. As such, the wind speed at ground level or at the mean height of the stockpiles, for example, (assumed less than 10m) would be reduced further therefore reducing the time that dust emissions from open surfaces are likely. It should be noted, however, that fugitive dust emitted from vehicles moving over unpaved surfaces or from material handling processes may be dispersed via substantially lower wind speeds once emitted and travel considerable distances, so additional consideration to this process should be given.

The evidence presented suggests that emissions and subsequent impacts to air quality associated with the construction activities will depend a lot upon the nature of the activities occurring at any one time or location and local meteorological conditions at the time of release. Given that during construction, emission source locations and volumes of materials

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[32] Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf [Accessed 22 March 2017]

[33] Desert Research Institute (2010) Measurement System Evaluation for Fugitive Dust Emissions Detection and Quantification

[34] United States Environmental Protection Agency (1995) AP-42 Section 13.2 Fugitive dust sources, www.epa.gov

being moved are constantly changing and meteorological conditions are variable, impacts have not been separately quantified for separate construction sites or activities, instead, the impact from construction dust and particulate matter in terms of human health and nuisance is said to have a major adverse impact at air sensitive receivers (see Table 8.4) within a conservative distance of 500m (see Figure 8.1) of construction activities if unmitigated and uncontrolled.

Table 8. 4 Assessment of Impact Relating to Construction Dust and Particulate Matter during Construction (Pre-Mitigation)

Impact	Potential impacts on construction dust and particulate matter during construction.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to air quality would be considered to be adverse (negative).				
Impact Type	Direct	**Indirect**	Induced		
	Potential impacts would likely be indirect impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Potential impacts to air quality will occur throughout the construction phase (30 months) only and can therefore be described as short term in nature.				
Impact Extent	**Local**	Regional	International		
	Construction activities at the site have the potential to result in significant emissions of dust up to 500m from the construction site boundary and unpaved access roads and can therefore be described as local.				
Impact Scale	The fugitive dust impacts are expected to be limited, localized (within 500m from the worksite boundary) and short-term (i.e., throughout the construction period of 30 months) and can therefore be described as **medium**.				
Frequency	**Frequent** throughout the construction period.				
Impact Magnitude	Positive	Negligible	Small	Medium	**Large**
	The impact magnitude is likely to be large				
Receptor Sensitivity	Low	**Medium**	High		
	When considering impacts to human health due to inhalation of airborne pollutants, all human air sensitive receivers are defined as ‘medium’ sensitivity. This represents general populations and areas of habitation.				
Impact Significance	Negligible	Minor	Moderate	**Major**	
	The significance is likely to be major.				

Mitigation / Management Measures

Throughout the construction phase, management procedures, such as those outlined below, should be outlined so that the impacts to air quality summarized in Table 8.4 are reduced to an acceptable level. These management methods should be defined in a dust management plan and should be adhered to throughout the construction phase. Effective site management is critical to the successful implementation of dust suppression procedures.

For the construction activities, several best practice mitigation and management measures are advised and include:

- water suppression or surface binding agents on construction site and access road at least 2 times a day during dry season period;
- use of localized dampening and activity specific dampening should be used where movement of friable material occurs to reduce localized emissions of dust;
- where unpaved roads are utilized by vehicles, water suppression on construction site and access road at least 2 times a day during dry season period;
- wheel washing should be used prior to entry onto a sealed road section to avoid tracking dirt onto sealed roads and generating dust;
- vehicles transporting dusty materials should be covered;
- stockpiling of material, for example, rocks, sand and soils should be minimized;
- stockpiles, machinery and dust causing activities should be located as far away from air sensitive receivers as possible;
- the design of stockpiles should be optimized to retain a low profile with no sharp changes in shape;
- drop heights of material should be minimized;
- wind breaks should be erected around the key construction activities and in the vicinity of potentially dusty works;
- weekly inspections for dust soiling should be carried out at receptors within 100m of the construction site boundary and results recorded;
- monitoring of PM_{10} should be undertaken using hand-held monitors to confirm the effectiveness of the site controls during the site walkovers;
- meteorological monitoring should be performed at one location, unaffected by site buildings etc. to inform use of mitigation on site during construction period; and
- any impacts to air quality during the construction phase of the Project should be investigated, the cause determined and actions taken to reduce those emissions in a timely manner.

Residual Impact (Post-mitigation)

When correctly applying and actively managing the specified mitigating controls it is reasonable to conclude that air sensitive receivers located within 500m downwind of any construction activity are likely to experience negligible impacts to air quality for the large majority of the time. However, due to the nature of construction activities and the scale and duration of the construction phase, no guarantee can be made that significant impacts will not arise under any circumstance. It can be concluded, therefore, that construction phase activities are likely to result in **minor** adverse impacts post mitigation (refer to Table 8.5).

Table 8. 5 Rating of Residual Impacts Related to Construction Dust and Particulate Matter(post-mitigation)

Impact	Potential impacts on construction dust and particulate matter during construction.		
Impact Nature	**Negative**	Positive	Neutral
	Potential impacts to air quality would be considered to be adverse (negative).		

Impact Type	Direct	**Indirect**	Induced		
	Potential impacts would likely be indirect impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Potential impacts to air quality will occur throughout the construction phase (30 months) only and can therefore be described as **short term** in nature.				
Impact Extent	**Local**	Regional	International		
	Construction activities at the site have the potential to result in significant emissions of dust up to 500m from the construction site boundary and unpaved access roads and can therefore be described as local.				
Impact Scale	The fugitive dust impacts are expected to be limited, localized (within 500m from the worksite boundary) and short-term (i.e., throughout the construction period of 30 months). Hence impact scale is expected to be **small.**				
Frequency	**Infrequent** throughout the construction period.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be large				
Receptor Sensitivity	Low	**Medium**	High		
	When considering impacts to human health due to inhalation of airborne pollutants, all human air sensitive receivers are defined as 'medium' sensitivity. This represents general populations and areas of habitation.				
Impact Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor**.				

Monitoring Plan

As the air quality impact during the construction phase of the Project is anticipated to be minor post mitigation, continuous real-time monitoring of fugitive dust throughout the construction period is not considered necessary, however, frequent qualitative monitoring surveys should be implemented to include site inspections for visible dust emissions in the vicinity of the site boundary (both internal and external); and visual monitoring of dust deposition onto surfaces on and off-site. The approach to the qualitative monitoring survey should be described in a dust management plan and all observations from the surveys recoded in a site log. Furthermore, monitoring of PM_{10} should be undertaken using hand-held monitors to confirm the effectiveness of the site controls during the site walkovers.

The details on the monitoring and auditing programme are presented in Chapter 19.

8.6.3 Impacts to Air Quality during Operation Phase

Overview

As discussed in ***Section 8.5.2,*** the Project will emit a number of key substances during normal operation which could potentially lead to significant impacts on air quality at air sensitive receivers in the study area. Stack parameters and emission data for the Project were provided by Myanmar UPA Company Limited (MUPA) and are presented in Table 8.7.

Potential impacts to air quality from the substances of interest were quantified initially by a screening assessment. The assessment identified the process contributions with insignificant environmental impacts allowing them to be screened out of the detailed modelling assessment. Those substances not screened out were further quantified using detailed dispersion modelling.

Assumptions and Limitations

During emergency situations, it may be necessary for the plant to shut down. During this time, a 2000kW emergency back-up diesel generator will provide electrical power to maintain the turbine generator unit and its auxiliaries in safe conditions. The generator stack parameters, emission profile and operating conditions during these emergency situations are not known at this stage. Whilst it is acknowledged that the emergency generator will have some impact on air quality, these impacts are considered short term and infrequent and it is assumed that the exhaust emissions arising during the use of the back-up generator will not result in significant adverse impacts to air quality so long as the generator is operated and maintained in line with international good practice procedures. On this basis, potential impacts from the emergency generators have been scoped out of the detailed dispersion modelling and have not been considered further.

Impact Assessment Methodology

Screening Assessment

The Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency [35] provide a conservative screening assessment tool which allows process contributions with insignificant environmental impacts to be screened out of further more detailed assessment. Process contributions are considered insignificant if the following criteria are met:

- The short-term process contribution is less than 10% of the short-term environmental standard; and
- The long-term process contribution is less than 1% of the long-term environmental standard.

The tool provides a number of varying dispersion factors in micrograms per cubic metre per gram per second (µg/m^3/g/s) based on stack height and averaging period as presented below in Table 8.6, which are then multiplied by the substance release rate from the Project.

Table 8. 6 Dispersion Factors in µg/m^3/g/s

Effective Height of Release in Meters	Annual Dispersion Factor	Monthly Dispersion Factor	Hourly Dispersion Factor
0	148	529	3900
10	32	33.7	580
20	4.6	6.2	161
30	1.7	2.3	77
50	0.52	0.68	31
70	0.24	0.31	16

[35] Department for Environment, Food and Rural Affairs (DEFRA) and Environment Agency (2016) Guidance on air emission risk assessment for your environmental permit [online] Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#calculate-pc-to-air [Accessed 23 March 2017]

100	0.11	0.13	8.6
150	0.048	0.052	4
200	0.023	0.026	2.3

To calculate the process contributions for comparison to the short-term averaging periods not included in Table 8.6, the following methodology was applied:

- hourly process contribution multiplied by 0.59 for comparison to 24-hour averaging period [36] ; and
- hourly process contribution converted using the power law [37] for comparison to the 10-minute averaging period.

The emission inventories for the Project including stack parameters and emission rates are presented below in Table 8.7. The results from the screening assessment are presented in Table 8.8.

Table 8. 7 Project Emission Inventory

Stack Parameters [38]	**Unit**	**Value**
Stack location	x, y	14°36'39.49"N, 98° 1'51.60"E
Actual Stack Conditions [39]		
Stack height	m	50
Stack diameter	m	6.5
Emission velocity	m/s	15
Actual exit temperature	K	379
Actual oxygen content (wet gas)	%	14.1
Actual moisture content (wet gas)	%	6.2
Actual volume flow rate	Am^3/s	498
Normalized Conditions [40]		
Normalized exit temperature	K	273.15

[36] Department for Environment, Food and Rural Affairs (DEFRA) and Environment Agency (2016) Guidance on air emission risk assessment for your environmental permit [online] Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#calculate-pc-to-air [Accessed 23 March 2017]

[37] The 10-minutre SO_2 process contributions was derived by applying the power law to the 1-hour process contribution (Ct2 = Ct1 x (t1/t2) ^0.2) (http://www.dot.ca.gov/newtech/researchreports/1969-1970/70-07.pdf)

[38] Main stack 33T/78RH-100GT

[39] Actual stack data provided by Myanmar UPA Company Limited (MUPA)

[40] International Finance Corporation (IFC) (2008) Environmental, Health and Safety Guidelines for Thermal Power Plants [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines [Accessed 23 March 2017]

Stack Parameters [38]	Unit	Value
Normalized oxygen content (dry gas)	%	15
Normalized moisture content (dry gas)	%	0
Normalized volume flow rate [41] [42]	Nm^3/s	338
Normalized Emission Concentrations [43]		
NO_X	mg/Nm^3	51
SO_2	mg/Nm^3	1.2
PM [44]	mg/Nm^3	5
Normalized Emission Rates		
NO_X	g/s	17.2
SO_2	g/s	0.405
$PM_{2.5}$	g/s	1.69
PM_{10}	g/s	1.69

Table 8. 8 Screening Assessment Results

Substance Released	Averaging Period	AQS[1]	Calculated PC[2] (µg/m3)	PC as % of AQS	Result	Detailed Modeling Required?
NO_2	1-hour	200	534	267%	Not insignificant	Yes
	Annual	40	8.96	22%	Not insignificant	Yes
SO_2	10-min	500	18.0	4%	Insignificant	No

[41] Environment Agency (2013) Pollution Inventory Reporting – Combustion Activities Guidance Note [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296994/LIT_7825_e97f48.pdf [Accessed 23 March 2017]

[42] Normalized flow rate at 15% oxygen, dry gas, 273K and a pressure of 101.3 kPa.

[43] Normalised concentrations provided by Myanmar UPA Company Limited (MUPA)

[44] The PM concentration is used to estimate emissions of both $PM_{2.5}$ and PM_{10} with reference made to Table 1.4-2 of the United States Environmental Protection Agency (USEPA) AP:42: Compilation of Air Emission Factors (1998) Chapter 1.4 Natural Gas Combustion [online] Available at: https://www3.epa.gov/ttn/chief/ap42/ch01/index.html [Accessed 23 March 2017]

Substance Released	Averaging Period	AQS[1]	Calculated PC[2] (µg/m3)	PC as % of AQS	Result	Detailed Modeling Required?
	24-hour	20	7.41	37%	Not insignificant	Yes
PM_{10}	24-hour	50	30.9	62%	Not insignificant	Yes
	Annual	20	0.878	4%	Not insignificant	Yes
$PM_{2.5}$	24-hour	25	30.9	124%	Not insignificant	Yes
	Annual	10	0.878	9%	Not insignificant	Yes

(1) Air Quality Standard
(2) Process Contribution

Detailed Modelling

For those substances and averaging periods concluded as 'not insignificant' from the screening process, detailed air dispersion modelling was undertaken. The model used in the assessment was the USEPA AERMOD dispersion model version 9.3.0. AERMOD is a state-of-the-art detailed dispersion model that can be used to represent complex multiple emission sources and predicting air quality at receptor locations considering meteorology. The model is widely recognized for use in this type of application, including by the IFC, US Environmental Protection Agency, UK Environment Agency and Australian Environmental Protection Agency.

Detailed dispersion modelling was used to predict concentrations of pollutants at ground level locations outside the Project site boundary. Five (5) years of hourly sequential meteorological data was used so that inter annual variability was incorporated into the model. The results of the assessment are based upon the worst-case result for any of the five meteorological years used at the air sensitive receiver location. The modelling methodology implemented, including receptor grid spacing, meteorological data information, NO_X to NO_2 conversion and the treatment of buildings, land use and terrain is presented in Table 8.9.

Table 8. 9 Detailed Modelling Methodology

Modelling Component	Method/Approach
Assessment Scenario	The potential impacts from the project were based on emissions from the stack during normal operation. An emission rate for NO_X, SO_2, $PM_{2.5}$ and PM_{10} was calculated based on the stack parameters detailed in Table 8.7. The scenario assumed continuous emissions throughout one entire year which comprises of 365 days.
Defining Sources	The representation of emission sources in AERMOD was based on the nature of the source being considered. As discussed, the substances of interest are from the combustion of natural gas resulting in emissions to the atmosphere through a stack. The source was therefore modelled as a point source.

Modelling Component	Method/Approach
Defining Emissions	Stack parameters and emission rates were defined for each substance with the potential to have adverse impacts on air quality during normal operation. The emission inventory for the project is presented in Table 8.7.
Receptor Grid	The dispersion model uses a nested grid extending up to 5 km from the facility fence line to determine the maximum process contribution in the study area and the process contribution arising at air sensitive receivers and in each air sensitive receiver classification. The receptor spacing varies with distance from the point sources in order to provide sufficiently dense receptors close to the site, and suitable spatial coverage further afield. The spacing of receptors is as follows: 75 meters spacing from 0 to 1000 meters; 150 meters spacing from 1000 to 2500 meters; and 300 meters spacing from 2500 meters to 5000 meters. Furthermore, specific receptor points were included in the model to reflect the locations of the representative air sensitive receivers identified in Figure 8.2.
Meteorological Data	The meteorological data used in the model must be reflective of the local conditions. There is very little meteorological data available for Myanmar, and that which was identified was not considered robust due to missing and incomplete data. Therefore five (5) years of meteorological data were modelled using a 12km x 12km grid resolution using the Weather Research and Forecasting Model (WRF)[45]. The WRF model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. The model is extensively validated using actual observations to ensure the best possible accuracy and precision.

[45] Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G Duda, X.-Y. Huang, W. Wang, and J. G. Powers, 2008: A Description of the Advanced Research WRF Version 3. NCAR Tech. Note NCAR/TN-475+STR, 113 pp

Modelling Component	Method/Approach
Conversion of NO_x to NO_2	Emissions from the Project contain oxides of nitrogen, occurring as both nitric oxide (NO) and NO_2. The ratio of these two gases in the exhaust gases from combustion processes varies, but is typically in the ratio of 90-95% NO to 5–10% NO_2. With regard to the assessment of impact on human health NO_2 is the pollutant of interest as NO has little effect on human health at concentrations typically encountered in ambient air. Within the atmosphere various processes oxidise NO to create NO_2. This process is largely dependent on the amount of oxidant in the atmosphere at the time of release. It is, therefore, overly pessimistic to assume 100% conversion from NO to NO_2, and it is necessary to use a factor to estimate ground level concentrations of NO_2 based upon total NO_x emitted. Based on USEPA suggested NO_x to NO_2 conversion approaches detailed in a March 2011 memorandum[46] an 80% conversion rate was used for short term and a 75% conversion rate was used for long term. These conversion factors have been applied in the results interpretation. The section of this approach for this study provides a conservative assessment.
Buildings	When air flow passes over buildings, a phenomenon known as building downwash occurs where the air is entrained in the lee of the building and drawn down to ground level. This effect can bring the plume from the stack down to ground level quicker than would otherwise be the case, and therefore increase the ground level concentration relative to a case where there are no buildings. Building effects are typically a consideration where the buildings are greater than one third the height of the stacks.

[46] USEPA, 2011. Memorandum - Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard. United States Environmental Protection Agency, March 01 2011 [Online] Available at: https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf [Accessed 23 March 2017]

Modelling Results at Human Air Sensitive Receivers

The modelling results based on the emissions inventory detailed in Table 8.7 and the methodology detailed in Table 8.9 is presented below in Table 8.10 to Table 8.16.

At each of the representative human air sensitive receivers (see Figure 8.2*)* the maximum process contribution and the predicted environmental concentration for NO_2, SO_2, $PM_{2.5}$ and PM_{10} is presented and the significance of the impact defined using the approach outlined in Section 8.3. In addition, the maximum process contribution and predicted environmental concentration at any point on the receptor grid has been identified and the significance also defined.

The results of the assessment comprise the maximum process contribution predicted over a period of five years from 2012 to 2016, as discussed in Table 8.9. This approach therefore presents a worst- case impact for the substances of interest. Where necessary contour plots showing dispersion away from the stack are presented for context.

Table 8. 10 NO_2 - Maximum 1-Hour Concentration

Receptor	Baseline Concentration (μg/m³)	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on Grid	169	Non-degraded	200	217	108%	386	193%	Major
ASR1	169	Non-degraded	200	7.39	3.7%	177	88%	Negligible
ASR2	169	Non-degraded	200	10.4	5.2%	180	90%	Negligible
ASR3	169	Non-degraded	200	7.91	4.0%	177	89%	Negligible
ASR4	169	Non-degraded	200	7.93	4.0%	177	89%	Negligible
ASR5	169	Non-degraded	200	10.2	5.1%	180	90%	Negligible
ASR6	169	Non-degraded	200	8.30	4.2%	178	89%	Negligible
ASR7	169	Non-degraded	200	5.67	2.8%	175	88%	Negligible
ASR8	169	Non-degraded	200	5.91	3.0%	175	88%	Negligible
ASR9	169	Non-degraded	200	6.33	3.2%	176	88%	Negligible
ASR10	169	Non-degraded	200	6.20	3.1%	176	88%	Negligible
ASR11	169	Non-degraded	200	7.53	3.8%	177	89%	Negligible
ASR12	169	Non-degraded	200	5.52	2.8%	175	88%	Negligible
ASR13	169	Non-degraded	200	3.80	1.9%	173	87%	Negligible
ASR14	169	Non-degraded	200	8.39	4.2%	178	89%	Negligible
ASR15	169	Non-degraded	200	7.65	3.8%	177	89%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 11 NO_2 - Maximum Annual Average Concentration

Receptor	Baseline Concentration (μg/m³)	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on Grid	7.92	Non-degraded	40	1.00	2.5%	8.92	22%	Negligible
ASR1	7.92	Non-degraded	40	0.146	<1%	8.06	20%	Negligible
ASR2	7.92	Non-degraded	40	0.0772	<1%	8.00	20%	Negligible
ASR3	7.92	Non-degraded	40	0.361	<1%	8.28	21%	Negligible
ASR4	7.92	Non-degraded	40	0.089	<1%	8.01	20%	Negligible
ASR5	7.92	Non-degraded	40	0.372	<1%	8.29	21%	Negligible
ASR6	7.92	Non-degraded	40	0.252	<1%	8.17	20%	Negligible
ASR7	7.92	Non-degraded	40	0.0587	<1%	7.98	20%	Negligible
ASR8	7.92	Non-degraded	40	0.0672	<1%	7.99	20%	Negligible
ASR9	7.92	Non-degraded	40	0.0483	<1%	7.97	20%	Negligible
ASR10	7.92	Non-degraded	40	0.0610	<1%	7.98	20%	Negligible
ASR11	7.92	Non-degraded	40	0.0416	<1%	7.96	20%	Negligible
ASR12	7.92	Non-degraded	40	0.100	<1%	8.02	20%	Negligible
ASR13	7.92	Non-degraded	40	0.0944	<1%	8.01	20%	Negligible
ASR14	7.92	Non-degraded	40	0.153	<1%	8.07	20%	Negligible
ASR15	7.92	Non-degraded	40	0.122	<1%	8.04	20%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 12 SO_2 - Maximum 24-Hour Average Concentration

Receptor	Baseline Concentration (μg/m^3)	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on Grid	7.92	Degraded	20	0.563	2.8%	30.6	153%	Negligible
ASR1	7.92	Degraded	20	0.0361	<1%	30.0	150%	Negligible
ASR2	7.92	Degraded	20	0.0282	<1%	30.0	150%	Negligible
ASR3	7.92	Degraded	20	0.0768	<1%	30.1	150%	Negligible
ASR4	7.92	Degraded	20	0.0359	<1%	30.0	150%	Negligible
ASR5	7.92	Degraded	20	0.200	<1%	30.2	151%	Negligible
ASR6	7.92	Degraded	20	0.0486	<1%	30.0	150%	Negligible
ASR7	7.92	Degraded	20	0.0159	<1%	30.0	150%	Negligible
ASR8	7.92	Degraded	20	0.0185	<1%	30.0	150%	Negligible
ASR9	7.92	Degraded	20	0.0165	<1%	30.0	150%	Negligible
ASR10	7.92	Degraded	20	0.0188	<1%	30.0	150%	Negligible
ASR11	7.92	Degraded	20	0.0115	<1%	30.0	150%	Negligible
ASR12	7.92	Degraded	20	0.0400	<1%	30.0	150%	Negligible
ASR13	7.92	Degraded	20	0.0153	<1%	30.0	150%	Negligible
ASR14	7.92	Degraded	20	0.0411	<1%	30.0	150%	Negligible
ASR15	7.92	Degraded	20	0.0578	<1%	30.1	150%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 13 $PM_{2.5}$ - Maximum 24-Hour Average Concentration

Receptor	Baseline Concentration	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on Grid	40.0	Degraded	25	2.32	9.3%	42.3	169%	Negligible
ASR1	40.0	Degraded	25	0.149	<1%	40.1	161%	Negligible
ASR2	40.0	Degraded	25	0.108	<1%	40.1	160%	Negligible
ASR3	40.0	Degraded	25	0.317	1.3%	40.3	161%	Negligible
ASR4	40.0	Degraded	25	0.148	<1%	40.1	161%	Negligible
ASR5	40.0	Degraded	25	0.825	3.3%	40.8	163%	Negligible
ASR6	40.0	Degraded	25	0.200	<1%	40.2	161%	Negligible
ASR7	40.0	Degraded	25	0.0656	<1%	40.1	160%	Negligible
ASR8	40.0	Degraded	25	0.0761	<1%	40.1	160%	Negligible
ASR9	40.0	Degraded	25	0.0680	<1%	40.1	160%	Negligible
ASR10	40.0	Degraded	25	0.0459	<1%	40.0	160%	Negligible
ASR11	40.0	Degraded	25	0.0474	<1%	40.0	160%	Negligible
ASR12	40.0	Degraded	25	0.165	<1%	40.2	161%	Negligible
ASR13	40.0	Degraded	25	0.0558	<1%	40.1	160%	Negligible
ASR14	40.0	Degraded	25	0.169	<1%	40.2	161%	Negligible
ASR15	40.0	Degraded	25	0.238	<1%	40.2	161%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 14 $PM_{2.5}$ – Maximum Annual Average Concentration

Receptor	Baseline Concentration ($\mu g/m^3$)	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on Grid	18.3	Degraded	10	0.131	1.3%	18.5	185%	Negligible
ASR1	18.3	Degraded	10	0.0191	<1%	18.4	184%	Negligible
ASR2	18.3	Degraded	10	9.15×10^{-3}	<1%	18.3	183%	Negligible
ASR3	18.3	Degraded	10	0.0472	<1%	18.4	184%	Negligible
ASR4	18.3	Degraded	10	0.0116	<1%	18.3	183%	Negligible
ASR5	18.3	Degraded	10	0.0487	<1%	18.4	184%	Negligible
ASR6	18.3	Degraded	10	0.0263	<1%	18.4	184%	Negligible
ASR7	18.3	Degraded	10	7.42×10^{-3}	<1%	18.3	183%	Negligible
ASR8	18.3	Degraded	10	7.48×10^{-3}	<1%	18.3	183%	Negligible
ASR9	18.3	Degraded	10	6.32×10^{-3}	<1%	18.3	183%	Negligible
ASR10	18.3	Degraded	10	6.24×10^{-3}	<1%	18.3	183%	Negligible
ASR11	18.3	Degraded	10	5.20×10^{-3}	<1%	18.3	183%	Negligible
ASR12	18.3	Degraded	10	0.0131	<1%	18.3	183%	Negligible
ASR13	18.3	Degraded	10	0.0124	<1%	18.3	183%	Negligible
ASR14	18.3	Degraded	10	0.0200	<1%	18.4	184%	Negligible
ASR15	18.3	Degraded	10	0.0159	<1%	18.3	183%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 15 PM_{10} - Maximum 24-Hour Average Concentration

Receptor	Baseline Concentration	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC / AQS (%)	Impact Significance
Maximum on	80	Degraded	50	2.32	4.6%	82.3	165%	Negligible
ASR1	80	Degraded	50	0.149	<1%	80.1	160%	Negligible
ASR2	80	Degraded	50	0.108	<1%	80.1	160%	Negligible
ASR3	80	Degraded	50	0.317	<1%	80.3	161%	Negligible
ASR4	80	Degraded	50	0.148	<1%	80.1	160%	Negligible
ASR5	80	Degraded	50	0.825	1.7%	80.8	162%	Negligible
ASR6	80	Degraded	50	0.200	<1%	80.2	160%	Negligible
ASR7	80	Degraded	50	0.0656	<1%	80.1	160%	Negligible
ASR8	80	Degraded	50	0.0761	<1%	80.1	160%	Negligible
ASR9	80	Degraded	50	0.0680	<1%	80.1	160%	Negligible
ASR10	80	Degraded	50	0.0459	<1%	80.0	160%	Negligible
ASR11	80	Degraded	50	0.0474	<1%	80.0	160%	Negligible
ASR12	80	Degraded	50	0.165	<1%	80.2	160%	Negligible
ASR13	80	Degraded	50	0.0558	<1%	80.1	160%	Negligible
ASR14	80	Degraded	50	0.169	<1%	80.2	160%	Negligible
ASR15	80	Degraded	50	0.238	<1%	80.2	160%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Table 8. 16 PM_{10} – Maximum Annual Average Concentration

Receptor	Baseline Concentration	Baseline Classification	AQS (1)	PC (2)	PC / AQS (%)	PEC (3)	PEC /AQS (%)	Impact Significance
Maximum on	28.3	Degraded	20	0.131	<1%	28.5	142%	Negligible
ASR1	28.3	Degraded	20	0.0191	<1%	28.4	142%	Negligible
ASR2	28.3	Degraded	20	9.15×10^{-3}	<1%	28.3	142%	Negligible
ASR3	28.3	Degraded	20	0.0472	<1%	28.4	142%	Negligible
ASR4	28.3	Degraded	20	0.0116	<1%	28.3	142%	Negligible
ASR5	28.3	Degraded	20	0.0487	<1%	28.4	142%	Negligible
ASR6	28.3	Degraded	20	0.0263	<1%	28.4	142%	Negligible
ASR7	28.3	Degraded	20	7.42×10^{-3}	<1%	28.3	142%	Negligible
ASR8	28.3	Degraded	20	7.48×10^{-3}	<1%	28.3	142%	Negligible
ASR9	28.3	Degraded	20	6.32×10^{-3}	<1%	28.3	142%	Negligible
ASR10	28.3	Degraded	20	6.24×10^{-3}	<1%	28.3	142%	Negligible
ASR11	28.3	Degraded	20	5.20×10^{-3}	<1%	28.3	142%	Negligible
ASR12	28.3	Degraded	20	0.0131	<1%	28.3	142%	Negligible
ASR13	28.3	Degraded	20	0.0124	<1%	28.3	142%	Negligible
ASR14	28.3	Degraded	20	0.0200	<1%	28.4	142%	Negligible
ASR15	28.3	Degraded	20	0.0159	<1%	28.3	142%	Negligible

(1) Myanmar National Environmental Quality (Emission) Guidelines, 2015.
(2) Process Contribution
(3) Predicted Environmental Concentration

Significance of the Impact (Pre-Mitigation)

Based on the emissions inventory presented in Table 8.7 and the modeling approach outlined in Table 8.9, the results from the modelling exercise indicate that the emissions of NO_2, SO_2, $PM_{2.5}$ and PM_{10} during the normal operation of the Project will have a negligible impact on air quality at the representative human air sensitive receivers identified in the study area. However, when considering the maximum NO_2 1-hour process contribution from the Project, exceedances of the air quality standard are predicted at some offsite locations within the study area as presented in *Figure 8.3*. With regard to these exceedances, the following three (3) observations are made:

- the locations where exceedances are predicted are where the terrain is complex (i.e. terrain above the height of the stack) and where the steady- state Gaussian-plume model AERMOD has some inherent limitations in its ability to account for turning or rising wind caused by the terrain itself;
- the locations where the exceedances are seen are in areas where no human ASRs exist; and
- the assessment methodology uses a conservative approach to modeling impacts to air quality in the study area. For example, the NO_x emission rate from the stack was modelled at the emission limit concentration for natural gas turbines greater than 50MWth. It is likely, however, that the plant in practice would operate below the NO_x emission limit, thus the ground level concentrations of NO_2 at offsite locations would be reduced.

A summary of the impacts is presented in Table 8.17.

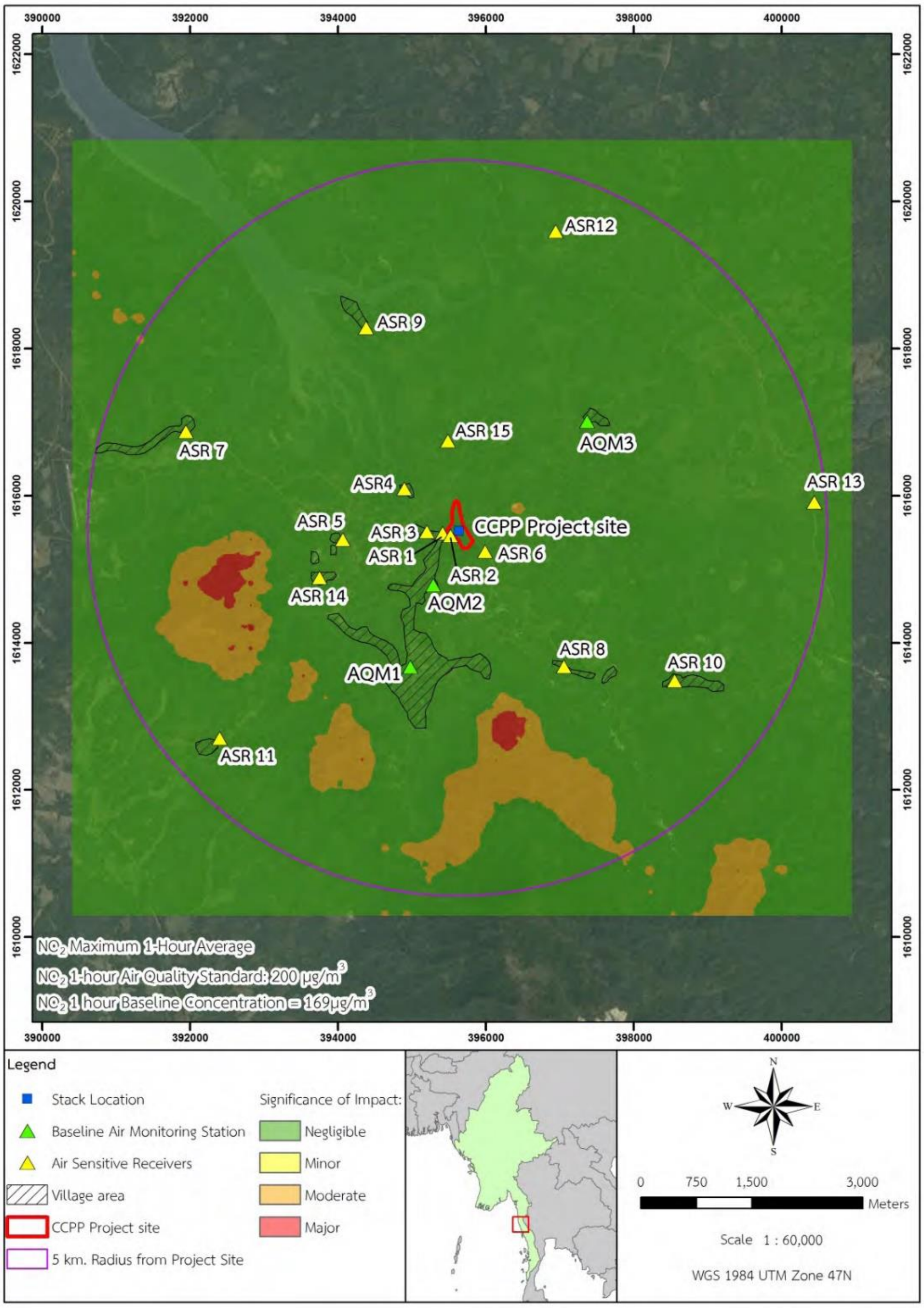

Figure 8. 3 NO_2 - Maximum 1-Hour Concentration

Table 8. 17 Assessment of Impact Relating to Air Quality during Normal Operation (Pre- Mitigation)

Impact	Potential impacts to air quality during normal operation.			
Impact Nature	**Negative**	Positive	Neutral	
	Potential impacts to air quality would be considered to be adverse (negative).			
Impact Type	Direct	**Indirect**	Induced	
	Potential impacts would likely be indirect impacts.			
Impact Duration	Temporary	Short-term	**Long-term**	Permanent
	Operational impacts would occur throughout the life time of the Project and			

	are therefore considered long-term.					
Impact Extent	**Local**		Regional		International	
	Emissions from the Project may cause adverse impacts up to 5km from the point of release and are therefore local in their extent.					
Impact Scale	The scale of the impacts is likely to be within 5km from the point of release and is therefore considered **medium** scale.					
Frequency	**Continuous** throughout the operation period.					
Impact Magnitude	Positive	**Negligible**	Small	Medium	Large	
	Emissions of NO_2, SO_2, $PM_{2.5}$ and PM_{10} will have a Negligible impact on air quality at human air sensitive receivers.					
Receptor Sensitivity	Low		**Medium**		High	
	When considering impacts to human health due to inhalation of airborne pollutants, all sensitive human receptors are defined as 'medium' sensitivity. This represents general populations and areas of habitation.					
Impact Significance	**Negligible**	Minor		Moderate	Major	
	The significance is likely to be negligible.					

Mitigation / Management Measures

The impact assessment defines the impacts on air quality as negligible based on the design parameters presented in Table 8.7. However, the following mitigation and management measures should be used to minimize impacts to air quality during the operation of the plant:

- Emission concentrations of NO_X from the proposed power plant stack will not exceed those outlined in Table 8.7 and where feasible NO_X concentrations should be reduced.
- Emergency diesel generators will be designed, operated and maintained in line with the IFC General EHS Guidelines for Air Emissions and Ambient Air Quality [47] and will be situated as far as reasonably practicable from air sensitive receivers in the study area.

Monitoring plan

In order to monitor and confirm that the abovementioned management measures are applied and concentrations do not exceed those specified in this AQIA, the following actions should be implemented:

- The main stack (33T/78RH-100GT) will be fitted with continuous emission monitoring capable of real-time measurement of NOx and transmitted to the operator control room; and
- The stack shall be fitted with sampling platform and two sampling ports at 90 degrees. Sampling ports should be four-inch (minimum) inner diameter threaded pipe connections with a cap.

Details on the monitoring and auditing programme are presented in Chapter 19.

Modelling Results at Agricultural Air Sensitive Receivers

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[47] International Finance Corporation (IFC) (2007) Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines: Air Emissions and Ambient Air Quality [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+manage ment/ehsguidelines [Accessed 22 March 2017]

The modelling results based on the emissions inventory detailed in Table 8.7 and the methodology detailed in Table 8.9 is presented below in Table 8.18 and Table 8.19.

The results of the assessment comprise the maximum process contribution predicted over a period of five years from 2012 to 2016, as discussed in Table 8.9. This approach therefore presents a worst-case impact for the substances of interest.

The maximum process contribution on the receptor grid has been identified and the significance defined. The results indicate that the maximum process contribution at any point on within the 5km study area are less than 10% of the relevant air quality standard; therefore, all impacts are considered negligible.

Table 8. 18 NOx – Maximum Annual Average

Receptor	Air Quality Standard (AQS) (1)	PC (2)	PC/AQS (%)	Impact Significance
Maximum on grid	30	1.34	4.5%	Negligible

(1) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe
(2) Process Contribution

Table 8. 19 SO_2 – Maximum Annual Average

Receptor	Air Quality Standard (AQS) (1)	PC (2)	PC / AQS (%)	Impact Significance
Maximum on grid	20	0.0318	<1%	Negligible

(1) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe
(2) Process Contribution

8.6.4 Impacts to Air Quality during the Decommissioning Phase

The impacts to air quality during the decommissioning phase will be similar in nature to those during the construction phase. The substances of concern are dust and particulate matter caused by material transfer, exposure of bare soil, stockpiling of dusty materials etc. Similarly, to the construction phase, the impact from decommissioning dust and particulate matter in terms of human health and nuisance is said to have a major adverse impact if unmitigated and uncontrolled. Throughout the decommissioning phase, mitigation and management measures similar to those specified in Section 8.6.2 of this air quality impact assessment should be implemented to make sure that impacts to air quality are reduced to an acceptable level. With the correct implementation of the mentioned mitigation and management measures the decommissioning phase activities are likely to result in minor adverse impacts at worst post mitigation.

CHAPTER 9 NOISE

9.1 INTRODUCTION

This Chapter presents an assessment of the potential noise impacts arising from the construction and operational phases of the Project. Noise sensitive receivers (NSRs) and potential sources of noise generation were identified and an assessment of the potential impacts was carried out. Mitigation and management measures are recommended where necessary.

9.2 ASSUMPTIONS AND LIMITATIONS

The assessment of potential impacts related to noise in this section is based on the environmental baseline data (Chapter 5) and the information available from the Project Proponent at the time of writing.

The noise impact assessment was carried out based on an assumed plant inventory for the construction and operational phases of the 200MW Combined Cycle Power Plant. These will be confirmed by the Engineering, Procurement and Construction (EPC) contractor prior to commencement of each phase. Should there be significant differences between the assumed plant inventory and that to be used on site, additional assessments may be needed and the proposed noise mitigation measures should be updated and implemented accordingly.

9.3 ASSESSMENT METHODOLOGY

9.3.1 Legislation Requirement

The construction and construction noise impact assessment were conducted with reference to relevant international guidelines and local legislation, regulations, standards where available. Noise level guidelines given in Myanmar National Environmental Quality Guideline (NEQ) and that in IFC General EHS Guidelines: Environmental – Noise Management are the same and are summarized in Table 9.1 below.

Table 9. 1 Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime (07:00 - 22:00)	Night-time (22:00 - 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The noise guideline values for residential, institutional and educational receptors are adopted for this assessment. The applicable standards are 55dB(A) for daytime and 45dB(A) for night-time, or a maximum increase in background levels of not more than 3dB(A) at the nearest receptor location off-site. Since baseline monitoring was conducted, noise criterion of a maximum increase in background levels of not more than 3dB(A) was adopted as the assessment criterion.

9.3.2 Construction Phase

The methodology adopted for the noise impact assessment is based on standard acoustics principles. The procedures of the assessment are summarized as follows:

- locate representative noise sensitive receiver (NSR) that may be affected by the works;
- assign Sound Power Level (SWL) to each plant item proposed and calculate the overall SWL associated with the proposed plant inventory;
- determine the distance between the approximate geographical center of the Project work site and the NSR;
- apply correction factors on the distance, façade reflection and screening/barrier, in accordance with BS5228: Part 1: 2009[48]; and
- predict the construction noise levels at NSRs on the basis of the plant activity and an in-built design control, if any.

9.3.3 Operation Phase

Noise model Sound PLAN was used for the operational noise impact assessment, in accordance with the Acoustics -- Attenuation of sound during propagation outdoors -- Part 1: Calculation of the absorption of sound by the atmosphere (ISO 9613-1:1993) and Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation (ISO 9613-2:1996).

The assessment results are presented in noise contours to provide an overall view of the predicted noise levels around the Project site.

9.3.4 Magnitude of the Construction and Operation Noise Impacts

Based on the effects of noise on health in consideration of annoyance, speech intelligibility, communication interference, disturbance of information extraction, sleep disturbance, and hearing impairment, the sensitivity of the NSRs are determined as follows:

- High Sensitivity - hospitals and theatres;
- Low Sensitivity - industrials and commercials. The magnitude of the construction and operational noise impacts are determined based on the criteria given in Table 9.2 below:

Table 9. 2 Predicted Construction and Operation Noise Impact

Impact Magnitude Classification	Negligible	Small	Medium	Large
Noise Levels, dB(A) $L_{eq,1hr}$	< or = background +3	> background + 3 to background +8	> background + 8 to background +13	> background + 13

[48] Noise and Vibration Control on Construction and Open Sites, Part 1. Code of Practice for Basic Information and Procedures for

Noise and Vibration control. British Standard, BS5228: Part 1: 2009

9.4 SUMMARY OF BASELINE CONDITIONS

Baseline noise monitoring was conducted at representative NSRs in September 2016 to establish the background levels in the area. A-weighted equivalent continuous sound pressure levels ($L_{Aeq, 10min}$) were recorded continuously over 72-hour at each location. At each location, daytime and night-time L_{Aeq} were calculated by averaging the hourly sound pressure levels measured between 0700 to 2200 hours and between 2200 to 0700 hours, respectively. Results of the background noise measurements are presented in Table 9.3. Details of baseline noise monitoring are given in Chapter 5.

Table 9. 3 Results of Background Noise Measurement

NSR [c]	Type of Uses	Averaged Background Noise Levels, dB(A) [a]		NEQ/IFC Operational Noise Level Guidelines, dB(A)	
		Day-time	Night-time	Day-time	Night-time
N1	Residential	60.7	63.8	55	45
N2	Residential	60.5	50.2	55	45
N3	Residential	58.7	62.2	55	45

9.5 PROPOSED PROJECT ACTIVITY

Based on the Scoping Study, the Administrative Framework (Chapter 3) and the Project Description (Chapter 4), the key potential impacts on noise identified arise from the following activities.

9.5.1 Construction Phase

The construction activities including combine cycle power plant, water intake facility and temporary jetty of particular importance for potential noise impacts are noted below:

1. Construction Equipment and Machinery: Heavy machinery such as excavators, bulldozers, cranes, and trucks are often used during construction. These machines generate significant noise levels, especially during site preparation, earthmoving, and structural construction activities.

2. Construction Processes: Various construction processes, such as pile driving, concrete pouring, and welding, can generate substantial noise levels. These activities may be intermittent but can have significant impacts on nearby areas, particularly during peak construction periods.

3. Worker Activities: Construction workers may also contribute to noise levels through their activities, such as tool operation, communication, and vehicle movement within the construction site.

4. Site Layout and Location: The layout and location of the construction site can influence noise propagation. Factors such as distance from sensitive receptors (e.g., residential areas, schools, hospitals) and the presence of natural barriers can affect how noise travels and its potential impact on surrounding areas. Worker camps and batching plants will be located in site fabrication area (described in Section 4.4.2.6)

5. Cumulative Effects: In addition to direct noise emissions from the construction site, cumulative effects may occur when combined with other sources of noise in the vicinity, such as traffic, industrial activities, or existing infrastructure.

6. Duration and Timing: The duration and timing of construction activities also play a role in noise impacts. Continuous or prolonged construction activities, particularly during sensitive periods such as nighttime or weekends, can lead to heightened concerns regarding noise disturbance.

Operation of the powered mechanical equipment (PME) will be the major sources of noise impact to the NSRs.

An indicative construction plant inventory for the construction activities during daytime period is summarized in Table 9.4**.** It is assumed that the construction works will be carried out during daytime period only.

Table 9. 4 Indicative Construction Plant Inventory (Daytime)

Plant Item	Reference [(a)]	Quantity During Peak hour	On-time %	Unit SWL dB(A)	Sub-Total SWL, dB(A)	Overall SWL, dB(A) [(b) (c)]
Group A [(d)]						118
Site Formation						
Excavator	BS D3 35	3	100%	106	111	
Bulldozer	BS D3 27	3	100%	109	114	
Dump truck	BS D3 52	3	100%	109	114	
Group B [(d)]						117
Piling						
Rotary Bored Piling rig	BS C3 14	4	100%	111	117	
Group C [(d)]						118
Substructure & superstructure						
Batching Plant	BS D5 11	1	100%	108	108	
Vibrating compactor	BS D3 116	5	100%	106	113	
Steel Structure						
Crawler crane 100t diesel	BS C4 41	1	100%	99	99	
Crawler crane 50t diesel	BS C4 46	1	100%	95	95	
Hydraulic crane 50t diesel	BS C4 46	2	100%	95	98	
Hydraulic crane 75t diesel	BS C4 41	2	100%	99	102	

Notes:

(a) *Noise and Vibration Control on Construction and Open Sites, Part 1. Code of Practice for Basic Information and Procedures for Noise and Vibration control.* British Standard, BS5228: Part 1: 2009.

(b) The figures are rounded-up to a whole number.

(c) The overall SWL represents the maximum potential noise impact during construction phase.

(d) Either Group A, B or C will be in operation at any one-time during construction phase, i.e. no overlapping of Group A, B and C.

9.5.2 Operation Phase

The sources of noise associated with the operation of the power plant are expected to include the heat recovery steam generators (HRSG), gas turbines, steam turbine and cooling tower. The key assumption for the noise assessment is that the power plant will be generally operated for 24 hours per day throughout the year, unless dispatched off-line by the grid control centre or shut down for maintenance. An indicative operational plant inventory for the power plant is presented in Table 9.5. Sound Pressure Levels (SPLs) are assumed to be 85 dB(A) at 1 m from each of the plant items.

Gas Turbine (GT) & Generator and Steam Turbine (ST) & Generator will be housed within fully enclosed turbine halls. It is assumed that a 20dB(A) noise reduction can be provided by the turbine halls, as the in-built design control for the operation of the Project.

Table 9. 5 Indicative Operation Plant Inventory

Plant Item	Quantity during peak hour	On-time during peak hour	Sound Pressure Level (SPL) at 1m, dB(A)
Heat Recovery Steam Generator (HRSG)	1	100%	85
Gas Compressor	1	100%	85
Gas turbine (GT) & Generator	1	100%	65[(a)]
Step Up Transformer	1	100%	85
Steam Turbine (ST) & Generator	1	100%	65[(a)]
20MW Gas Engines (Existing)	1	100%	85
Cooling Tower	1	100%	85

Note: (a) 20dB(A) of noise reduction will be provided by the turbine halls.

9.6 Receptor Identification And Sensitivity

The nearest representative NSRs that may potentially experience noise impacts from the work sites of the Project during construction and operational phases are identified. The locations of the representative NSRs are summarized in Table 9.6 and shown in Figure 9.1. As the identified NSRs are residential, the sensitivity of the receptor is considered as **medium**.

Table 9. 6 Representative Noise Sensitive Receivers

NSR	Location	Type of Uses
NSR1	Village House in Hle Gone Village	Existing Residential
NSR2	Village House in Mi Gyaung Aing Village	Existing Residential
NSR3	Village House in Pyin Gyi Village	Existing Residential

Staff quarters will be provided within the Project site during the operation phase of the Project. In order to minimize the noise impact to the occupants of the staff quarters, noise mitigation/management measures given in Section 9.7.2 should be considered, where practicable, during the detailed design phase of the Project.

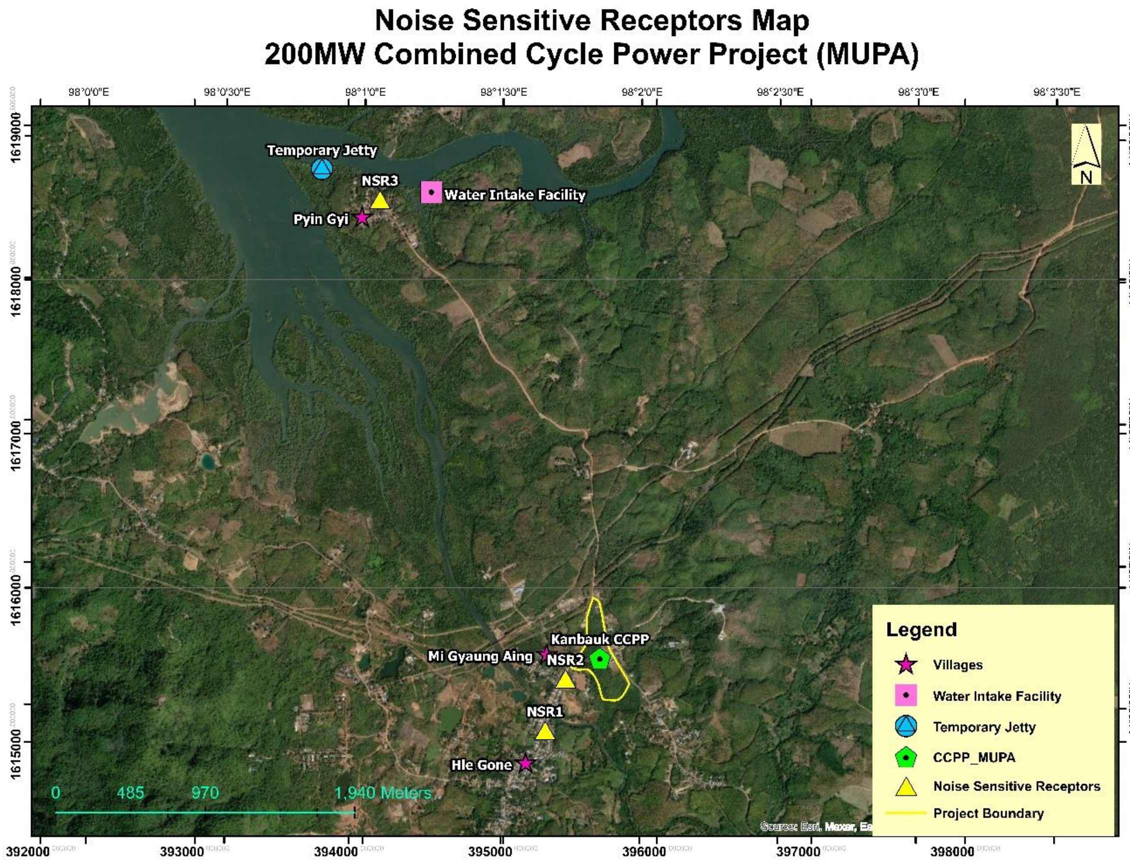


Figure 9. 1 Locations of Representative Noise Sensitive Receivers (NSRs)

9.7 Assessment Of Impacts

9.7.1 Construction Phase

Potential Impacts

The results of the predicted construction noise levels at the representative NSRs are presented in Table 9.7.

Table 9.7 Predicted Construction Noise Levels at Representative NSRs without Noise Mitigation Measures during Daytime Period

NSR	Maximum SWL from Construction Activities [a], dB(A)	Distance between the approximate geographical centre of the construction work site and NSR (D), m	Predicted Noise Level [b] [c], dB(A)
NSR1	118	152	69
NSR2	118	300	63
NSR3	118	550	58

Note:
(a) The maximum SWL of 118dB(A) from *Table 6.4* has been adopted in the calculation for conservatism.
(b) Predicted noise level = overall SWL + distance correction + façade reflection
= 118 – (20 x log D + 8) + 3
(c) The figures are rounded-up to a whole number.

Potential Consequence

With the indicative plant inventory presented in Table 9.4, the predicted construction noise levels at the representative NSRs are in the range of 69 - 70dB(A). Cumulative noise impact is presented in Table 9.8.

Table 9.8 Cumulative Construction Noise Levels at Representative NSRs without Noise Mitigation Measures during Daytime Period

NSR	Predicted Noise Level (A), dB(A)	Daytime Averaged Background Noise Level (B), dB(A) [c]	Cumulative noise level (C), dB(A) [a]	Increase background[b], dB(A) in noise	Compliance[b]
NSR1	69	61	70	9	No
NSR2	63	61	65	4	No
NSR3	58	61	63	2	Yes

Notes: (a) Cumulative Noise Level (C) = 10 x log $(10^{(A/10)} + 10^{(B/10)})$
(b) Noise assessment criterion: maximum increase in background levels of not more than 3 dB(A).
(c) The background noise environment at NSR1/NSR2/NSR3 is considered similar to that at the monitoring station N1. Hence, measured background noise levels at N1 are adopted as the background noise levels at NSR1/NSR2/NSR3.

The predicted noise levels at the three identified representative NSRs do not comply with the NEQ and IFC General EHS Guidelines during daytime period. The increases in background levels are 9dB(A), 4dB(A), and 2dB(A) at NSR1, NSR2, and NSR3 respectively. Noise mitigation measures are considered necessary to mitigate the noise impact due the construction of the Project.

Significance of Impacts

As presented in Table 9.7, the predicted noise levels do not comply with the assessment noise criteria. The construction noise impact is considered to be of **moderate** significance at the nearest receptor. A construction noise impact assessment summary is given in Table 9.9.

Table 9.9 Rating of Impacts on Project Infrastructure due to Construction Noise (Pre- Mitigation)

Impact	Potential impacts on project infrastructure due to construction noise.				
Impact Nature	Negative	Positive	Neutral		
	Potential noise impacts would be considered to be adverse (negative).				
Impact Type	Direct	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact from construction activities is temporary for the duration of the proposed Project.				
Impact Extent	Local	Regional	International		
	Noise impact from construction equipment and activities will have localised				
Impact Scale	NSRs near Project area may have significant impact due to construction activities.				
Frequency	Throughout construction period				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is likely to be medium.				
Receptor Sensitivity	Low	Medium	High		
	The identified NSR are residential, the sensitivity of the receptor is considered as medium.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be moderate.				

Mitigation / Management Measures

In view of the predicted noise exceedances during construction of the Project. Direct noise mitigation measures such as noise barriers should be considered to control the noise.

1. Selection of Quieter Equipment: Choose construction machinery and equipment with lower noise emissions whenever possible. Modern equipment often comes with noise-reducing features or can be outfitted with noise-reducing attachments.

2. Maintenance and Tuning: Regular maintenance and tuning of construction equipment can help ensure optimal performance and minimize noise emissions. This includes checking and repairing exhaust systems, engine components, and hydraulic systems to reduce noise levels.

3. Noise Barriers and Enclosures: Install temporary or permanent noise barriers and enclosures around noisy construction activities to contain and reduce noise emissions. These barriers can be constructed using materials such as concrete, wood, or sound-absorbing panels.

The use of noise barriers will be an effective means to mitigate the noise impact arising from the construction works. It is recommended that noise barriers should be installed at the site boundary (facing the villages) and high enough which completely hides the noise sources from the NSR. It is anticipated that at least a 10dB(A) noise reduction can be provided. The noise barrier material should have a superficial surface density of at least 7kg/m^{-2} and have no openings or gaps.

4. Construction Scheduling: Schedule noisy construction activities, such as pile driving or concrete pouring, during periods when noise-sensitive receptors are least affected, such as daytime hours on weekdays. Minimize noisy activities during evenings, nights, and weekends to reduce disturbance to nearby residents.

5. Buffer Zones: Create buffer zones between the construction site and sensitive receptors, such as residential areas, by using natural features like trees, hills, or existing structures to help attenuate noise propagation.

6. Noise Monitoring and Compliance: Implement a comprehensive noise monitoring program to assess noise levels at various locations around the construction site. Ensure compliance with relevant noise regulations and standards by regularly monitoring noise levels and adjusting construction activities as needed to mitigate exceedances.

7. Community Engagement and Communication: Maintain open and transparent communication with nearby residents and stakeholders regarding construction activities and associated noise impacts. Address concerns and complaints promptly and consider implementing community feedback into noise mitigation measures.

8. Employee Training: Provide training to construction workers on noise management practices, including proper operation of equipment, use of personal protective equipment (PPE) such as earplugs or earmuffs, and adherence to noise control measures.

9. Post-Construction Monitoring: Conduct post-construction noise monitoring to verify the effectiveness of mitigation measures and identify any remaining noise issues that may require further attention or adjustments.

Proposed noise mitigation measures and the reduced SWLs are shown in Table 9.10.

Table 9.10 Proposed Noise Mitigation Measures

Plant Item	Noise Mitigation Measures	Noise Reduction, dB(A)	Reduced SWL, dB(A)	Overall SWL, dB(A)
Group A				**108**
Site Formation				
Excavator	Noise barrier at site boundary	-10	101	
Bulldozer	Noise barrier at site boundary	-10	104	
Dump truck	Noise barrier at site boundary	-10	104	
Group B				**107**
Piling				
Rotary Bored Piling rig	Noise barrier at site boundary	-10	107	
Group C				**108**
Substructure & superstructure				
Batching plant	Noise barrier at site boundary	-10	98	

Plant Item	Noise Mitigation Measures	Noise Reduction, dB(A)	Reduced SWL, dB(A)	Overall SWL, dB(A)
Vibrating compactor	Noise barrier at site boundary	-10	103	
Steel Structure				
Crawler crane 100t – diesel	Noise barrier at site boundary	-10	89	
Crawler crane 50t – diesel	Noise barrier at site boundary	-10	85	
Hydraulic crane 50t –	Noise barrier at site boundary	-10	88	
Hydraulic crane 75t –	Noise barrier at site boundary	-10	92	

With the implementation of the noise barriers at the site boundary (facing the villages), the mitigated noise levels due to the construction of the Project were calculated at the representative NSRs with results summarized in Table 9.11 with cumulative noise presented in Table 9.12.

Table 9.11 Predicted Construction Noise Levels at Representative NSRs with Noise Mitigation Measures during Daytime Period

NSR	Maximum SWL from Construction Activities [(a)], dB(A)	Distance between notional noise source positions of the construction work site and NSR (D), m	Predicted Noise Level [(b), (c)], dB(A)
NSR1	108	152	59
NSR2	108	300	53
NSR3	108	550	48

Notes:

(a) The maximum SWL of 108dB(A) from Table 6.10 has been adopted in the calculation for conservatism.

(b) Predicted noise level = overall SWL + distance correction + façade reflection

= 108 – (20 x log D +8) + 3

(c) The figures are rounded-up to a whole number.

Table 9.12 Cumulative Construction Noise Levels at Representative NSRs with Noise Mitigation Measures during Daytime Period

NSR	Predicted Noise Level (A), dB(A)	Daytime Averaged Background Noise Level (B), dB(A) [(c)]	Cumulative noise level (C), dB(A) [(a)]	Increase in background noise [(b)], dB(A)	Compliance [(b)]
NSR1	59	61	63	2	Yes
NSR2	53	61	62	1	Yes
NSR3	48	61	61	0	Yes

Notes:

(a) Cumulative Noise Level(C) = 10 x log $(10^{(A/10)} + 10^{(B/10)})$

(b) Noise assessment criterion: maximum increase in background levels of not more than 3 dB(A).

Results indicate that with the adoption of the recommended mitigation measures, the predicted noise levels due to construction activities comply with the NEQ and IFC General EHS Guidelines during daytime period at the identified representative NSRs. The increase in background levels is not more than 3 dB(A) at the NSRs.

Residual Impact (Post-mitigation)

With the implementation of the proposed mitigation measures, the impact due to the construction of the Project is considered to be a **negligible** significance at the nearest receptors. A summary of construction noise impact assessment after mitigation is given in Table 9.12.

Table 9.13 Rating of Residual Impacts on Project Infrastructure due to Construction Noise (Post-Mitigation)

Impact	Potential impacts on project infrastructure due to construction noise.				
Impact Nature	Negative	Positive	Neutral		
	Potential noise impacts would be considered to be adverse (negative).				
Impact Type	Direct	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact from construction activities is temporary for the duration of the proposed Project.				
Impact Extent	Local	Regional	International		
	Noise impact from construction equipment and activities will have localized impact.				
Impact Frequency	NSRs near Project area may have significant impact due to construction activities.				
	Throughout construction period				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is likely to be medium.				
Receptor Sensitivity	Low	Medium	High		
	The identified NSR are residential, the sensitivity of the receptor is considered as medium.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be moderate.				

Other Mitigation Measures and Management Measures

Other than implementation of noise barriers, good site practices are recommended to be implemented by the EPC contractor to minimize the potential noise impacts during the construction phase, including:

- Well-maintained equipment to be operated on-site;
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components;
- Shut down or throttled down between work periods for machines and construction plant items (e.g. trucks) that may be in intermittent use;
- Reduce the number of equipment operating simultaneously as far as practicable;
- Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors far as practicable;
- Locate noisy plant (such as hydraulic hammer and lorry mounted concrete pump) as far away from receptors as practicable;

- Avoid transportation of materials on- and off-site through existing community areas; and
- Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.

Comparison with applicable regulations, standards and guidelines

With the implementation of recommended noise mitigation measures for the proposed plant inventory and only 1 group of equipment operating at any one-time during construction (i.e. no overlapping of Group A, B and C), the predicted construction noise levels comply with the NEQ and IFC EHS Guidelines during the construction phase at all NSRs. It is not anticipated that adverse noise impacts will occur during the construction phase of the Project.

In the case of significant changes to the construction plant inventory and respective operating parameters from the current assumptions, re-assessment may be required to be conducted to identify compliance with noise criteria.

Monitoring plan

Monthly noise monitoring should be conducted at the representative NSRs by the EPC contractor to check noise levels and compliance at the NSRs throughout the construction phase.

9.7.2 Operation Phase

Potential Impacts

The operational noise levels at the representative NSRs were predicted based on the plant inventory presented in Table 9.5**.** - Pipeline During the operation phase, noise generated from the water intake pipeline itself might be anticipated, because the pipeline is buried underground. However, if the pipeline is aboveground or partially exposed, there could be some noise generated from the flow of water or mechanical components such as pumps or valves. The noise generated by the water intake pipeline could affect nearby residential areas, wildlife habitats, or sensitive ecosystems. For example, if the pipeline passes through residential areas or near wildlife habitats, noise pollution could disturb residents or disrupt wildlife behavior, breeding patterns, or migration routes. The noise contour is illustrated in Figure 9.2. The predicted operation noise levels are summarized in Table 9.14.

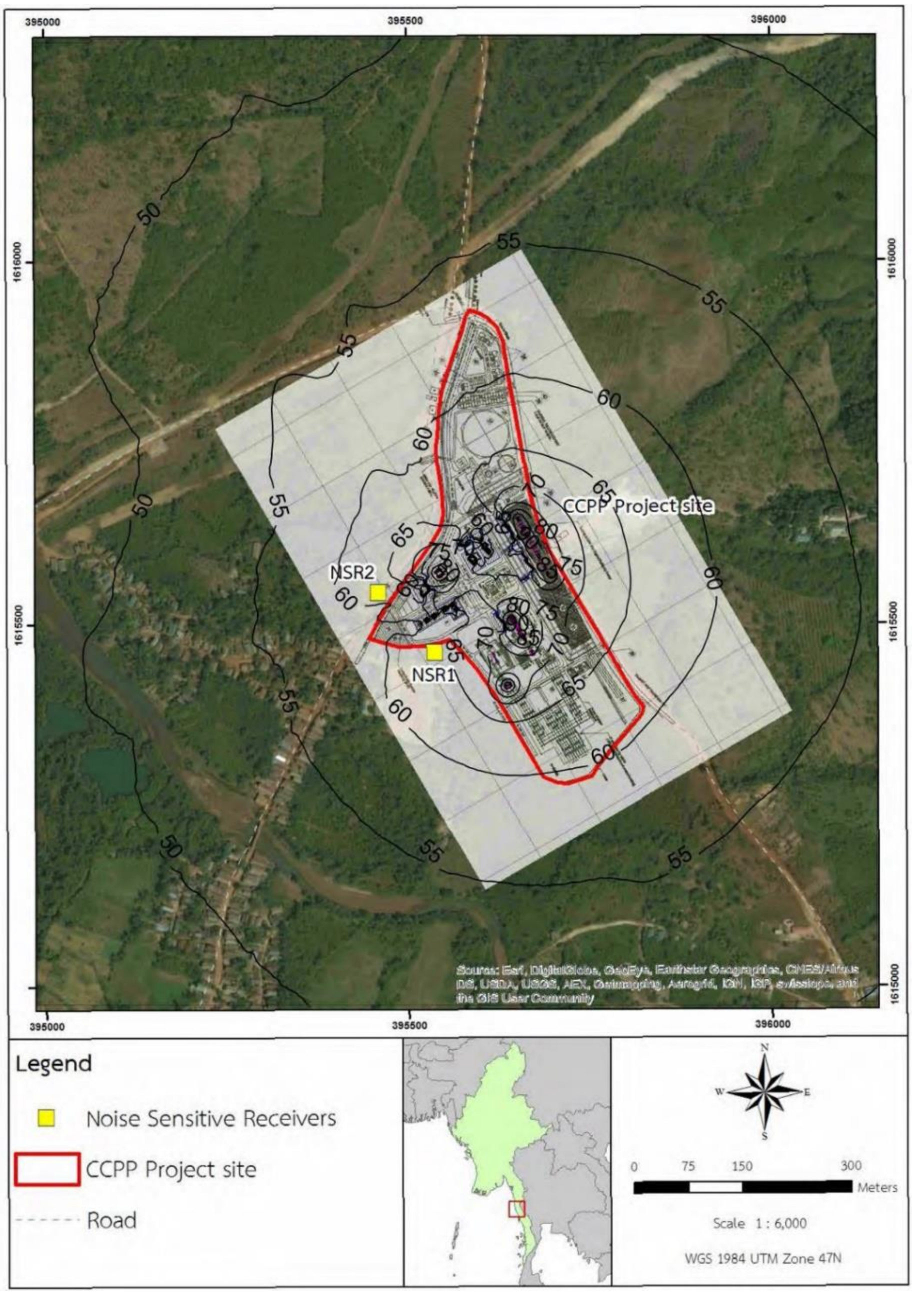


Figure 9. 2 Operational Noise Contour (without Mitigation Measures)

Table 9.14 Predicted Operational Noise Levels at Representative NSRs without Mitigation Measures

NSR	Predicted Noise Level (A), dB(A)	Averaged Background Noise Level (B), dB(A)		Cumulative Noise Level (C), dB(A) [(a)]		Increase in background noise [(b)], dB(A)		Compliance [(b)]	
		Day	Night-time	Day	Night-time	Day	Night-time	Day	Night-time
NSR1	69	61	64	70	70	**9**	**6**	**N**	**N**
NSR2	63	61	64	65	67	**4**	3	**N**	Y
NSR3	58	61	64	63	65	2	1	Y	Y

Notes: (a) Cumulative Noise Level(C) = 10 x log $(10^{(A/10)} + 10^{(B/10)})$

(b) Noise assessment criterion: maximum increase in background levels of not more than 3 dB(A).

Potential Consequence

The predicted operational noise levels at NSR1 exceed both the NEQ and IFC General EHS Guidelines during daytime and night-time periods, meanwhile, the predicted noise levels at NSR2 and NSR3 exceed noise criteria during night-time period. The increases in background levels are 8dB(A) and 19dB(A) at NSR1 during daytime and night-time periods, respectively, and 8dB(A) at NSR2 and 5dB(A) at NSR3 during night-time period. Noise mitigation measures are considered necessary to mitigate the noise impact due the operation of the Project.

Significance of Impacts

As presented in Table 9.14, the predicted noise levels do not comply with the assessment noise criteria. The operation noise impact is considered to be of **moderate** significance at the nearest receptor. A construction noise impact assessment summary is given in Table 9.15.

Table 9.15 Rating of Impacts on Project Infrastructure due to Operation Noise (Pre-Mitigation)

Impact	Potential impacts on project infrastructure due to operation noise.			
Impact Nature	**Negative**	Positive	Neutral	
	Potential noise impacts would be considered to be adverse (negative).			
Impact Type	**Direct**	Indirect	Induced	
	Potential impacts would likely be direct impacts.			
Impact Duration	Temporary	Short-term	**Long-term**	Permanent
	The impact from operational activities is long-term for the duration of the proposed			
Impact Extent	**Local**	Regional	International	
	Noise impact from operation equipment will have localised impact.			

Impact Scale	NSRs near Project area may have significant impact due to construction				
Frequency	Throughout operation period				
Impact Magnitude	Positive	Negligible	**Small**	**Medium**	**Large**
	• Small Magnitude at N1 during daytime period • Medium Magnitude at N2 during night-time period • Large Magnitude at N1 during night-time period				
Receptor Sensitivity	Low	**Medium**	High		
	The identified NSR are residential, the sensitivity of the receptor is considered as medium.				
Impact	Negligible	**Minor**	**Moderate**	**Major**	
Significance	• Minor Impact at N1 during daytime period • Moderate Impact at N2 during night-time period • Major Impact at N1 during night-time period				

Mitigation / Management Measures

In view of the predicted noise exceedances during operation of the Project, direct noise mitigation measures, such as noise barriers and installation of silencers, should be considered to mitigate noise impact.

In consideration of close proximity between representative NSRs and Project site, noise barriers should be installed at the site boundary (facing the villages) that can completely hide the operation plant equipment from the NSRs. The noise barrier material should have a superficial surface density of at least 10kg/m^2 and have no openings or gaps in order to minimise the transmission of sound through the barrier. In addition to the noise barriers, installation of silencers should also be installed for fans or exhausts to reduce the noise impact from the HRSG and cooling towers.

Proposed noise mitigation measures for operation plant items and the reduced SPLs are shown in Table 9.16.

Table 9.16 Proposed Noise Mitigation Measures

Plant Item	Noise Mitigation Measures [(a)]	Required Noise Reduction dB(A)	Reduced SPL at 1m, dB(A)
Heat Recovery Steam Generator (HRSG)	Installation of silencer	-15	70
Gas Compressor	-	-	85
Gas Turbine (GT) & Generator	-	-	65
Step Up Transformer	-	-	85
Steam Turbine (ST) & Generator	-	-	65
20MW Gas Engines (Existing)	-	-	85

Plant Item	Noise Mitigation Measures [a]	Required Noise Reduction dB(A)	Reduced SPL at 1m, dB(A)
Cooling Tower	Installation of silencer	-10	75

Note: [a] In addition to the silencers, noise barriers that can completely hide the operation plant equipment from the NSRs should be installed at the site boundary (facing the villages), as shown in Figure 6.3.

With the implementation of the noise barriers and installation of silencers for the HRSG and cooling towers, the mitigated noise contour is presented in Figure 9.3 with predicted noise levels summarized in Table 9.17.

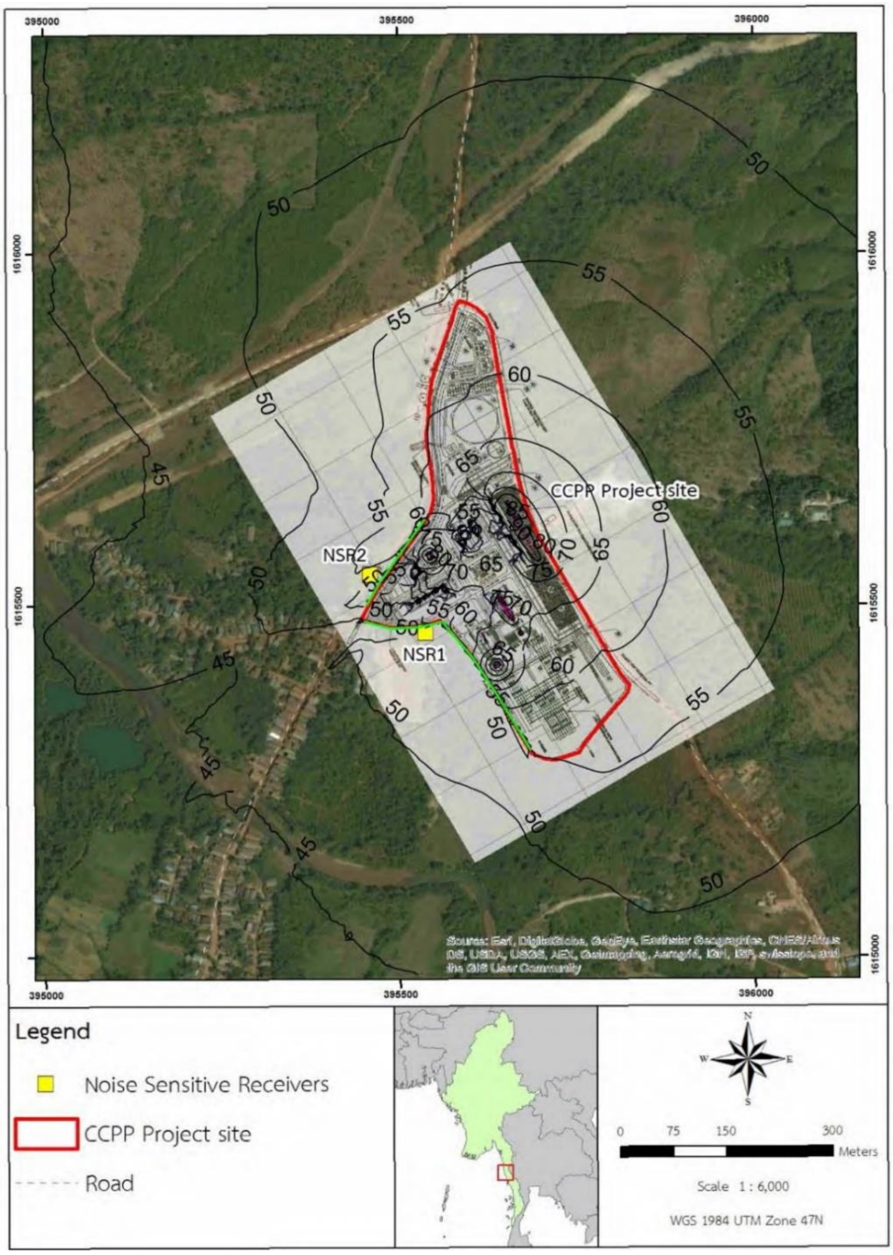


Figure 9. 3 Operational Noise Contour with Mitigation Measures

Table 9.17 Predicted Operational Noise Levels at Representative NSRs with Mitigation Measures

NSR	Predicted Noise Level (A), dB(A)	Averaged Background Noise Level (B), dB(A) (b)		Cumulative Noise Level (C), dB(A) (a)		Increase in background noise (b) , dB(A)		Compliance (b)	
		Day	Night-time	Day	Night-time	Day	Night-time	Day	Night-time
NSR1	59	61	64	63	65	2	1	Y	Y
NSR2	53	61	64	62	64	1	0	Y	Y
NSR3	48	61	64	61	64	0	0	Y	Y

Notes: (a) Cumulative Noise Level (C) = 10 x log $(10^{(A/10)} + 10^{(B/10)})$
(b) Noise assessment criterion: maximum increase in background levels of not more than 3 dB(A).

Results indicate that with the adoption of the recommended mitigation measures, the predicted noise levels due to operational activities comply with the NEQ and IFC General EHS Guidelines during daytime and night-time periods at all NSRs. The increase in background levels is not more than 3 dB(A) at all NSRs.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the noise impact due to the operation of the Project is considered to be a **negligible** significance at the nearest receptors. A summary of operational noise impact assessment after mitigation is given in Table 9.17.

Table 9. 18 Rating of Residual Impacts on Project Infrastructure due to Operation Noise (Post- Mitigation)

Impact	Potential impacts on project infrastructure due to operation noise.				
Impact Nature	**Negative**	Positive		Neutral	
	Potential noise impacts would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect		Induced	
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The impact from operational activities is long-term for the duration of the proposed Project.				
Impact Extent	**Local**	Regional		International	
	Noise impact from operation equipment will have localized impact.				
Impact Scale	NSRs near Project area may have significant impact due to construction activities.				
Frequency	Throughout operation period				
Impact	Positive	**Negligible**	Small	Medium	Large

<table>
<tr><td>Magnitude</td><td colspan="5">• Negligible Magnitude at N1 during daytime period
• Negligible Magnitude at N2 during night-time period
• Negligible Magnitude at N1 during night-time period</td></tr>
<tr><td rowspan="2">Receptor Sensitivity</td><td>Low</td><td colspan="2">Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">The identified NSR are residential, the sensitivity of the receptor is considered as medium.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>Negligible</td><td>Minor</td><td colspan="2">Moderate</td><td>Major</td></tr>
<tr><td colspan="5">• Negligible Impact at N1 during daytime period
• Negligible Impact at N2 during night-time period
• Negligible Impact at N1 during night-time period</td></tr>
</table>

Other Mitigation Measures and Management Measures

Other than implementation of noise barriers and installation of silencers, good site practices are recommended to be implemented by the Project Proponent to minimise the potential noise impacts during the operation phase, including:

- Selecting equipment with lower SWLs;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;
- Re-locating noise sources to fewer sensitive areas to take advantage of distance and shielding;
- Installing vibration isolation for mechanical equipment;
- Installing acoustic enclosures for equipment casing radiating noise;
- Siting permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing noise of ground operations at the source or through the use of sound barriers and deflectors.
- To minimize the impact of noise from the water intake pipeline. This must be include using soundproofing materials, implementing noise barriers or enclosures, optimizing equipment placement, scheduling maintenance activities during off-peak hours, or establishing buffer zones between the pipeline and sensitive receptors.

Comparison with applicable regulations, standards and guidelines

With the implementation of the recommended noise mitigation measures, i.e. installation of noise barriers at site boundary (facing the villages) and installation of silencers for the HRSG and cooling towers, the predicted operational noise levels comply with the NEQ and IFC EHS Guidelines during the operation phase at all NSRs. It is not anticipated that adverse noise impacts will occur during the operation phase of the Project.

In the case of significant changes to the operation plant inventory and respective operating parameters from the current assumptions, re-assessment may be required to be conducted to identify compliance with noise criteria.

Monitoring plan

Noise commissioning test should be conducted for the operation plant items by the Project Proponent prior to the operation of the Project to ensure compliance with the relevant noise criteria at the representative NSRs.

CHAPTER 10 SURFACE WATER

10.1 Introduction

During the construction and operation phases, different activities have the potential to generate wastewater, accidental spills, sedimentation, and increased water consumption, which could lead to impacts on the hydrology and quality of surrounding freshwater bodies. In the Project study area, the Heinze Chaung River is identified as the most prominent potential receiving body. Therefore, it is important to understand the interaction between impacts generated from construction and operation activities of the Project and the subsequent effects on surface water quality and hydrology. This Chapter presents an evaluation of the potential impacts on surface water associated with the construction and operation of the proposed Project based on the impacts identified during Scoping.

This Chapter also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP, Chapter 19) for the Project.

10.2 Assumptions And Limitations

The assessment of potential impacts related to surface water in this section is based on the environmental baseline data (presented within Chapter 5), socio-economic baseline data (presented within Chapter 6) and the information available from MUPA at the time of writing. Judgements and assessments have been made based on professional knowledge and previous experience of ERM. It is noted that no quantitative modelling has been undertaken with regards to any elements of the surface water impact assessment. Should there be significant changes in factors such as assumed input data, engineering design of wastewater management and treatment components of the Project, or agreed assessment criteria, then elements of this impact assessment and associated management, mitigation and monitoring measures may be needed to reflect these changes.

The environmental parameters sampled in the baseline survey (refer to Chapter 5) are based upon commonly found contaminants.

This chapter focuses purely on water bodies as the receptor. It is recognized that any changes to surface water may potentially impact sensitive receptors that utilize these surface water resources. It is recognized that there is considerable cross over between assessment of impacts to surface water, and assessment of impacts to fish stock, mangrove ecosystems and any surface water users. In this regard, this chapter assesses impacts and develops management, mitigation and monitoring measures in relation to reducing impacts to surface water only. Assessing impacts to receptors from identified changes to water quality or hydrology (identified as a result of this Chapter) has been undertaken within the scope of other respective chapters, and considered the various management, mitigation and monitoring measures developed within this chapter.

10.3 Assessment Methodology

The methodology used for assessing impacts to surface water is aligned with the general impact assessment methodology presented in Chapter 7.

10.4 SUMMARY OF BASELINE CONDITIONS

The main river within the Project area is Heinze Chaung River. The Heinze River is located approximately 3km north-west of the Project site boundary. The river is under tidal influence, and becomes brackish during the dry season. The estuary and creeks of the river are navigable by small craft and are fringed by mangrove forest. There are number of villages located on its banks, therefore, the river is currently used for fisheries, navigation and marine logistic purposes.

Results from baseline sampling of surrounding water bodies, including the Heinze Chaung River, showed that in general the water bodies are healthy with low levels of organic matter contamination. However, total suspended solids, total dissolved solids, and certain metals (including lead and arsenic) were found to be at elevated concentrations at some stations.

10.5 ASSESSMENT OF IMPACTS TO SURFACE WATER

10.5.1 Construction Phase

Proposed Project Activities with Potential Impact

Construction of the power plant will be carried out by the EPC contractor appointed by MUPA. Construction is expected to start mid-2019 and be complete in the region of 30 months with SCOD end of 2021. The maximum number of workers onsite during construction is anticipated to be 600 persons.

During the construction phase, potential impacts to surface water may arise from the following activities:

- Wastewater discharges and runoff, including contaminated surface water runoff, and increased erosion and sedimentation from excavation and foundation works;
- Inappropriate waste storage and disposal; and
- Pressure on local water supplies due to Project's water intake requirements.

The gas pipeline extends 2.6 kilometers from the Metering Station of MOGE to the plant. This pipeline runs across the Mi Chaung Ai stream underground. This route was already constructed in April 2019, so it is not considered for impact assessment for construction phase.

The consumption by the combined cycle power plant can indeed impact the water usage of villagers who rely on groundwater. Despite the distance of 2 km between the nearest village (Pyin Gyi) and the river, the large-scale extraction of water from the river by the power plant may still affect groundwater levels in the vicinity.

The withdrawal of such a significant volume of water from the river can potentially reduce its flow, which in turn may impact the recharge of groundwater aquifers. Groundwater recharge often depends on the presence of surface water bodies such as rivers, which replenish underground reservoirs through natural processes. When river flow decreases due to water extraction by the power plant, the recharge of groundwater may be compromised, leading to lowered groundwater levels over time.

As a result, villagers who rely on groundwater for various purposes such as drinking, agriculture, and domestic use may experience decreased access to water or even face water scarcity issues. The reliance on groundwater becomes particularly critical in regions where surface water sources are limited or subject to heavy demand and environmental pressures.

Therefore, while the villages are located near the river, the water usage by the combined cycle power plant can still have significant implications for the availability and sustainability of groundwater resources for the local community.

Wastewater Discharges and Runoff

Wastewater discharge and runoff during the construction phase may lead to contamination of freshwater sources if not managed appropriately. During the construction phase, there are a number of anticipated wastewater sources.

Workers will be accommodated in a worker's camp adjacent to the site, and sanitary wastewater streams from the workers could potentially impact surface water. Sanitary facilities, including toilets and septic tanks, will be provided for the use of the construction workforce both on-site and at the workers' accommodation. If not adequately designed and positioned to reflect the local hydrological and hydrogeological patterns, untreated sanitary wastewater due to leakages or overflows could have the potential to enter surface water. Periods of high rainfall could lead to overflow, or rapid through-flow, of the effluent to surface water prior to its full digestion in the septic tanks. Raw sewage can impact surface water quality by promoting the growth of algae and delivering pathogens that may be harmful to human and ecological receptors. Sanitary wastewater is generally characterized as having a high concentration of solids (suspended and dissolved), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), nutrients (nitrogen, ammonia) and faecal coliform counts. The organic substances (e.g. hydrocarbon, protein) are decomposed in water, and the decomposition of organic matter will reduce the oxygen content dissolved in water. Quantities of sanitary wastewater discharge for the Project are not yet known, but estimates can be made based on the number of workers. The approximate number of people onsite during the construction phase is expected to be an average of 600 people per day. Conservatively assuming 100L/person/day of water consumption, and considering sanitary wastewater production to be 80% of water consumption per person (for non-continuous use), this equates to the production of 48,000 liters of sanitary wastewater daily. In addition, construction activities such as site clearance, earthworks, disposal of back fill materials, installation of hard standing areas, etc., could cause runoff of unconsolidated sediments during rainfall. The generation of sediment laden run off could be transferred to the nearby freshwater bodies, which could increase total suspended solids and turbidity in receiving waters.

Construction of the pumping station and water intake pipeline at the embankment of the Heinze River (shown in Figure 10.1***)*** may cause impacts on surface water quality if piling or dredging activities are required. This could result in localized impacts such as runoff and erosion of exposed bare soil, slopes and earth, and release of cement materials into surface water bodies with stormwater runoff. Baseline surveys for the Heinze River found that there were already elevated levels of TSS.

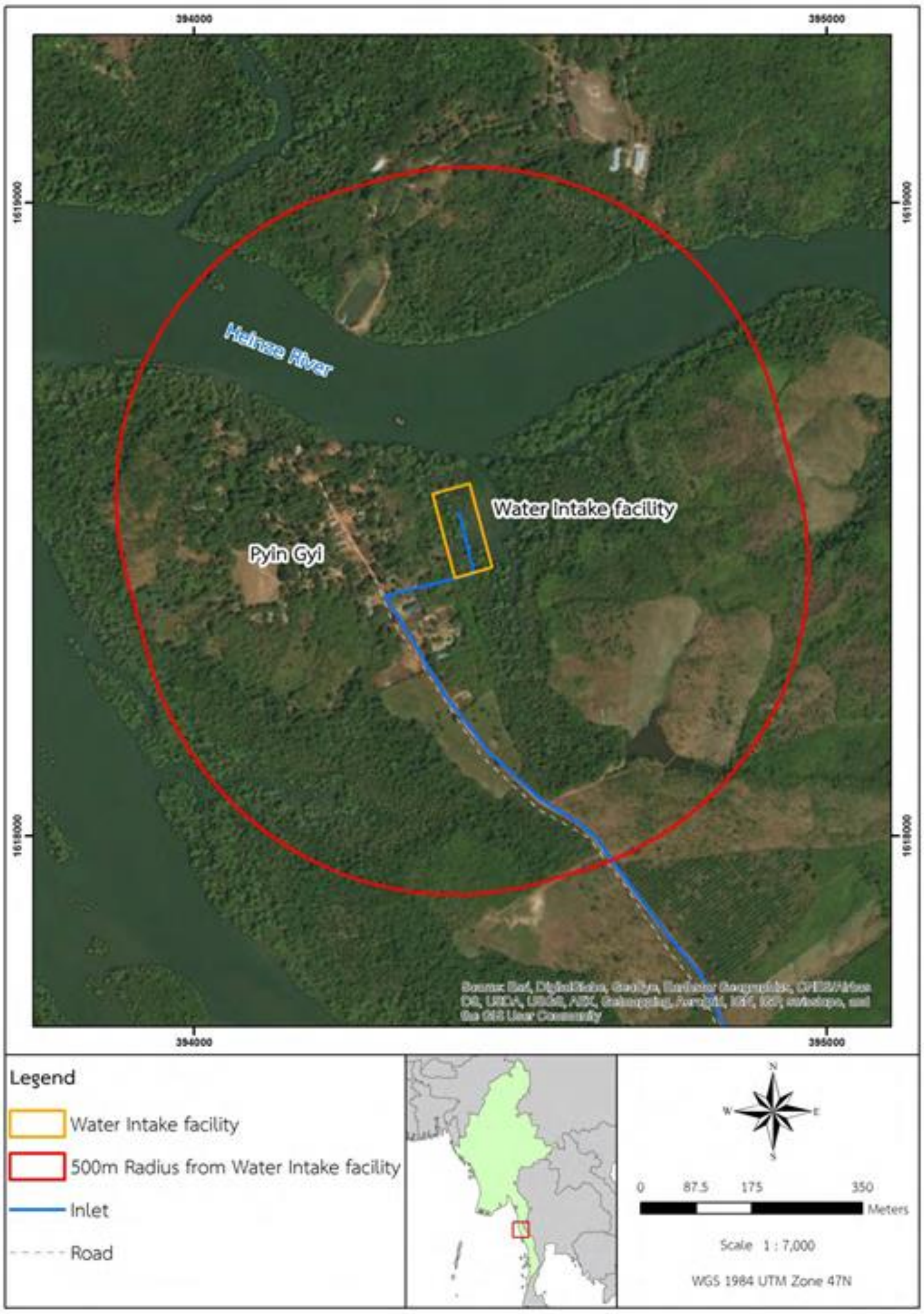


Figure 10. 1 Water Intake Facility

Wastewater may also be generated from washing of equipment and machinery on site, as well as from the concrete batching plant. This wastewater may contain suspended solids and traces of hydrocarbons. The discharge of wastewater produced during concreting can also lead to changes in the pH of the receiving water body, if not first treated.

The sewage generated onsite will be collected through underground pipes into a holding tank, from where the sewage will be routed to an onsite sewage treatment plant or alternatively transported periodically by vacuum trucks and transferred to a septic tank or discharge to common drain. The capacity of the system is based on the number of workers and will be equivalent to 48 (simultaneous) persons. Additional septic tanks will be provided, if necessary, depending upon the location and number of workers as per the site condition.

The contractor will be responsible for ensuring that any wastewater discharged meets the applicable World Bank/ IFC General EHS Guidelines prior to discharge of such wastewater. Stormwater runoff will be drained to a common settlement tank to remove solids, before being discharged to a common drain.

Potential impacts to surface water quality are expected to be short-term and localized in nature, and can be controlled if wastewater treatment systems are adequately designed.

Waste Storage and Disposal

During the construction phase, waste materials, if not stored and disposed of appropriately, have the potential to cause surface water contamination through direct release or from contaminated stormwater runoff.

The majority of the generated wastes from the Project during the construction phase will be non-hazardous. General construction waste will comprise of surplus or off- specification materials such as concrete, steel cuttings/filings, wooden planks, packaging paper or plastic, wood, plastic pipes, metals, etc. Domestic wastes consisting of food waste, plastic, glass, aluminum cans and waste packages will also be generated by the construction workforce. There will also be biomass waste associated with the clearance of tree, shrubs and grass. Approximately $800m^3$ of biomass waste is anticipated during construction. Opportunities for providing biomass waste to the local community will be explored or biomass waste will be disposed of by a licensed waste contractor. All excavated material will be backfilled with no surplus.

A small proportion of the waste generated during construction will be hazardous, including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on site.

Based on experience with similar projects, the total approximate quantities of non- hazardous and hazardous waste that could be a potential source of impact during this stage (assuming an average of 600 workers per day) include:

- 600 kg/day of solid (non-hazardous) waste; and
- 135 kg/month hazardous waste (estimated based on similar Project).

Infill will be used for backfilling, while steel waste will be sold as scrap. Wooden crates will be disposed by authorized 3rd party disposal contractors. Hazardous wastes will be disposed of by authorized 3rd party disposal contractors. The construction contractor will handle, store and dispose of all waste in accordance with applicable guidelines. Concrete waste of inert nature will be stored in a laydown area near the concrete batching plant and will be reused where possible. Any bitumen waste will be stored separately in a lined area to be disposed of by licensed contractors.

Pressure on Local Water Supply due to Project's Water Intake Requirements

During construction, water is required for construction worker activities and prefabricated concrete activities. The maximum number of workers onsite during construction is anticipated to be 600 persons and each worker is estimated to consume approximately 33.3 litres of water per day [49].Prefabricated concrete activities are estimated to consume 40m^3 of water per day.

The average water consumption rate during construction is anticipated to be 1,799 m^3 per month (approximately 60 m^3 (60,000 L) per day). The raw water required during construction will be obtained from the local water distribution services. The raw water will be treated and purified to supply for construction.

The Socio-Economic Baseline found that, in the study area, groundwater is the main source of drinking water along with stored water from streams. Water from the Heinze river is also used by villagers from Pyin Gyi to some extent for domestic use but not as drinking water. Water is available all year round except in Phet Taung during the dry season.

WHO Regional Office for South-East Asia[50] suggests that, including requirements for drinking, cooking, washing, cleaning, and waste disposal, up to 70 L per person per day of water are required for human use. The Project's water requirement of 60,000 L per day during construction is equivalent to the water requirement for 857 people. Since MUPA will be utilizing the local water distribution services and local population in Kanbauk tract and surroundings is well over 10,000, it is not anticipated that the Project's water requirements during construction will have a significant impact on local water supply.

Receptor Identification and Sensitivity

The primary receptor for impacts to surface water from wastewater discharge and runoff is the Heinze River, and adjoining streams and tributaries. Based on the baseline sampling conducted in the Heinze river, some parameters were found to be above relevant standards, and therefore the water bodies may be more sensitive to changes. However, the resources do not support very diverse or susceptible populations of flora and/or fauna, and their importance for local habitats and communities would be considered moderate. Overall, sensitivity of the receptor is considered Medium.

Table 10. 1 Rating of Impacts on Surface Water due to Construction Phase, including Wastewater discharges and runoff, inappropriate waste storage and disposal, and Water Use (Pre-Mitigation)

Impact	Potential impacts on surface water due to construction phase.			
Impact Nature	Negative	Positive	Neutral	
	Potential impacts to surface water would be considered to be adverse (negative).			
Impact Type	Direct	Indirect	Induced	
	Potential impacts would likely be direct impacts.			
Impact Duration	Temporary	Short-term	Long-term	Permanent
	Construction is expected to start mid-2019 and be complete in the region of 30			
Impact Extent	Local	Regional	International	
	Potential impacts would be limited to the Project area and downstream of the Heinze			

[49] Metcalf& Eddy Inc. Wastewater Engineering: Treatment, Disposal, Reuse. 3rd Edition McGraw Hill, Network, 1979

[50] http://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WHO/WHO5%20-%20Minimum%20water%20quantity%20needed%20for%20domestic%20use.pdf

Impact Scale	The total approximate quantities of wastewater that could be a potential source of impact during this stage (assuming an average of 600 workers per day) include 48,000 L/day of sanitary wastewater. The total approximate quantities of waste that could be a potential source of impact during this stage (assuming an average of 600 workers per day) include 600 kg/day of solid waste and 135 kg/month hazardous waste. The Project's water requirement of 60,000 L per day during construction is equivalent to the water requirement for 857 people. The scale of potential impacts due to release of waste or wastewater is potentially large due to the number of workers and quantities of waste/wastewater present during this stage, but appropriate waste management practices will mitigate the impacts.				
Frequency	Impacts to surface water from waste management, wastewater discharges and water use could occur intermittently but repeatedly throughout the day for the duration of the construction phase.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is likely to be small.				
Receptor Sensitivity	Low	Medium	High		
	The primary receptor for impacts to surface water from wastewater discharge and runoff is the Heinze River, and adjoining streams and tributaries. Sensitivity of the receptor is considered Medium.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be minor.				

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Install silt trap to treat surface run-off from bunded areas prior to discharge to the stormwater system;
- Implement adequate sanitary facilities for the construction workforce;
- Liquid effluents arising from construction activities will be treated to the applicable IFC guideline and Myanmar NEQG prior to discharge;
- Exposed soil surfaces should be protected by paving or fill material as soon as possible to reduce the potential of soil erosion and subsequent sedimentation;
- Use methods for minimizing sediment runoff, as appropriate to the conditions on-site, including: wheel cleaning facilities, sand bag barriers, mulching, and re-vegetation, protect temporary trafficked areas on-site with coarse stone ballast or equivalent, open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms;
- Regularly, and particularly following rainstorms, inspect and maintain drainage systems and erosion control and silt removal facilities to ensure proper and efficient operation at all times;
- Surface run-off from bunded areas should pass through oil/water separators prior to discharge to the stormwater system;

- Erosion and Sediment Control Measures: Implement erosion and sediment control measures, such as silt fences, sediment traps, and erosion control blankets, to prevent soil erosion and sedimentation of nearby water bodies during construction activities. These measures help to minimize the discharge of sediment-laden stormwater runoff into streams or rivers.
- Stormwater Management Plans: Develop and implement comprehensive stormwater management plans that include strategies for managing and treating stormwater runoff from construction sites. This may involve the installation of temporary stormwater detention basins, sedimentation ponds, or vegetated swales to capture and treat runoff before it is discharged off-site.
- Site Grading and Drainage Design: Design the site grading and drainage systems to minimize surface runoff and direct stormwater away from sensitive areas, such as wetlands, watercourses, and neighboring properties. Proper grading and drainage design can help reduce the volume and velocity of stormwater runoff, thereby reducing erosion and sedimentation risks.
- Use of Permeable Surfaces: Where feasible, use permeable paving materials or porous pavement systems for temporary access roads, parking areas, and staging areas to promote infiltration of stormwater into the ground. This helps to reduce surface runoff and alleviate pressure on stormwater management infrastructure.
- Vegetative Buffer Zones: Establish vegetative buffer zones along water bodies and sensitive areas to help filter and absorb stormwater runoff, reducing the transport of pollutants and sedimentation into adjacent watercourses. Planting native vegetation can also enhance soil stability and provide habitat for wildlife.
- Construction Site Best Management Practices (BMPs): Implement construction site BMPs, such as proper waste management, spill prevention and response measures, and vehicle and equipment maintenance protocols, to minimize the potential contamination of stormwater runoff with construction-related pollutants, including chemicals, fuels, and construction debris.
- Oil-contaminated water, if any, will be collected and handled by local licensed wastewater sub-contractors (if available, to be determined at a later stage).
- Provide training to labourers for waste disposal in designated areas and use of sanitation facilities;
- Implement proper storage of the construction materials and wastes to minimize the potential damage or contamination of the materials;
- Ensure that storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container;
- Implement construction materials inventory management system to minimize over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period;
- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odour nuisance);
- Dispose of waste by licensed contractors.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

Monitoring plan

As detailed in the ESMP chapter, monitoring for surface water during the construction phase should consist of half-yearly monitoring up and downstream of the pumping station in the Heinze River, using standard analytical methods.

10.5.2 Operation Phase

Proposed Project Activities with Potential Impact

The operation phase is expected to continue for approximately 30 years. The average number of permanent workers present during operation is expected to be approximately 49, with small numbers of additional staff for security, cleaning, technical assistance, and occasional maintenance. The assessment of operational phase impacts includes those arising from routine operations and maintenance of the power plant. During the operation phase, potential surface water impacts may arise from domestic wastewater discharge, inappropriate waste storage and disposal, contaminated surface water runoff, cooling water withdrawal, erosion, and sedimentation.

During the operation phase, potential impacts to surface water may arise from the following activities:

- Wastewater discharges and runoff, primarily process wastewater (including cooling water discharge);
- Inappropriate waste storage and disposal;
- Pressure on local water supplies due to Project's water intake requirements; and
- Impacts to Surface Water Hydrology from Increased Impervious Surfaces.
- Gas pipeline operation (2.6 km)

Wastewater Discharges and Runoff

Sources of wastewater generation during the operation phase primarily consist of process wastewater, sanitary wastewater, and stormwater. Approximate quantities which will be generated during operation are as follows:

- Sludge from river water pre-treatment: 1 m3/hr
- DM plant neutralized water: 5 m3/hr
- Cooling tower blowdown: 60 m3/hr
- Stormwater: intermittent
- Washing water from Main Block: intermittent
- Sanitary wastewater (sewage, kitchen, greywater): ~ 10 m^3/hr

As wastewater will ultimately be discharged to the nearby small water channel discharge point to the North West side of the Project Site, there may be potential impacts to downstream users of the water or aquatic ecosystems, due to altered water quality.

An overview of management of wastewater and treatment from the Plant is as follows:

Wastewater Treatment System

The wastewater system will collect and dispose of the following plant wastes:

- Cooling tower blow down;
- Chemical spillage / waste;
- Oily spillage / waste;
- Clear water from sewage treatment plant; and
- Equipment drains.

Stormwater, process wastewater (including blowdown water and plant/ equipment washed water) and sanitary wastewater will be collected and treated in the wastewater treatment plant located within the power plant prior to discharge into the final checking pond and discharge off-site. Wastewater conditions will comply with the relevant standards as described in Chapter 3. All treated wastewater will be collected, monitored and discharged into the water channel at discharge point.

Wastewater from the plant process will be treated with pH control within a pH range 6 to 9 in the neutralization treatment system and oil-water separator system. The treated wastewater will be discharge into final checking pond before discharge to the small water channel. Sewage will be treated in a package sewage treatment and discharged into the wastewater discharge system to the north west side of the Project site. The sludge will be dewatered and disposed off-site by a licensed waste contractor.

The Power Plant drain for stormwater at areas of where lubricating oils are handled will be connected to an oil and grease pit (interceptor). The contaminants will be captured in the pit and removed manually. Contaminated stormwater will be sent to the oil-water separator system before discharge to the water treatment facility while uncontaminated stormwater will be discharged offsite into the small water channel discharge point to the north west side of the Project Site.

Wastewater will be collected in different sumps depending on the location of the waste source:

- Drain/Stormwater: All open drains shall be formed from concrete. Building perimeter drains shall be covered using hot dipped galvanized steel gratings. A storm water sump or catch basin shall be provided at every change of direction of open drain.
- Water run-off from roofs of building shall be channeled at regular discharge points to the apron drains. Apron drains shall connect to roadside drain along roads within the site. Internal drains shall also be provided for surface run-off at buildings not enclosed by roof and shall connect to the nearest apron drains or roadside drains. The flow in roadside drains shall be intercepted by outlet drains at key locations around the site and ultimately be discharged to the designated discharge points.
- In general, the discharge of storm water through the drainage system shall be by gravity. The size of the storm water drains, pits and sumps shall be designed to account for specific site conditions and shall comply with the relevant Myanmar National Codes and Standards.
- Rainwater within the transformer pits shall be sufficiently sized to contain oil spillage by means of oil stop valve. The rainwater, if not contaminated will be pumped directly to storm water drainage.
- Chemical Waste/ Industrial Wastewater: The equipment and miscellaneous plant drain

systems shall collect wastewater from the plant and equipment drains, floor wash-down, and fire protection discharges, and direct it to the oil/water separator. The oil/water separator shall remove oil, grease, and gross suspended solids. The oil/water separator system shall be sized on a 60-day cycle for disposal of oil collected. The oily waste from the oil/water separator shall be collected in a double-walled underground tank for offsite disposal. Gas turbine compressor wash water, HRSG chemical cleaning waste, and other chemical laden or otherwise undesirable water shall be collected on site and held for subsequent pickup and appropriate disposal by tank trucks.

- Sanitary Sewage System: All domestic sewage shall be collected from toilets, sinks, and showers and transferred to a sewage underground holding tank. The tank shall be fiberglass with an easily accessible manhole cover for pump-out and two-level alarms. The system shall also be designed to be easily tied-in to a future public sewer line or treatment system.
- The proposed water discharge alignment will run alongside the west of the Project site boundary, and the wastewater will be discharged into the ditch north west of the Project site. The overall total wastewater discharge is anticipated to be approximately 70 to 100 m^3/h.
- It should be noted that the cooling water discharge will be collected and treated prior discharge into final checking pond before discharge to local stream, and its temperature will be ambient at the point of discharge. There are therefore not expected to be any impacts related to thermal discharge to surrounding water bodies.

As presented herein above, the Project will be equipped to treat all wastewater to comply with the discharge specification before discharge to the small water channel, located to the north west of the Project Site. A sewage treatment plant will also be installed.

Waste Storage and Disposal

During the operation and maintenance phase, waste materials, if not stored and disposed of appropriately, have the potential to cause impacts to surface water quality.

The majority of the generated wastes from the Project during the operation phase will be non-hazardous. A small proportion of the waste generated during operation will be hazardous, including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on site.

Table 10.2 presents details of the solid (non-hazardous) waste and approximate quantities anticipated during operation. The solid waste generated during the operation phase will be collected and segregated for recycle and non-recycle waste (i.e. paper, plastic). Project proponent will dispose those wastes by collaborating with Yebyu Township Development Committee. There will also be minimal other waste such as wood crates from maintenance activities which will be provided to the local community as fire wood.

Table 10. 2 Solid (Non-Hazardous) Waste during Operation

Waste Type	Anticipated Quantity	# Employees	Total Solid Waste
Domestic Solid Waste	1.65kg per employee per week	49	80.85 kg/week

The hazardous materials to be stored on site during operation are presented in Table 10.3. The chemicals will be transported appropriately to the Project site and Material Safety Data Sheets (MSDS) will be prepared from chemical suppliers in Myanmar.

Table 10. 3 Hazardous Materials during Operation

Hazardous Material	Use of Hazardous Materials	Storage Location Onsite	Quantities to be Stored Onsite
Oxygen Scavenger	Chemical Dosing System	Chemical Storage House	$1m^3$
Phosphates	Chemical Dosing System	Chemical Storage House	$1m^3$
Fouling Agent	Chemical Dosing System	Chemical Storage House	$1m^3$
Anti-corrosion	Chemical Dosing System	Chemical Storage House	$1m^3$
Biocides	Chemical Dosing System	Chemical Storage House	$1m^3$
Hydrochloric Acid	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Water Treatment System and Demineralized Water	Chemical Storage House	$10m^3$
Hydrogen Chloride	Water Treatment System and Demineralized Water System	Chemical Storage House	$10m^3$
Diesel oil	Liquid fuel for emergency diesel engine generator, emergency diesel generator	Storage Tank	4,000 litres

The design will aim to reduce, wherever practicable, the volume of hazardous and non-hazardous solid waste generated during construction and operation, and to provide the basis for the management of waste in accordance to the regulatory procedures for solid waste storage and disposal.

Hazardous wastes will be disposed of by authorized 3rd party disposal contractors. MUPA will handle, store and dispose of all waste in accordance with applicable guidelines.

The significance of potential impacts to surface water due to contamination from waste storage and disposal during the operation phase are assessed in the following table, and mitigation measures are presented.

Gas Pipeline Operation

1. Spills and leaks: Gas pipeline spills and leaks can result in the release of chemicals and other contaminants into nearby water bodies. These contaminants can include hydrocarbons, solvents, and other hazardous materials, which can harm aquatic life and contaminate drinking water supplies.

2. Sedimentation and erosion: Pipeline maintenance activities can result in soil erosion and sedimentation, which can cause water bodies to become cloudy and decrease water quality. Sediments can also transport pollutants such as heavy metals and pesticides, which can have harmful effects on aquatic ecosystems.

3. Groundwater contamination: Pipeline leaks or spills can also lead to groundwater contamination, which can have long-lasting impacts on local water resources. Groundwater contamination can affect drinking water supplies, agricultural irrigation, and other uses of water.

4. Discharge of treated wastewater: Gas pipeline operators may discharge treated wastewater into nearby water bodies, which can contain pollutants such as salt, metals, and other contaminants. These discharges can impact water quality and harm aquatic life.

5. Land disturbance: Pipeline maintenance activities can result in land disturbance, which can cause runoff of pollutants such as fertilizers, pesticides, and sediment into nearby water bodies.

Receptor Identification and Sensitivity

The primary receptor for impacts to surface water quality from wastewater discharge and waste storage and disposal is the Heinze River, and adjoining streams and tributaries. Secondary receptors include the aquatic ecosystem and potential water users downstream of the discharge location. Based on the baseline sampling conducted in the Heinze river, some parameters were found to be above relevant standards, and therefore the water bodies may be more sensitive to changes. However, the resources do not support very diverse or susceptible populations of flora and/or fauna, and their importance for local habitats and communities would be considered moderate. Overall, sensitivity of the receptor is considered Medium.

Table 10. 4 Rating of Impacts on Surface Water Quality due to Wastewater Discharges and Runoff, and Inappropriate Waste Storage and Disposal during the Operation Phase

<table>
<tr><th>Impact</th><td colspan="4">Potential impacts on surface water quality due to wastewater discharges and runoff, and inappropriate waste storage and disposal during the operation phase.</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td colspan="2">Positive</td><td>Neutral</td></tr>
<tr><td colspan="4">Potential impacts to surface water would be considered to be adverse (negative).</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be direct impacts.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">The operation phase is expected to continue for approximately 30 years, which would be considered long-term.</td></tr>
<tr><th>Impact Extent</th><td>Local</td><td colspan="2">Regional</td><td>International</td></tr>
</table>

<table>
<tr><td></td><td colspan="5">Potential impacts would be limited to the Project area and downstream of the Heinze River, and hence would be considered to be local.</td></tr>
<tr><td>Impact Scale</td><td colspan="5">Approximate quantities which will be generated during operation are as follows:
• Sludge from river water pre-treatment: 1 m^3/hr
• DM plant neutralized water: 5 m^3/hr
• Cooling tower blowdown: 60 m^3/hr
• Stormwater: intermittent
• Washing water from Main Block: intermittent
• Sanitary wastewater (sewage, kitchen, greywater): ~ 10 m^3/hr
The total approximate quantities of non-hazardous waste that could be a potential source of impact during this stage (assuming an average of 49 workers per day) is 80.85 kg/week. Quantities of hazardous materials stored on site that could potentially act as a source of impact if improperly stored or disposed of are approximately 35 m^3. The scale of potential impacts due to release of waste or wastewater is potentially large due to the number of workers and quantities of waste/wastewater present during this stage, but appropriate waste management practices will mitigate the impacts. Discharged water will be treated to meet applicable IFC EHS Guidelines.</td></tr>
<tr><td>Frequency</td><td colspan="5">Impacts to surface water quality from waste management and wastewater discharges
could occur intermittently but repeatedly throughout the duration of the operation phase.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">The impact magnitude is likely to be small.</td></tr>
<tr><td rowspan="2">Receptor Sensitivity</td><td colspan="2">Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">The primary receptor for impacts to surface water from wastewater discharge and runoff is the Heinze River, adjoining streams and tributaries, and downstream water users and aquatic ecosystem. Sensitivity of the receptor is considered Medium.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">The significance is likely to be minor</td></tr>
</table>

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Install oil/water separators to treat surface run-off prior to discharge to the stormwater system;
- Implement adequate sanitary facilities for onsite personnel;
- Install onsite wastewater treatment facilities or processes such as filtration, flocculation or biochemical treatment before discharge;
- Liquid effluents arising from operations will be treated to the applicable IFC guideline and Myanmar NEQG prior to discharge;
- Conduct monitoring of temperature at the discharge point at a frequency of once every 15 days;

- Implement discharge system shutdown in event that discharge temperature of effluent exceeds standard;
- Efforts to be made to increase the cycle of concentration to reduce the volume of blow down and consequently the volume of make-up water required by the cooling tower;
- Stormwater drainage and wastewater will be treated in accordance to the applicable WB/IFC EHS Guidelines for Thermal Power Plant (2008);
- Separated oil will be disposed of as part of oily wastes and handled as a hazardous waste stream. The treated de-oiled water will be discharged with the plant wastewater.
- The sewage from the entire plant area will be collected and treated in a sewage treatment plant (STP). No untreated sewage will be directly discharged into the Heinze River or surrounding the site, or disposed of on land, for the duration of the Project life cycle;
- In order to monitor STP performance, continuous evaluation and monitoring of discharge parameters will be undertaken at the outlet point of STP.
- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odour nuisance);
- Store wastes in closed containers away from direct sunlight, wind and rain;
- Store waste systematically to allow inspection between containers to monitor leaks or spills;
- Ensure that storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container and dispose of waste by licensed contractors.
- Implement robust leak detection systems for gas pipeline, regular inspections, and emergency response plans to minimize the risk of spills. Promptly address any leaks to prevent contamination.
- Water Recycling and Reuse: Implementing water recycling and reuse systems within the power plant can reduce the overall water consumption by treating and reusing wastewater for various processes. This can help minimize the amount of freshwater withdrawn from the river, alleviating pressure on both surface water and groundwater sources.
- Efficiency Improvements: Enhance the efficiency of the power plant's water usage through technological advancements and operational optimizations. Upgrading equipment and adopting best practices can reduce water wastage and improve overall water use efficiency.
- Alternative Water Sources: Explore alternative water sources for the power plant's operations, such as treated wastewater or saline water, to reduce reliance on freshwater from the river. Utilizing non-potable water sources can help preserve freshwater resources for the villagers who depend on groundwater.
- Groundwater Monitoring: Establish a comprehensive groundwater monitoring program to assess and track changes in groundwater levels and quality over time. This can provide valuable data for understanding the impacts of the power plant's water usage and implementing adaptive management strategies accordingly.
- Water Conservation Awareness: Promote water conservation practices and awareness

campaigns among both the power plant staff and the local community. Encourage responsible water use behaviors, such as fixing leaks, optimizing irrigation practices, and implementing water-saving technologies, to reduce overall water demand and minimize impacts on groundwater resources.

- Ecological Restoration: Implement ecological restoration and conservation measures along the riverbank and within the watershed to enhance ecosystem resilience and support natural water filtration and recharge processes. Protecting riparian areas and restoring wetlands can help maintain healthy river ecosystems and contribute to groundwater recharge.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation.

Monitoring plan

As detailed in the ESMP chapter, monitoring for surface water during the operation phase should consist of the following:

- Temperature monitoring at discharge point, bi-weekly, using standard analytical methods.
- Quarterly monitoring at discharge point, using standard analytical methods.

Impacts to Water Quantity

Pressure on Local Water Supply due to Project's Water Intake Requirements

The Project will require raw water intake from the Heinze River for several processes during the operational phase, make up water for cooling towers, demineralized water system, service water system, potable water system, etc. This water withdrawal from the Heinze River may have potential impacts related to existing water uses, as follows:

- Impact on downstream water users; and
- Impact on downstream fishing activity having negative impact on fisherman's livelihood.

The main water supply source will be taken from Heinze River via the water intake pumping station through the water treatment facility and transported to the Project Site via the water intake pipeline which will be retained in the water storage tank on site.

The raw water from Heinze River will be passed through the pre-treatment plant and directed to the Reverse Osmosis System. The majority of the water will be supplied to meet the plant service water / cooling tower make-up and the balance will be taken to meet the plant potable water and other requirements.

Table 10.5 presents the water requirements and their volumes during operation.

Table 10. 5 Water Requirements during Operation

Water Requirement	Volume
Cooling water system	500 m^3/h (circulating)
Domestic water	4m^3/h

Source: MUPA, 2017

The raw water will be taken from Heinze River, using the Water Intake Pumping station at the flow rate of approximately 860 m^3/hour.

The lowest flow rate estimated from flow velocity measurements in the dry season in the intake location of the Heinze River, where the Project will withdraw from, is estimated to be 28.5 m^3/s (based on lowest flow velocity of 0.9 m/s, shallowest depth of 1.9 m, and average width of river of 150 m at intake location), which would be equivalent to 102,600 m^3/hr. The maximum intake requirement for the Project is expected to be 860 m^3/hr. This is equivalent to approximately 0.83% of the lowest dry season flow in the river at the intake location. This is based on a worst-case scenario, comparing the Project's maximum expected water withdrawal requirements, with a constant withdrawal over a 24-hour period, during the lowest measured flow rate in the dry season.

Based on the above comparison of the Project's water intake requirements with the estimated flow rates of the river during the dry season, it is expected that there will be adequate flow to support the Project's water withdrawal, and the Project is not expected to have any significant impacts on current water users for the Heinze River.

Impacts to Surface Water Hydrology from Increased Impervious Surfaces

During the operation phase, the physical footprint of the Project will increase the impermeable area of the local topography, resulting in changed hydrological characteristics, such as reduced water infiltration to the soil, which could create additional surface run-off (and increase the flow velocity of this run-off), as well as reducing infiltration into subsurface aquifers. Surface water bodies may have the potential to be affected by changes to their flow rates and discharge volumes due to variation in the drainage patterns in their basin. In addition, the increased stormwater runoff from the Project's impermeable surfaces will have to be accommodated by the drainage infrastructure of the Project site, as well as the irrigation canal (which is the eventual point of discharge).

To provide an estimate of stormwater volume that will need to be accommodated by the drainage of the Project, peak runoff discharges around the Project site have been estimated using an analytical calculation which takes into account catchment area, rainfall intensity and runoff coefficient (also called the "Rational Method"). The peak runoff discharge from the impermeable surfaces of the Project site is estimated as follows:

$$QQ = 0.278 \times 10^{-6} CCCCCC \qquad \textbf{\textit{Eq. 1}}$$

where,

Q = estimated peak runoff flow rate
(m^3/s) C = runoff coefficient
I = rainfall intensity
(mm/hour) A = catchment
area (m^2)

For rainfall intensity, a return period of 25 to 100 years is commonly used in sizing detention ponds or drainage ditches (Osman Akan, 1993 [51]). To obtain maximum rainfall intensities of

[51] Osman Akan, A. 1993. Urban Stormwater Hydrology.

a storm of certain duration usually requires either 1) reference to an Intensity-Duration-Frequency (IDF) curve specific to the region, or 2) very frequent rainfall data (at least hourly) over a long period of time. Unfortunately, neither of these data are available for the Project area, or even for Tanintharyi Region. However, Sitiwong and Yonchai (2013) derived IDF curves for neighboring Kanchanaburi Province in Thailand. Using the data from their curves, and assuming a 1-in-100-year storm of 15-minute duration, the maximum rainfall intensity in the region was approximately 250 mm/h. For the purposes of this assessment, this maximum rainfall intensity will be used to approximate representation for the Project area in the runoff calculations.

As a worst-case scenario, taking the catchment area to be equivalent to a concrete surface (C = 0.90), and the area of the Project footprint (including pipelines) to be approximately 9.47 hectares (ha) (94,700 m^2), the estimated runoff for a worst case 15-minute duration storm with a return period of 100 years, would be approximately 5.92 m^3/s (for 15-minute duration). To compare this with the peak runoff rate that would have existed for the same footprint in the natural setting prior to the project, the same formula can be used, but C (the runoff coefficient) would be 0.20 (sandy or loam soil). Based on this, the prior peak runoff rate for the Project footprint would have been 1.32 m^3/s.

Although the relative increase in runoff rate is substantial due to the increase in impervious area, the runoff rate of 5.92 m^3/s would only occur as a very worst-case scenario 1-in-100-year storm, and for only a short duration.

As long as the Project implements appropriate drainage system to accommodate the maximum runoff, impacts to hydrology are expected to be minor.

Table 10. 6 Rating of Impacts on Surface Water Quantity due to Pressure on Local Water Supply due to Project's Water Intake Requirements and Increased Impervious Surfaces during the Operation Phase

<table>
<tr><td>Impact</td><td colspan="4">Potential impacts on surface water quantity due to pressure on local water supply due to Project's water intake requirements and increased impervious surfaces during the operation phase.</td></tr>
<tr><td rowspan="2">Impact Nature</td><td>Negative</td><td colspan="2">Positive</td><td>Neutral</td></tr>
<tr><td colspan="4">Potential impacts to surface water quantity would be considered to be adverse (negative).</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be direct impacts.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">The operation phase is expected to continue for approximately 30 years, which would be considered long-term.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td colspan="2">Regional</td><td>International</td></tr>
<tr><td colspan="4">Potential impacts would be limited to the Project area and downstream of the Heinze River, and hence would be considered to be local.</td></tr>
</table>

http://books.google.co.th/books?id=ZyJtRojkDg0C&pg=PA6&lpg=PA6&dq=design+ponds+return+period+duration+rainfall&source= web&ots=-U4jCFGjeK&sig=dLhEjM42jFuFitaIl3VXcTUSRtI&hl=en&sa=X&oi=book_result&resnum=5&ct=result

<table>
<tr><td>Impact Scale</td><td colspan="60">The maximum intake requirement for the Project is expected to be 860 m^3/hr. This is equivalent to approximately 0.83% of the lowest dry season flow in the southern channel of the river.
As a worst-case scenario, taking the catchment area to be equivalent to a concrete surface (C = 0.90), and the area of the Project footprint (including pipelines) to be approximately 9.47 hectares (ha) (94,700 m^2), the estimated runoff for a worst case 15-minute duration storm with a return period of 100 years, would be approximately 5.92 m^3/s (for 15-minute duration). The prior peak runoff rate for the Project area (in the absence of the Project) would have been 1.32 m^3/s.
The scale of potential water quantity impacts is relatively small, especially if adequate mitigation measures are implemented.</td></tr>
<tr><td>Frequency</td><td colspan="60">Water intake for the Project would be near-continuous for the Project's duration.
Stormwater runoff would be intermittent, depending on local rainfall events.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td colspan="12">Positive</td><td colspan="12">Negligible</td><td colspan="12">Small</td><td colspan="12">Medium</td><td colspan="12">Large</td></tr>
<tr><td colspan="60">The impact magnitude is likely to be small.</td></tr>
<tr><td rowspan="2">Receptor Sensitivity</td><td colspan="20">Low</td><td colspan="20">Medium</td><td colspan="20">High</td></tr>
<tr><td colspan="60">The primary receptor for impacts to surface water quantity is the Heinze River, and adjoining streams and tributaries. Sensitivity of the receptor is considered Medium.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td colspan="15">Negligible</td><td colspan="15">Minor</td><td colspan="15">Moderate</td><td colspan="15">Major</td></tr>
<tr><td colspan="60">The significance is likely to be negligible to minor.</td></tr>
</table>

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- The Project commits to comply with following WB/IFC EHS Guideline measures or equivalent of them that are pertinent to river water intake systems:
- Reduction of intake flow to such a level that there is sufficient flow in the river to maintain resource use (i.e., irrigation) as well as biodiversity during annual mean low flow conditions.
- Ensure that drainage channel has enough capacity to accommodate the increased rainfall runoff from the Project's impervious surface.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

Monitoring plan

As detailed in the ESMP chapter, monitoring for surface water during the operation phase should consist of the following:

- Continuous monitoring of water intake quantities and flow rates in the Heinze River.

CHAPTER 11 SOIL AND GROUNDWATER

11.1 INTRODUCTION

During the construction and operation phases, different activities have the potential to generate wastewater, accidental spills, which could lead to impacts on the quality of soil or groundwater due to leaching. In addition, groundwater use for the Project could impact the availability of groundwater for users in surrounding communities. In the Project study area, the groundwater aquifers are primarily Irrawadian and Peguan aquifers. Changes to in-situ groundwater levels, groundwater quality and any changes to soil structure and quality due to Project activities may lead to impacts to ecological receptors, as well as any future groundwater users. This Chapter presents an evaluation of the potential impacts on soil and groundwater associated with the construction and operation of the proposed Project based on the impacts identified during Scoping.

This Chapter also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP, Chapter 19) for the Project.

11.2 ASSUMPTIONS AND LIMITATIONS

The assessment of potential impacts related to soil and groundwater in this section is based on the environmental baseline data (presented within Chapter 5), socio- economic baseline data (presented within Chapter 6) and the information available from MUPA at the time of writing. Judgements and assessments have been made based on professional knowledge and previous experience of ERM. It is noted that no quantitative modelling has been undertaken with regards to any elements of the soil and groundwater impact assessment. Should there be significant changes in factors such as assumed input data, engineering design of wastewater management and treatment components of the Project, or agreed assessment criteria, then elements of this impact assessment and associated management, mitigation and monitoring measures may be needed to reflect these changes.

11.3 ASSESSMENT METHODOLOGY

The methodology used for assessing impacts to surface water is aligned with the general impact assessment methodology presented in Chapter 7.

11.4 SUMMARY OF BASELINE CONDITIONS

Chapter 5 provides the details of the baseline conditions for soil and groundwater in the Project study area.

11.5 GROUNDWATER

The productivity of aquifers near the Project area can be classified as “Strong Pore Water”, or “Weak Fissure Water”, and groundwater quality is considered “Fresh Groundwater”. The groundwater type ranges from “Pore Water” to “Fractured Water”. Groundwater resources classifications consist of "Discontinuous Aquifer in Hilly Area" and "Continuous Aquifer in Plain and Intermountain Basin", with Natural Recharge Modulus ranging from 200,000-500,000 m^3/km^2-yr.

According to TEAM Consulting's groundwater surveys in June 2013, they found that groundwater was used for domestic purposes at the sampling locations in nearby communities. ERM's surveys also found that groundwater was used as a local source of drinking water.

Also in the TEAM's groundwater survey, groundwater in the Project area was found to be slightly acidic and arsenic, lead and iron were found at elevated levels. However, results from the follow up survey by ERM and SEM in 2016 indicated that heavy metal levels are compliant with the US EPA National Primary Drinking Water Regulations and WHO standard at all monitoring locations. Groundwater is also known to have high levels of chloride and salinity (due to proximity to sea).

Therefore, overall, it can be concluded that groundwater quality is ranges from good to slightly poor, and its importance can be rated as medium as there is some evidence that it is used by local people for domestic purposes.

11.6 Soil

Soils in the Project study area is classified primarily as Gleysol Soils. The soils are composed of Saline Muddy Soil Mangroves. This soil has high salt and water, low oxygen and high hydrogen sulphide contents.

Soil quality in the Project study area was found to contain elevated levels of arsenic (in comparison of USEPA screening criteria), while all other metals were found to be at acceptable levels.

11.7 Assessment Of Impacts To Soil And Groundwater

11.7.1 Construction Phase

Proposed Project Activities with Potential Impact

Construction of the power plant will be carried out by the EPC contractor appointed by MUPA. Construction is expected to start mid-2019 and be complete in the region of 30 months with SCOD end of 2021. The maximum number of workers onsite during construction is anticipated to be 600 persons.

Construction activities of the Project will include: mobilization, site clearance, onshore construction of all Project components and commissioning. Heavy equipment such as bulldozers, excavators, dump trucks, compactors, etc. will be used at the Project Site. Earth works will include clearing of vegetation and grading of the Project site.

Impacts during the construction phase are noted as being similar across all aspects of the Project (i.e. Power Plant and all linear infrastructures) and are thus assessed collectively. Based upon this, during the construction phase the following impacts are identified as potentially occurring to groundwater and soil:

- Loss of soil structure, quantity and quality due to improper management during site clearance activities;
- Soil and groundwater contamination due to improper construction waste storage and disposal;
- Soil and groundwater contamination due to improper discharge of waste water discharges and runoff; and

- Soil and groundwater contamination due to potential accidental leaks and spills.

Effects to groundwater levels and its associated impacts to local water use are not anticipated to be significant because the raw water required during construction will be obtained from the local water distribution services.

It is noted that soil and groundwater contamination due to improper construction waste storage and disposal would be the result of contaminated surface water run- off being discharged from waste storage and disposal areas. The production and discharge of this contaminated surface water is assessed extensively within Chapter 10 (Surface Water). It is considered that this impact has therefore already been covered and will not be re-assessed within the context of impacts to soil and groundwater. This is also the case with the impacts due to improper discharge of wastewater and runoff which if direct to either a surface water, groundwater or soil receptor would all be subject to similar impacts and thus mitigation, management and monitoring measures. Additionally, impacts due to accidental leaks or spills are considered unplanned events, and are therefore assessed within Chapter 17.

Loss of Soil due to Improper Management during Site Clearance Activities

Soil works, including vegetation clearance, potential grading and levelling, compaction, construction of various structures must be carried out at the Power Plant site, access roads, and for the laying of the right of way for the water intake pipeline. Changes to soil structure may be caused by mechanical disturbance to the soil from these activities. Exposure of soil to rain and wind may in turn cause erosion and loss of top soil. It is anticipated that the subsoil, which will be stripped and removed from the Project site, will be utilized for levelling/ backfilling, and therefore there will be no net loss from the main Project site. It is anticipated that approximately 6,600 m^3 of soil will be removed due to excavation activities of the water intake pipeline and then backfilled. This phase of the Project is generally the most intensive in terms of potential for topsoil loss. Poor topsoil management can lead to a loss of topsoil through either the air (as dust) or as sediment entrained within surface water flows. Soil erosion can also result from poor management of stockpiled soils, excavated areas and general construction areas.

Additionally, soil will be compacted at the Power Plant site and access roads, permanent operator housing and the lay down area to ensure soil stability. Movement of heavy vehicles in the construction area will also result in soil compaction and damage to the soil structure. This compaction of the soil may potentially result in changed hydrological characteristics, such as reduced permeability and water infiltration to the soil, which could create additional surface run-off (and increase the flow velocity of this run-off), as well as reducing infiltration into subsurface aquifers.

Soils near the Project are mostly degraded, and are therefore prone to erosion. If compaction and erosion are not managed, associated potential impacts could include excessive sedimentation of local waterways, loss of topsoil and reduction in soil fertility, and detrimental changes to site hydrology. However, soil compaction and erosion due to construction activities will only be limited to the vicinity of the Project area.

Receptor Identification and Sensitivity

Groundwater in the local communities surrounding the Project area is used for domestic purposes. Groundwater quality ranges from good to slightly poor, and its importance can be rated as medium.

Soil quality can be considered degraded and of low sensitivity/importance. The resource does not support diverse habitat or populations, and has limited use in local communities (i.e. for topsoil of rubber plantations).

Table 11. 1 Rating of Impacts on Soil due to Topsoil Loss during Construction Phase (Pre-Mitigation)

Impact	Potential impacts on soil due to topsoil loss during construction phase.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to soil and groundwater would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Construction is expected to start mid-2019 and be complete in the region of 30 months, which would be considered long-term.				
Impact Extent	**Local**	Regional	International		
	Potential impacts would be limited to the Project footprint, and hence would be considered to be local.				
Impact Scale	The scale of this impact is expected to be small given that it will occur over a relatively small area compared to the rest of the landscape. It will also not occur in valuable agricultural land.				
Frequency	This impact will occur throughout the construction phase, with the most intensive time being during the clearance of the power plant site.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be small.				
Receptor Sensitivity	**Low**	Medium	High		
	Groundwater in the local communities surrounding the Project area is used for domestic purposes. Groundwater quality ranges from good to slightly poor, and its importance can be rated as medium. Soil quality can be considered degraded and of low sensitivity/importance. The resource does not support diverse habitat or populations, and has limited use in local communities (i.e. for topsoil of rubber plantations).				
Impact Significance	**Negligible**	Minor	Moderate	Major	
	The significance is likely to be negligible.				

Mitigation / Management Measures

During soil disturbing activities, the mitigation measures developed with regards to surface water quality (Chapter 10) will serve to prevent soil loss through limiting TSS loading in surface water bodies. Additionally, mitigation measures developed within Chapter 8 (Air Quality), particularly those aimed at dust prevention, will also minimize soil losses. Other mitigation measures to be implemented include:

Delineation of clearance boundaries to limit the areas to be cleared;

- Scheduling clearance activities (if possible) to avoid extreme weather events such as heavy rainfall, extreme dry and high winds;
- Revegetation areas with temporary land use, conducting progressive rehabilitation;
- Demarcate routes for movement of heavy vehicles to minimize disturbance of exposed soils and compaction of sub-surface layers;
- Reuse topsoil as much as possible within rehabilitation activities;
- Control erosion through diversion drains, sediment fences, and sediment retention basins; and
- Where topsoil is to be stored for later use in rehabilitation activities, the following basic principles are to be applied:
    - Stockpiles to be separated into topsoil and sub-soil and be located at least 50m from any surface water source or groundwater well;
    - To the extent possible, stockpiles are to be located in areas surrounded by natural wind barriers to minimize the potential for wind erosion;
    - Stockpile storage areas are to be prepared in advance of the removal of topsoil as much as possible; and
    - Topsoil heights are to be restricted in height to 2m above ground level to minimize wind erosion, and they are only to be partially compacted on the upper layer in order to promote aeration, maintain soil vertical structures, reduce runoff and encourage infiltration.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact on is considered to be a **Negligible Negative Impact** post mitigation.

Monitoring plan

As detailed in the ESMP chapter, monitoring for soil during the construction phase should consist of monitoring of soil quality in the event of any leakage or spillage of hazardous substances, with the parameters to be sampled based upon the likely chemical compositions of the material, with locations, to be defined on a case-by-case basis, using standard analytical methods, and a frequency to be defined on a case-by-case basis.

11.7.2 Operation Phase

Proposed Project Activities with Potential Impact

The operation phase is expected to continue for approximately 30 years. The average number of permanent workers present during operation is expected to be approximately 49, with small numbers of additional staff for security, cleaning, technical assistance, and occasional maintenance. The assessment of operational phase impacts includes those arising from routine operations and maintenance of the power plant. During the operation phase, potential soil and groundwater impacts may arise from the following activities:

- Loss of soil due to increased erosion potential during operations;
- Soil and groundwater contamination due to improper operation waste storage and disposal;
- Soil and groundwater contamination due to improper discharge of waste water discharges and run-off; and
- Soil and groundwater contamination due to potential accidental leaks or spills.

Effects to groundwater levels and its associated impacts to local water use are not anticipated to be significant because the main water supply source will be taken from Heinze River via the water intake pumping station through the water treatment facility and transported to the Project Site via the water intake pipeline which will be retained in the water storage tank on site.

Similar to construction impacts, it is noted that soil and groundwater contamination due to improper construction waste storage and disposal would be the result of contaminated surface water run-off being discharged from waste storage and disposal areas. The production and discharge of this contaminated surface water is assessed extensively within Chapter 10 – Surface Water Quality. It is considered that this impact has therefore already been covered and will not be re-assessed within the context of impacts to soil and groundwater. This is also the case with the impacts due to improper discharge of wastewater and runoff which if direct to either a surface water, groundwater or soil receptor would all be subject to similar impacts and thus mitigation, management and monitoring measures. Additionally, impacts due to accidental leaks or spills are considered unplanned events, and are therefore assessed within Chapter 17.

Loss of Soil Due to Increased Erosion Potential During Operations

During the operation phase, the physical footprint of the Power Plant, Water intake Pipeline and gas supply pipeline will increase the impermeable area of the Project, resulting in changed hydrological characteristics, such as reduced water infiltration to the soil, which could create additional surface run-off (and increase the flow velocity of this run-off), as well as reducing infiltration into subsurface aquifers.

The total area of the Project's footprint will be 9.47 hectares (94,700 m^2). As discussed in ***Chapter 10 (Surface Water)*** regarding impacts to surface water, the increased impervious surfaces from the Project footprint are expected to cause maximum rainfall runoff rates of 5.92 m^3/s (for a worst case 1-in-100-year 15-minute storm). This increased flow rate has the potential to cause soil erosion and sedimentation. However, if the drainage infrastructure surrounding the Project is designed with enough capacity to accommodate this increased flow rate, then the potential impacts can be minimized.

The significance of potential impacts to soil due to erosion from increased run-off from impervious surfaces during the operation phase are assessed in the following table, and mitigation measures are presented.

Receptor Identification and Sensitivity

Groundwater in the local communities surrounding the Project area is used for domestic purposes. Groundwater quality ranges from good to slightly poor, and its importance can be rated as medium.

Soil quality can be considered degraded and of low sensitivity/importance. The resource does not support diverse habitat or populations, and has limited use in local communities (i.e. for topsoil of rubber plantations).

Table 11. 2 Rating of Impacts on Soil due to Loss of Soil due to Increased Erosion Potential during the Operation Phase

Impact	Potential impacts on soil due to Loss of soil due to increased erosion potential during the operation phase.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to soil and groundwater would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The operation phase is expected to continue for approximately 30 years, which would be considered long-term. However, impacts due to rainfall runoff would be of relatively short duration, lasting only as long as each individual rainfall event.				
Impact Extent	**Local**	Regional	International		
	Potential impacts would be limited to the Project area and the immediate surroundings due to any potential erosion from rainfall runoff, and hence would be considered to be local.				
Impact Scale	The total area of the Project's footprint will be 9.47 hectares (94,700 m^2). The increased impervious surfaces from the Project footprint are expected to cause maximum rainfall runoff rates of 5.92 m^3/s (for a worst case 1-in-100-year 15-minute storm). The scale of potential impacts to erosion due to increased runoff during rainfall events is potentially large in the case of a major rainfall event, but the frequency of such an event is not expected to be very often, and the duration would be short. Additionally, the scale of potential impacts is reduced if adequate drainage infrastructure is implemented.				
Frequency	Impacts to erosion due to rainfall runoff would be intermittent and infrequent, in line with the expected occurrence of local rainfall events. Impacts will be more frequent during the rainy season.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be small.				
Receptor Sensitivity	**Low**	Medium	High		
	Groundwater in the local communities surrounding the Project area is used for domestic purposes. Groundwater quality ranges from good to slightly poor, and its importance can be rated as medium. Soil quality can be considered degraded and of low sensitivity/importance. The resource does not support diverse habitat or populations, and has limited use in local communities (i.e. for topsoil of rubber plantations).				
Impact Significance	**Negligible**	Minor	Moderate	Major	
	The significance is likely to be negligible.				

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Implement all measures from ***Chapter 10*** (Surface Water) in relation to managing surface water runoff.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

Monitoring plan

As detailed in the ESMP chapter, monitoring for soil during the operation phase should consist of half-yearly monitoring at locations of accidental spillage, waste storage areas, using standard analytical methods.

No groundwater monitoring is anticipated to be required during the operation phase.

CHAPTER 12 VISUAL IMPACT ASSESSMENT

12.1 INTRODUCTION

The development of the Project will be introducing a number of new elements into the existing visual environment. This Chapter presents a purely qualitative assessment of impacts to visual amenity (assessed as one of the interrelated effects on population and how various groups experience and perceive changes in the values attributed to the landscape). During the construction and operation there will be a range of activities which have the potential to change how various people will perceive/see the landscape. The key visually sensitive receptors within the vicinity of the proposed Project have been identified in the Baseline Chapter 5 and this Chapter undertakes an assessment of predicted impacts to these during construction and operation.

This Chapter also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP, ***Chapter 19***) for the Project.

12.2 ASSUMPTIONS AND LIMITATIONS

The assessment of potential impacts related to Visual Environment in this section is based on the environmental baseline data (presented within Chapter 5) and the information available from the Project Proponent at the time of writing. Judgements and assessments have been made based on professional knowledge and previous experience of ERM.

This assessment has been undertaken primarily as a desktop study drawing upon limited site analysis. No quantitative modelling, viewshed analysis, stakeholder engagement or photomontage development has been undertaken with regards to any elements of the visual impact assessment. It is based purely on information readily available as secondary sources (primarily online mapping databases) and information gathered during site visits for the purposes of gaining other quantitative environmental data (e.g. water quality, soil quality, air quality baseline). No direct on-ground identification of the visual baseline is therefore available. Additionally, no stakeholder engagement was undertaken to determine the various values that particular visual sensitive receptors place on various elements of the landscape.

12.3 ASSESSMENT METHODOLOGY

Based on the Scoping Study and the Project Description in Chapter 4, key potential impacts to the visual amenity have been identified. The following elements of the Project are not considered likely to cause visual impacts:

- The Water Intake Pipeline. This will be approximately 3.3 km long and run between the Water Treatment Facility and the Water Storage Tank located within the Project Site. It will be installed underground along an existing road which is surrounded by predominantly rubber tree plantations and agricultural land, and unlikely to cause notable visual impact.
- The Gas Metering and Gas Supply Pipeline already exist and are therefore considered as baseline conditions and not as part of the visual impact assessment.

Visual impacts from the Project are considered likely to arise from the following activities:

12.3.1 Construction Phase

- 200MW Combined Cycle Power Plant (CCPP);
    - Site Clearance & Preparation – although the site is brownfield, there is some existing vegetation and structures that will need to be cleared prior to construction starting. Disturbance of soil for excavation and foundation works, civil infrastructure works and associated laydown areas (if any) will also be required;
    - Construction of all elements of the CCPP within the Project Site.
- Water Intake Pumping Station including Water Treatment Facility.

12.3.2 Operation Phase

The long-term operational presence of the following Project structures will change the nature of the existing landscape and visual amenity.

- 200MW Combined Cycle Power Plant (CCPP)

1. Water Intake Station:

- Pump Operations: During the operation phase, pumps at the water intake station continue to draw water from the source to supply the power plant's cooling system. While modern pumps are designed to be efficient and relatively quiet, they still produce noise during operation.

- Mechanical Equipment: Other mechanical components such as valves, gates, and screens may also produce noise as they regulate the flow of water into the intake system.

- Routine Maintenance: Periodic maintenance activities, such as inspections, repairs, and equipment servicing, may generate additional noise at the intake station.

2. Transportation of Water:

- Pipeline Operations: If water is transported via pipelines from the intake station to the power plant, the operation of pumps and associated pipeline infrastructure may continue to produce noise during the operation phase.

3. Potential Impacts:

- Community Noise: Noise generated by ongoing operations at the water intake station and during transportation activities may continue to impact nearby communities (Pyin Gyi Village) , particularly if the power plant operates continuously or if transportation routes pass through residential areas.

- Ecological Disturbance: Continued noise emissions from water intake operations and transportation activities may still affect wildlife and aquatic ecosystems near the water source and along transportation routes.

- Worker Health and Safety: Workers involved in the operation and maintenance of the water intake station and transportation activities may continue to be exposed to noise hazards, requiring ongoing monitoring and management to ensure their health and safety.

The dimensions of notable Project structures are detailed in Table 12.1, with the tallest structures being the main stack at 50 meters high, then the various water storage tanks reaching 10 m and 65 m diameter for the largest tank. Most buildings are low-level one to two stories and are not considered to be more than 10 m high. While no model of the facilities within the Project Site has been developed, Figure 12.1 indicates what a CCGT power plant might look like.

Figure 12. 1 Generic Image of a CCGT power plant with one Gas Turbine Building

Table 12. 1 Key CCPP Facility Dimensions

Facility	Estimated Size (m^2)	Height where Indicated
Stack		50m
Steam Turbine Building	1,200	
1 x Gas Turbine Housing	1 x 250	
Administration Building	300	One story building
Canteen	280	One story building
Control Room, Laboratory and Storage Building	480	Two story building.
Electrical Substation Building	1,350	One story building.
Workshop	480	Two story building with bridge crane
Warehouse	480	Two story building with bridge crane
Demin and Potable Treatment Plant	300	
Wet Cooling Tower	1,600	Main cooling system incl. Pump house
Service water and Fire Fighting Pump House	200	
Potable Water Storage Tank	Ø23m	8m height
Demineralized Water Tank	Ø8m	5m height
RO Permeate and Fire Water Storage Tank	Ø65m	10m height
Waste Water Pond	600	Depth of around 3m
Guard House	2x150	
Black Start Diesel Generator Building	720	
Distillate Fuel Oil (Diesel) Tank (3 days)	Ø3m	Horizontal tank with approximate volume 23,900 m^3 inside Diesel Generator Building
Warehouse		

Facility	Estimated Size (m^2)	Height where Indicated
Main Substation 230kV Switchyard	12,000	230 kV double busbar arrangement, control room included in 230 kV substation.
Housing Areas for MOEP and CCPP Staff	1,000 + 6,400	6,400 m^2 is located east of existing site area
Water treatment Plant	2,000	
Raw Water Control Room	150	One story building.

Given the nature of the proposed facilities, a 5km radius from the main Project Site facilities has been taken as the study area for the Visual Baseline and impact assessment.

To assess the magnitude of change, ratings are classified according to Table 12.2.

Table 12. 2 Magnitude of Change for Visual

Magnitude of Change	Typical Criterial and Thresholds
Imperceptible	An imperceptible, barely or rarely perceptible change in visual characteristics
Small	A small change in visual characteristics over a wide area or a moderate change either over a restricted area or infrequently perceived
Medium	A moderate change in visual characteristics, frequent or continuous and over a wide area or a clearly evident change either over a restricted area or infrequently.
Large	A clearly evident and frequent/ continuous change in visual characteristics affecting an extensive area.

12.4 Assessment Of Impacts

12.4.1 Site Formation and Construction (Kanbauk PP & Water Supply Site)

Summary of Baseline Conditions

The key baseline conditions note that much of the Project Site for the CCGT Plant is within a brownfield site (See Figure 5.30), while the Water Supply Site is in a greenfield site (See Figure 5.31).

Proposed Project activity

Visual impacts during site formation and construction will be caused by earthworks, light emissions (including any flate testing), disturbance and physical presence of facilities as they are erected. Note impact of built facilities is covered for operation in Sections 12.4.2 and 12.4.3.

Receptor Identification and Sensitivity

All VSRs described in the Baseline Chapter 5 are potentially affected by the impact, having low sensitivity (VSR3) as well as high sensitivity (VSR 1, VSR 2). Key receptors for this impact will be those VSRs closest to the Project Sites i.e. villagers in Mi Gyaung Auing and Kanbauk for the CCGT and Pyin Gyi for the Water Supply Site and all those pagodas and monasteries that are nearby – all with high sensitivity.

Table 12. 3 Rating of Impacts of Site Formation and Construction (Pre-Mitigation)

Impact	Potential impacts of Site Formation				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	**Temporary**	Short-term	Long-term	Permanent	
	Site formation and construction works will be temporary.				
Impact Extent	**Local**	Regional	International		
	Earthworks, light emissions, disturbance and physical presence of new facilities will be local to the confines of the Project Sites although some light emissions will be visible further away and any facilities higher than current fencing surrounding of the CCGT site will become more visible as they rise above it.				
Impact Scale	CCGT - There is just one stack reaching up to 50m. While this is high, there is only one such tall structure that will be visible to a farther distance than the main CCGT Plant itself if Water Supply facilities are low level structures with a small footprint, therefore considered small scale.				
Frequency	It is assumed construction works will take place continuously until the Project				
Impact Magnitude	Positive	Negligible	**Small**	**Medium**	Large
	Magnitude of this impact at the CCGT is considered small-medium, while at the water supply site is small.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	Two VSRs are considered to have high sensitivity - VSR 1 – Inhabitants of Villages and VSR 2 – Worshipers at Local Pagodas/ Worshiping Sites. VSR 3– Recreational Visitors and Tourists have low sensitivity.				
Impact Significance	Negligible	Minor	**Moderate**	Major	
	The significance is likely to be moderate.				

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- For temporary earthworks areas, including outside the Project site, minimize clearing of vegetation as far as practical
- Reinstate temporary areas outside the Project site (if any)
- Good construction practice, including hoarding of construction site(s)
- Landscape extensive areas within the proposed site with a variety of planting
- Manage lighting of construction site(s) and any flare testing activity to consider minimization of light pollution/ light spill
    - Minimize test flaring activity and conduct during the day
    - Use shielding, directional alignment and window coverings (eg at worker accommodation) that minimize external visibility of indoor lighting
    - Minimize lighting use and light intensity to as low as reasonably practicable

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Minor to Moderate Negative Impact post** mitigation.

Monitoring plan

The suggested mitigation measures should be controlled by

- General site inspections during construction;
- Preparation of a landscape plan for the proposed Project Site; and
- Preparation of Lighting management plan for construction activities.

12.4.2 Operation of Kanbauk Power Plant

Summary of Baseline Conditions

The key baseline conditions note that much of the Project Site for the CCGT Plant is within a brownfield site (See ***Figure 5.30***).

Proposed Project activity

Visual impacts during operations will be caused by the physical presence of new facilities, light emissions (including any flaring) and disturbance.

Receptor Identification and Sensitivity

All VSRs described in the Baseline ***Chapter 5*** are potentially affected by the impact, having low sensitivity (VSR3) as well as high sensitivity (VSR 1, VSR 2). Key receptors for this impact will be those VSRs closest to the Project Sites i.e. villagers in Mi Gyaung Auing and Kanbauk for the CCGT and all those pagodas and monasteries that are nearby – all with high sensitivity.

Table 12. 4 Rating of Impacts of Operation (Pre-Mitigation)

<table>
<tr><td>Impact</td><td colspan="4">Potential impacts of Operation</td></tr>
<tr><td rowspan="2">Impact Nature</td><td>Negative</td><td>Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="4">Potential impacts would be considered to be adverse (negative).</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td>Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be direct impacts.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">The physical presence of new facilities will cause visual impact for the duration of the proposed Project.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td colspan="2">International</td></tr>
<tr><td colspan="4">Facilities that rise higher than any fencing/ wall currently surrounding the CCGT site will be visible a distance away.</td></tr>
<tr><td>Impact Scale</td><td colspan="4">CCGT - There is just one stack reaching up to 50m. While this is high, there is only one such tall structure that will be visible to a farther distance than the main CCGT Plant itself. The majority of the plant is considered to be no more than two storey buildings with some taller facilities up to a maximum of 10m high. Overall, the bulk of the CCGT Plant is considered of medium scale within this rural context.</td></tr>
</table>

Frequency	See Duration				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Magnitude of this impact at the CCGT is considered medium.				
Receptor Sensitivity	Low	Medium	High		
	Two VSRs are considered to have high sensitivity - VSR 1 – Inhabitants of Villages and VSR 2 – Worshipers at Local Pagodas/ Worshiping Sites. VSR 3– Recreational Visitors and Tourists have low sensitivity.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be moderate.				

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

At design stage

- Careful design to contain light to areas that need illumination and prevent light spill/ glare
  - Shielding, directional alignment and window coverings that minimize external visibility of indoor lighting
  - Minimize lighting use and light intensity to as low as reasonably practicable
- Careful design to improve aesthetics
  - Texture of building material to blend with landscape/sky
  - Paint/ Treat large components (e.g. flare stack, offices, storage buildings, stacks) to blend in with the landscape/sky
  - Establishing viewing corridors between buildings to maintain view through the site/ to key views such as pagodas etc.

For operation phase

- Manage lighting on site and flare activity to consider minimization of light pollution and horizon glow
- Maintain all facilities in good repair
- Ensure trees/ shrubs are planted along the boundary of the site to act as screening.
- Ensure all soft landscaping within the site is well maintained. Replace any soft landscaping if not in good health

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Minor to Moderate Negative Impact post** mitigation

Monitoring plan

The suggested mitigation measures should be controlled by

- Preparation of a landscape plan for the proposed Project Site; and
- Preparation of Lighting Management Plan for operation of the CCGT Plant.

12.4.3 Operation of Water Supply Structures

Summary of Baseline Conditions

The key baseline conditions note that much of the Project Site for the CCGT Plant is within a brownfield site (See Figure 5.30), while the Water Supply Site is in a greenfield site (See Figure 5.31).

Proposed Project activity

Visual impacts during site formation and construction will be caused by earthworks, light emissions (including any flate testing, disturbance and physical presence of new facilities.

Receptor Identification and Sensitivity

All VSRs described in the Baseline ***Chapter 5*** are potentially affected by the impact, having low sensitivity (VSR3) as well as high sensitivity (VSR 1, VSR 2). Key receptors for this impact will be those VSRs closest to the Project Sites i.e. villagers in Mi Gyaung Auing and Kanbauk for the CCGT and Pyin Gyi for the Water Supply Site and all those pagodas and monasteries that are nearby – all with high sensitivity.

Table 12. 5 Rating of Impacts of Operation of Water Supply Structures (Pre-Mitigation)

<table>
<tr><th>Impact</th><td colspan="5">Potential impacts of Operation of Water Supply Structures.</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td colspan="2">Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="5">Potential impacts would be considered to be adverse (negative).</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td colspan="2">Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="5">Potential impacts would likely be direct impacts.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td colspan="2">Permanent</td></tr>
<tr><td colspan="5">Physical presence of new facilities will cause visual impact for the duration of the proposed Project.</td></tr>
<tr><th rowspan="2">Impact Extent</th><td>Local</td><td colspan="2">Regional</td><td colspan="2">International</td></tr>
<tr><td colspan="5">Water Supply facility is relatively small and assumed to be no more than 5m high, therefore only visible very locally.</td></tr>
<tr><th>Impact Scale</th><td colspan="5">Water Supply facilities are low level structures with a small footprint, therefore considered small scale.</td></tr>
<tr><th>Frequency</th><td colspan="5">See Duration</td></tr>
<tr><th rowspan="2">Impact Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">Small magnitude of change.</td></tr>
<tr><th rowspan="2">Receptor Sensitivity</th><td>Low</td><td colspan="2">Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">Two VSRs are considered to have high sensitivity - VSR 1 – Inhabitants of Villages and VSR 2 – Worshipers at Local Pagodas/ Worshiping Sites. VSR 3– Recreational Visitors and Tourists have low sensitivity.</td></tr>
<tr><th rowspan="2">Impact Significance</th><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">The significance is likely to be minor.</td></tr>
</table>

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

At design stage

- Careful design to contain light to areas that need illumination and prevent light spill/ glare e.g. consider
  - Shielding, directional alignment and window coverings that minimize external visibility of indoor lighting
  - Minimize lighting use and light intensity to as low as reasonably practicable
- Careful design to improve aesthetics e.g. consider
  - Texture (i.e. materials) and Finish (i.e. color of external walls) of buildings to blend with landscape/sky

For operation phase

- Manage lighting on site to consider minimization of light pollution and horizon glow
- Maintain all facilities in good repair
- Ensure trees/ shrubs are planted along the boundary of the site to act as screening

Noise Control Measures: Implement noise control measures such as sound barriers, acoustic enclosures, and mufflers to minimize noise emissions from pumps, machinery, and equipment.

Operational Best Practices: Adopt operational best practices to reduce noise emissions during routine maintenance activities and transportation operations, such as scheduling maintenance during off-peak hours.

Community Engagement: Maintain open communication with nearby communities and stakeholders to address concerns related to noise impacts and implement appropriate mitigation measures.

Regulatory Compliance: Ensure compliance with noise regulations and standards established by relevant authorities and conduct regular noise monitoring to assess and mitigate noise impacts as needed.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible to Minor Negative Impact** post mitigation

Monitoring plan

The suggested mitigation measures should be controlled by

- Ensuring the Water Supply site is included in Landscape Plan prepared for the whole Project; and
- Ensuring the Water Supply facilities are included in Lighting Management Plan prepared for the whole Project.

12.4.4 Decommissioning

The physical environment features (landscape) after decommissioning have been assessed based on the assumption that the facilities will remain in place even after decommissioning. Therefore, the visual impacts are assumed to be similar to the ones assessed during operation and the same mitigations measures are proposed.

CHAPTER 13 GREENHOUSE GAS

13.1 Introduction

During the construction and operation phases, different activities have the potential to increase greenhouse gas emissions. The main emission sources are released from fuel combustion (for example, natural gas combustion in electricity generation process, diesel fuel combustion in mobile vehicles).

This chapter provides an estimate of the greenhouse gas (GHG) emissions that are likely to be emitted by the Project, as related to the issue of climate change. GHGs are assessed in order to provide an indication of what a Project's GHG emissions will be, and to find ways to mitigate them early in the development process.

13.2 Assumptions And Limitations

It is noted that all greenhouse data in this report cannot yet be used for official greenhouse gas inventory reporting[52] until the site is operational and actual operational data is used for greenhouse gas inventory calculation.

All greenhouse gas calculation methodologies have been formulated using accurate calculation methodologies sourced from IPCC. These methodologies can be replicated for greenhouse gas inventory use when the MUPA site becomes operational.

13.3 Assessment Methodology

According to the Greenhouse Gas Protocol, greenhouse emissions fall under the following three scopes, all of which have been considered for MUPA (also referred to as 'the company'):

- **Scope 1 – Direct GHG Emissions:** Direct emissions from assets, projects and all other operations that are under the operational or financial control of the company. These emissions include energy related emissions from combustion of fuels and process related emissions. This also includes self- generated electricity.
- **Scope 2 – Location Based Indirect Emissions from Purchased Energy:** Indirect emissions from electricity, steam, heating or cooling purchased from the local grid. These suppliers should be outside of the company's boundary. This electricity is not purchased from a specific supplier, and therefore the estimated emissions from this category are based on a weighted average based on the mix of electricity production supplied to the grid.
- **Scope 3 – Other Indirect Emissions:** This emissions category is very broad and can include all related emissions from outside the company boundary that is not already included under Scope 2. This includes all emissions related to the company such as suppliers (upstream), customers (downstream) and support services (either upstream or downstream). Due to the indirect nature of these emissions and the lack of operational control of suppliers, customers or support services it is usually difficult to assess scope 3 emissions without using estimations and assumptions. For some industrial sectors Scope 3 emissions can be the most significant source of emissions (for example, midstream companies or retailers). However, for the power industry the majority of emission is likely to come from Scope 1, due to the emission of fuel combustion.

[52] Official greenhouse gas inventory reporting includes Sustainability Reporting, CDP, DJSI or other nationally relevant greenhouse reporting schemes.

All Scope 1, 2 and 3 emissions were quantified according to the following standards:

- GHG Protocol Corporate Accounting and Reporting Standard
- GHG Protocol Scope 2 Guidance
- GHG Protocol Corporate Value Chain (Scope 3) Standard

Emission factors and calculations were sourced mainly from the following:

- Intergovernmental Panel on Climate Change (IPCC) Guidelines for National
- Greenhouse Gas Inventories, 2006 (IPCC 2006)

The assessment of impact magnitude and significance related to GHG is based on the methodology described in ***Chapter 7***. The mitigation measures are based on international good practice (as recommended under the IFC EHS Guidelines), and good practice relevant to GHG emissions.

13.3.1 Global Warming Potentials

The global warming potentials (GWPs) used in this assessment are sourced from the 2007 IPCC Fourth Assessment Report (AR4). Although the 2013 Fifth Assessment Report (AR5) provides the latest GWPs, the GWPs from the AR4 are more commonly adapted.

The global warming potential is used to evaluate the potency of non-CO_2 greenhouse gases compared to CO_2 as a baseline. For example, methane (CH_4) is 25 times more potent than CO_2 in its global warming effect, meaning that 1 kg of CH_4 emitted is equivalent to 25 kg of CO_2 emitted. The 100 years' time horizon is used in line with greenhouse gas inventory best practices.

Table 13. 1 Global Warming Potentials

Industrial Designation or Common Name	Formula	Global Warming Potential for 100-years' Time Horizon from IPCC Fourth Assessment Report
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Source: IPCC Fourth Assessment Report Working Group I
https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

13.4 Summary Of Baseline Conditions

Myanmar is among the least emitting countries in the world, with 0.22 tCO_2eq per capita per year. According to data from UNFCCC Country Brief 2014: Myanmar[53], Myanmar's total GHG emissions in 2010 were 357.02 million tons of CO_2 equivalent (CO_2eq), including all greenhouse gasses. This indicated significant emissions from agriculture.

According to Myanmar's National Communication or inventory submission to the UNFCCC, the baseline national GHG emissions (excluding removals and Land Use Change and Forestry) for Myanmar in the year 2005 was 38,374.90 Gg CO_2eq (or 37.37 million tones CO_2eq). The majority of Myanmar's emissions comes from its agricultural sector (26,527.05 Gg CO_2eq).

[53] http://newsroom.unfccc.int/media/406268/country-brief-myanmar.pdf

All of the removals accounted for in the National Communication are from land use change & forestry (-95,774.73 Gg CO_2eq). The total net emissions from Myanmar including removals are -57,399.83 Gg CO_2eq. Myanmar is already a net greenhouse gas (GHG) sink.

13.5 Proposed Project Activity

Based on the Scoping Study, the Administrative Framework (Presented in Chapter 3) and the Project Description (presented in Chapter 4), the key potential impacts on greenhouse gas identified arise from the following activities.

13.5.1 Construction Phase

The main activities contributing to direct Scope 1 greenhouse emissions at the site are as follows:

- Mobile combustion from heavy machinery (e.g. excavators, bulldozers, cranes, etc.) and vehicles using diesel.
- The activity contributing to Scope 2 Location Based Emissions is as follows:
- Electricity purchased from the grid connected from substation, then connected to MUPA.

The activities selected for initial Scope 3 screening are as follows:

- Transmission loss from grid electricity supplier.

13.5.2 Operation Phase

Scope 1 emissions of GHG from the plant operation will mainly come from the following source:

- Natural gas combustion in electricity generation process.

13.6 Receptor Identification And Sensitivity

The direct receptor in the scope of this impact assessment is the global atmosphere. The indirect receptors from climate change due to global greenhouse gas emissions increase include Myanmar's weather.

Myanmar's Intended Nationally Determined Contribution (INDC) reported that Myanmar is extremely vulnerable to the negative effects of climate change. In 2015, for the third consecutive year, Myanmar was ranked globally by studies, as the second most vulnerable country in the world to extreme weather events over the last 20 years. In addition, climate models predict further sustained impacts from climate change in future, which will further expose Myanmar to the negative impacts of climate change.

13.7 Assessment Of Impacts

13.7.1 Construction Phase

Summary of Scope 1, 2 and 3 Emissions

The majority of emissions during construction phase are expected from Scope 1 Mobile combustion emissions, followed by electricity purchased and transmission loss. Combing all Scope emissions, the total release of GHG emissions during construction phase is estimated to be 3,079.20 tonnes CO_2eq per year as shown in Table 13.2.

Table 13. 2 Emissions Breakdown by Scope and Activity

Emission Scopes	Unit	Value
Scope 1 Direct Emissions		
Mobile Combustion	tCO_2eq/year	2,058.45
Scope 2 Market Based		
Electricity Purchased (Location Based from grid)	tCO_2eq/year	922.83
Scope 3 Indirect Emissions from Transmission Loss		
Emissions from transmission loss from grid electricity	tCO_2eq/year	97.92
Scope 1 + Scope 2 + Scope 3	**tCO_2eq/year**	**3,079.20**

Scope 1 Direct Emissions

On site vehicles and heavy mobile machineries are expected to use diesel as the main sources of fuels. Site use of fuels was estimated as following table.

Table 13. 3 Expected Mobile Combustion

Mobile Fuels	Units	Estimated Annual Consumption
Diesel	litre/year	750,000

Emissions are calculated and converting the energy use into emissions by using an emission factor. The emission factor is sourced from IPCC, which uses emission factors based on net heating value basis. Energy use is calculated from estimated volume of fuels to be used and the estimated net heating value of the fuels.

The Tier 1 method of IPCC was selected since there are no site specific or country specific emission factors available.

Due to lack of heating value from MUPA the heating value was estimated using Department of Alternative Energy Development and Efficiency (DEDE) Thailand net heating values. Additionally, the mass of diesel was converted to volume using density.

Table 13. 4 Mobile Fuels Net Heating Values

Fuel	Units	MJ/unit
Diesel	Litre	36.42

Source: http://www.dede.go.th/download/state_59/frontpage_july2559.pdf

The following are the emission factors used for converting energy use to emissions. These emission factors were sourced from IPCC.

Table 13. 5 Default IPCC Mobile Fuels Emission Factors

Fuel	$kgCO_2/TJ$ (default)	$kgCH_4/TJ$ (default)	kgN_2O/TJ (default)
Gas/ Diesel Oil	74,100	3.9	3.9
Source	IPCC 2006 Vol. 2 Ch. 1 Table 1.4	IPCC 2006 V.2 Ch.3 Table 3.2.2	IPCC 2006 V.2 Ch.3 Table 3.2.2

The final results of emissions calculation are as follows:

Table 13. 6 Expected Mobile Emissions

Mobile Combustion	Annual Use (litre/year)	Annual Energy Use (TJ)	Annual Emissions (kg/year)			Total CO2eq Emissions	
			CO2	CH4	N2O	kg CO2eq/year	tonnes CO2eq/year
Emission Factors (kg of greenhouse gas per TJ)			74,100	3.9	3.9		
Global Warming Potential for 100-year time horizon			1	25	298		
Diesel	750,000.00	27.32	2,024,042	2,663	31745.493	2,058,450	2,058

Scope 2 Market Based

During construction phase, MUPA will use electricity supply from local distribution. The following are the estimated annual consumption for MUPA. An average annual consumption of 2,920,000kWh was used for emissions estimation.

The emission factor used (Table 13.7) is based on a national average of generation plant that feed electricity to the grid.

Table 13. 7 Myanmar Electricity Grid Emission Factor

Emissions per kWh of electricity generated		
$kgCO_2/kWh$	$kgCH_4/kWh$	kgN_2O/kWh
0.315665174	0.00000622419	0.00000072998

Source: Electricity-specific emission factors for grid electricity, August 2011, https://ecometrica.com/assets/Electricity-specific- emission-factors-for-grid-electricity.pdf.

The resulting emissions from multiplying energy use by emission factor are as Table 13.8: The total estimated Scope 2 emissions during construction are approximately 922.83 tonnes CO_2eq per year.

Table 13. 8 Expected Indirect Emissions from Purchased Electricity

Electricity Purchased	Annual Consumption (kwh/year)	Annual Emissions (kg/year)			Total CO_2eq Emissions	
		CO_2	CH_4	N_2O	Kg CO_2eq/year	Tonnes CO_2eq/year
Emissions per kWh of electricity generated		0.315665174	0.00000622419	0.00000072998		
Global Warming Potential for 100-year time horizon		1	25	298		
Electricity	2,920,000	921,742	454.37	635.20	922,832	922.83

Scope 3 Indirect Emissions from Transmission Loss

Transmission loss counts as Scope 3 since MUPA is not directly responsible for the emissions. The following is the available data for Myanmar's transmission loss rate:

Table 13. 9 Myanmar's Transmission Loss Rate

Emissions associated with T&D losses per kWh of electricity consumed		
kgCO_2/kWh	kgCH_4/kWh	kgN_2O/kWh
0.033493308	0.0000006604	0.0000000775

Source: Electricity-specific emission factors for grid electricity, August 2011, https://ecometrica.com/assets/Electricity-specific- emission-factors-for-grid-electricity.pdf.

Scope 3 transmission emissions for MUPA are approximately 97.92 tonnes CO_2eq per year

Table 13. 10 Expected Indirect Transmission Loss Emissions

Source	Annual Energy Consumption	Annual Emissions (kg/year)			Total CO_2eq Emissions	
		CO_2	CH_4	N_2O	kg CO_2eq/year	tonnes CO_2eq/year
Emissions associated with T&D losses per kWh of electricity consumed		0.033493308	0.0000006604	0.0000000775		
Global Warming Potential for 100-year time horizon		1	25	298		
Transmission emission	2,920,000	97,800	48.21	67.44	97,916	97.92

The significance of potential impacts to greenhouse gas during construction phase is assessed in the following table.

Table 13. 11 Rating of Impacts on Climatic Condition due to GHG emissions (Pre-Mitigation)

<table>
<tr><td>Impact</td><td colspan="4">Potential impacts on climatic condition due to GHG emissions.</td></tr>
<tr><td rowspan="2">Impact Nature</td><td>Negative</td><td>Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="4">Potential impacts to climate would be considered to be adverse (negative).</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td>Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be direct impacts through the release of emissions from fuel combustion.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">Many of the major greenhouse gases can remain in the atmosphere for tens to hundreds of years after being released.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td colspan="2">International</td></tr>
<tr><td colspan="4">Greenhouse gasses are a global emission and may affect the global climate.</td></tr>
<tr><td>Impact Scale</td><td colspan="4">The emissions from construction phase are calculated to be 3,079.20 tonnes CO_2eq. Compared to Myanmar's GHG release of 357.02 million tons in 2010, the total GHG releases from the Project are insignificant (approximately 0.009%).</td></tr>
<tr><td>Frequency</td><td colspan="4">Emissions will be released intermittently, but repeatedly throughout the construction period.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td colspan="4">Positive | Negligible | Small | Medium | Large</td></tr>
<tr><td colspan="4">Minor emissions of GHG will be emitted as a result of the Project, and considered insignificant emissions according to IFC (25,000 tonnes CO_2eq per year). Magnitude is considered Negligible.</td></tr>
<tr><td rowspan="2">Receptor Sensitivity</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="4">The direct receptor to greenhouse gas is the global atmosphere. The greenhouse effect is enhanced by greenhouse gas emissions of anthropogenic nature. Minor emissions of GHG will be emitted as a result of the Project, and not likely to significantly change atmospheric GHG concentrations. Receptor/resource sensitivity is rated as Low.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>Negligible</td><td>Minor</td><td>Moderate</td><td>Major</td></tr>
<tr><td colspan="4">As per the impact assessment methodology defined in Chapter 7, the combination of a Low resource sensitivity and Negligible impact magnitude will result in an overall Negligible potential impact.</td></tr>
</table>

Mitigation and Management Measures

The following measures will be put in place for the Project during construction to reduce GHG emissions;

- Implement the same mitigation measures to minimize impacts to Air Quality (Chapter 8).
- Develop and implement preventive maintenance plan for machines, and engines to ensure combustion efficiency.
- Develop vehicle maintenance plan.

Residual Impact (Post-mitigation)

The significance of the residual impact on climatic condition as a result of GHG emissions is considered to be a **Negligible Negative Impact**.

13.7.2 Operation Phase

Scope 1 Direct Emissions

During the operation phase of the Project, the main activities contributing to direct Scope 1 greenhouse emissions at the site are mainly from electricity generation from the gas turbine generators in the Combined Cycle Power Plant (CCPP). The gas turbine will use natural gas as the only fuel. According to the gas supply agreement between MOGE and EPGE, gas will be supplied from Zawtika and Yanada to the power plant as about 39 mmscfd and 52 mmscfd, respectively.

To evaluate emissions, the methodology from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy, Chapter 2 Stationary Combustion is used. Total emissions are calculated by the following equation, considering the quantity of fuel consumed (in TJ) for combustion purposes.

EQUATION 2.1

GREENHOUSE GAS EMISSIONS FROM STATIONARY COMBUSTION

$$Emissions_{GHG,\,fuel} = Fuel\ Consumption_{fuel} \bullet Emission\ Factor_{GHG,\,fuel}$$

Where:

$Emissions_{GHG,fuel}$ = emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

$Emission\ Factor_{GHG,fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO_2, it includes the carbon oxidation factor, assumed to be 1.

The following data have been defined as fuel to be used in the CCPP. These data represent natural gas from Zawtika or Yanada offshore gas field. Additionally, the energy content of natural gas was converted using DEDE Thailand conversion factors.

Table 13. 12 Fuels Net Heating Values

Fuel	Units	Value	Source
Natural gas (Zawtika)	BTU/scf	913	MUPA Fuel Specification and Supply Data
Natural gas (Yanada)	BTU/scf	712	MUPA Fuel Specification and Supply Data
Natural Gas (Dry)	MJ/scf	1.02	http://www.dede.go.th/download/state_59/Thailand%20alternative%20energy%202015.pdf, Page 57
Conversion Factors			
1 BTU =1055.056 Joule (J)			API Compendium of Greenhouse Gas Emissions Methodology for the Oil and Natural Gas Industry, Section 3 Technical Consideration, August 2009, Page 3-15

Table 13.13 is the emission factors used for converting energy use to emissions. These emission factors were sourced from IPCC.

Table 13. 13 Default IPCC Emission Factors for Stationary Combustion

Fuel	$kgCO_2/TJ$ (default)	$kgCH_4/TJ$ (default)	kgN_2O/TJ (default)
Natural Gas	56,100	1	0.1

Source: IPCC 2006 Vol. 2 Ch. 2 Table 2.2

The result of using above equation with the above parameters showed that 1,570,642.28 tonnes of CO_2eq will be emitted per year based on estimated data provided by MUPA, as shown in ***Table 13.14***. Compared to Myanmar's GHG emissions of 357.02 million tonnes CO_2eq in 2010, the total GHG releases from the Project is approximately 0.44%.

The estimated GHG emissions from the power plant during operation will exceed the threshold that defines significant emitters of GHGs by the ADB SPS and EP III (100,000 tonnes CO_2eq per year) and IFC PS3 (25,000 tonnes CO_2eq per year). Therefore, the Project is required to report annual GHG emissions as per the applicable reference framework.

Table 13. 14 Estimated GHG Emissions during Operation Phase

Source	Fuel Use	Annual Fuel Use	Annual Energy Use		Annual Emissions (kg/year)			Total CO_2eq Emissions	
	(10^6 ft^3/day)	(10^6 ft^3/year)	(10^6 BTU/year)	(TJ/year)	CO	CH	NO	(kg CO eq/year)	(tonnes CO_2eq/year)
Global Warming Potential for 100-year time horizon					**1**	**25**	**298**		
Default Emission Factor (kg of greenhouse gas per TJ) (2)					**56100**	**1**	**0.1**		
Natural gas (Zawtika)	39	14,235	12,996,555	13,712.09	769,248,435.93	342,802.33	408,620.38	769,999,858.64	769,999.86
Natural gas (Yanada)	52	18,980	13,513,760	14,257.77	799,861,097.31	356,444.34	424,881.65	800,642,423.30	800,642.42
Total									**1,570,642.28**

The technology of the Project is an efficient form of combined cycle mode. In a combined cycle operation, the heat of exhaust gas will be admitted to the Heat Recovery Steam Generator (HRSG) where superheated steam will be produced which will drive the steam turbine to generate electrical power. This combination increases the thermal efficiency to approximately 50-60%. In addition, the Project uses natural gas as its fuel to generate electricity that provides more efficiency than coal because of higher operating temperatures, and when used together with the more efficient combined-cycle results in even higher efficiencies (*IEA, 2006*)[54]. In comparison, the GHG emissions of the best available technology for coal is anticipated to be 900 gCO_2/kWhe, while for gas the GHG emission is anticipated to be 400 gCO_2/kWhe[55].

The proposed Project is likely to have a long-term positive effect on emissions reduction in power generation industry. In 2010/2011 a total of 7,543.06 million kWh[56] was generated by the Myanmar Electric Power Enterprise (MEPE). Of the total production, 8.9% was thermal power generation, 0.4% was diesel-generated electricity, 67.7% was hydropower, and the remaining 23% was production from gas power plants. Since Myanmar has considerable natural gas reserves, an option for emission reductions would be fossil fuel switching from coal use to the less carbon intensive natural gas.

A study showed switching the current thermal production from coal in Myanmar to natural gas would result in emission reductions of about 251,053 tons of CO_2[57], if fully replacing coal with natural gas for the production of the same amount of MWh. Replacing the 600 MW of power production currently planned as coal power with natural gas, would give another 1,455,300 tons of CO_2 emission reductions.

The significance of potential impacts to greenhouse gas during operation phase is assessed in the following table.

Table 13. 15 Rating of Impacts on Climatic Condition due to GHG emissions (Pre-Mitigation)

<table>
<tr><th>Impact</th><td colspan="4">Potential impacts on climatic condition due to GHG emissions.</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td>Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="4">Potential impacts to climate would be considered to be adverse (negative).</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td>Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be direct impacts through the release of emissions from Project operation.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">Many of the major greenhouse gases can remain in the atmosphere for tens to hundreds of years after being released.</td></tr>
<tr><th rowspan="2">Impact Extent</th><td>Local</td><td>Regional</td><td colspan="2">International</td></tr>
<tr><td colspan="4">Greenhouse gases can potentially affect the Earth's climate.</td></tr>
</table>

[54] IEA, 2006a: Energy Technology Perspectives 2006: Scenarios and strategies to 2050. International Energy Agency, Paris, 484 pp.

[55] European Commission Joint Research Centre (EUR 19754 EN), Greenhouse Gas Emissions from Fossil Fuel Fired Power Generation Systems.

[56] http://www.csostat.gov.mm/S09MA02.asp cited in UNEP RISØ CENTRE, June 2013, Emission Reduction Profile Myanmar

[57] Calculated using IPCC guidelines regarding emission factors and plant efficiency, for plants built after 2000. cited in UNEP RISØ CENTRE, June 2013, Emission Reduction Profile Myanmar

Impact Scale	The emissions from Power Plant are calculated to be 1,570,642.28 tonnes of CO_2eq orn1.57 million tonnes CO_2eq per annum. Compared to Myanmar's GHG emissions of 357.02 million tonnes CO_2eq in 2010, the total GHG releases from the Project is approximately 0.44%.				
Frequency	Emissions will be released continuously throughout the operation period.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The GHG emissions during operation phase are considered 'significant emissions' according to ADB SPS and EP III (100,000 tonnes CO_2eq per year) and of IFC PS3 (25,000 tonnes CO_2eq per year). Magnitude is therefore considered Medium.				
Receptor Sensitivity	Low	**Medium**	High		
	The direct receptor to greenhouse gas is the global atmosphere. The greenhouse effect is enhanced by greenhouse gas emissions of anthropogenic nature. The concentration of GHG in the atmosphere beyond the level of naturally occurring concentrations could result in more heat being held within the atmosphere. Receptor/resource sensitivity is rated as Medium.				
Impact Significance	Negligible	Minor	**Moderate**	Major	
	As per the impact assessment methodology defined in Chapter 7 the combination of a medium resource sensitivity and medium impact magnitude will result in an overall Moderate potential impact.				

Mitigation and Management Measures

The Project has employed a CCGT technology which was designed for high reliability and efficiency operation with lower environmental impact. CCGT plant offer half as much CO_2 per kWh compared to other power generation technology. At this stage it is considered that further design measures and control measures are not considered necessary due to the higher efficiencies of combined-cycle technology.

It is therefore proposed to undertake an annual GHG inventory to monitor the GHG emissions according to the applicable requirements (i.e. ADB SPS, EP III and IFC):

- Conduct annual pollutant release inventory to monitor the GHG emissions from the Project. The GHGs emission shall be reported as CO_2eq unit.
- Where feasible, arrange emissions offsets (including the Kyoto Protocol's flexible mechanisms and the voluntary carbon market), including reforestation, afforestation.

Residual Impact (Post-mitigation)

The Project employs the most effective GHG reduction measure. The mitigation measures above have been put in place to monitor the GHG emission. There will be no reduction in the impact level, residual impact significance would be **Moderate Negative Impact**.

13.8 Green House Impact

To estimate and analyze the indirect effects of clearing trees for the combined cycle power plant project on carbon sequestration rates, we need to consider several factors:

1. Tree Biomass: Calculate the biomass of the trees in the areas designated for the power plant, water intake plant, and jetty. This involves estimating the volume and density of the trees in each area.

2. Carbon Content: Determine the carbon content of the tree biomass. This can vary depending on the species of trees and their age, but it is typically around 50% of the dry weight of the biomass.

3. Carbon Sequestration Rate: Estimate the annual carbon sequestration rate of the trees in each area. This rate depends on factors such as tree species, age, and environmental conditions, but it can range from a few kilograms to several hundred kilograms of carbon per hectare per year.

4. Loss of Carbon Sequestration: Calculate the total carbon sequestration that will be lost due to the clearing of trees in each area. This involves multiplying the biomass of the trees by the carbon content and then multiplying by the carbon sequestration rate.

5. Total Indirect Effects* Sum up the loss of carbon sequestration from all three areas to determine the total indirect effects of tree clearing for the project.

Once these calculations are completed, you can analyze the implications of the loss of carbon sequestration on the project's overall carbon footprint and its contribution to climate change. Additionally, you can explore potential mitigation measures, such as reforestation or afforestation efforts in other areas, to offset the carbon emissions associated with tree clearing.

To estimate and analyze the indirect effects of clearing trees for the combined cycle power plant project on carbon sequestration rates, we'll need to calculate the approximate area of trees cleared and then estimate the carbon sequestration potential of those trees.

1. Total Area Cleared:

- For the power plant: 94696 square meters
- For the water intake plant: 22000 square meters
- For the jetty: 3500 square meters

Total area cleared = 94696 + 22000 + 3500 = 120196 square meters

2. Carbon Sequestration Rate:

The carbon sequestration rate varies depending on the type of trees and their age. A general estimate for mature trees is around 22 kg of carbon dioxide (CO_2) absorbed per tree per year.

3. Number of Trees Cleared:

Since we don't have information on the density or type of trees, let's assume an average density of 100 trees per hectare (10,000 square meters).

Total number of trees cleared = Total area cleared / Area per tree

= 120196 square meters / (100 trees/10000 square meters)

≈ 1201 trees

4. Carbon Sequestration Reduction:

Carbon sequestration reduction = Number of trees cleared * Carbon sequestration rate per tree per year

≈ 1201 trees * 22 kg CO_2 per tree per year

≈ 26422 kg CO_2 per year

So, the estimated indirect effect of clearing trees for the project on carbon sequestration rates is approximately 26,422 kilograms of CO_2 per year. This represents the reduction in the amount of carbon dioxide absorbed by the cleared trees annually.

13.8.1 Mitigation

To mitigate the loss of carbon sequestration due to tree clearing for the project, several measures can be implemented. Here are the potential mitigation strategies:

1. Reforestation and Afforestation: Planting new trees in other areas to replace those that were cleared can help offset the loss of carbon sequestration. Reforestation involves replanting trees in areas that were previously forested but have been cleared, while afforestation involves planting trees in areas that were not previously forested.

2. Vegetative Buffer Strips: Establishing vegetative buffer strips along water bodies, roadways, and other sensitive areas can help mitigate the loss of carbon sequestration. These buffer strips can be planted with trees and shrubs to enhance carbon storage and provide other environmental benefits, such as erosion control and habitat restoration.

3. Agroforestry Practices: Implementing agroforestry practices, such as alley cropping or silvopasture, can integrate trees into agricultural landscapes while providing multiple benefits, including carbon sequestration. By combining trees with crops or livestock, agroforestry systems can enhance carbon storage in both aboveground biomass and soil organic matter.

4. Urban Forestry: Enhancing urban green spaces through tree planting initiatives and urban forestry programs can help mitigate the loss of carbon sequestration in urban areas. Planting trees along streets, in parks, and on other public lands can provide numerous environmental, social, and economic benefits while sequestering carbon.

5. Protected Areas and Conservation: Protecting existing forests and natural habitats from further degradation and deforestation is essential for preserving carbon sequestration capacity. Establishing protected areas, conservation easements, and land trusts can help safeguard critical ecosystems and maintain carbon stocks.

6. Improved Forest Management: Implementing sustainable forest management practices, such as selective logging, reduced-impact logging, and agroforestry, can help maintain or enhance carbon sequestration while allowing for timber extraction and other economic activities.

7. Education and Outreach: Increasing awareness and understanding of the importance of forests and trees for carbon sequestration can encourage community engagement and support for conservation and restoration efforts. Education and outreach programs can empower stakeholders to act to protect and restore forests in their local communities.

8. Policy and Incentives: Implementing policies and incentives that promote forest conservation, reforestation, and sustainable land use practices can provide financial support and regulatory frameworks to facilitate mitigation efforts. This may include carbon offset programs, tax incentives for tree planting, and subsidies for sustainable forestry practices.

Integrating mangroves or other trees into the temporary jetty area can serve as an effective way to mitigate the impacts of tree clearing for the project while also reducing greenhouse gas emissions. There are:

1. Mangrove Planting: Mangroves are highly efficient at sequestering carbon dioxide from the atmosphere and storing it in their biomass and soils. By planting mangroves in the temporary jetty area, you can enhance carbon sequestration and offset the carbon emissions resulting from tree clearing for the project.

2. Selection of Native Trees: In addition to mangroves, consider planting other native tree species in the temporary jetty area. Native trees are well-adapted to the local climate and

soil conditions and can provide multiple ecosystem benefits, including carbon sequestration, habitat restoration, and erosion control.

3. Integration with Restoration Efforts: Incorporate the planting of mangroves and other trees into broader habitat restoration efforts in the project area. Collaborate with local conservation organizations, government agencies, and community groups to develop and implement restoration plans that prioritize carbon sequestration and ecosystem resilience.

4. Enhanced Biodiversity: Planting mangroves and native trees in the temporary jetty area can enhance biodiversity by providing habitat for diverse plant and animal species. A healthy and diverse ecosystem is better able to withstand environmental stresses and disturbances, including those associated with industrial development.

5. Long-Term Management: Implement a long-term management plan for the planted mangroves and trees to ensure their health and vitality. This may include regular monitoring, maintenance activities such as watering and pruning, and protection measures to prevent damage from storms, erosion, and human activities.

6. Community Engagement: Engage local communities and stakeholders in the mangrove and tree planting efforts to foster stewardship and ownership of the restored area. Provide educational opportunities and training programs to raise awareness about the importance of mangroves and trees for carbon sequestration and ecosystem health.

CHAPTER 14 BIODIVERSITY

14.1 INTRODUCTION

This Chapter outlines the results of the assessment of impacts to terrestrial biodiversity and ecosystem services. Mitigation and management measures have been recommended to align with the requirements for compliance with IFC PS6.

This Chapter also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP, Chapter 19) for the Project.

14.2 ASSUMPTIONS AND LIMITATIONS

The assessment of potential impacts related to biodiversity and ecosystem services in this section is based on the environmental baseline data (presented within Chapter 5), socio-economic baseline data (presented within Chapter 6**)** and the information available from the Project Proponent at the time of writing. Judgements and assessments have been made based on professional knowledge and previous experience of ERM.

14.3 ASSESSMENT METHODOLOGY

The significance of the impacts has been evaluated using a standardized approach based on ERM's Impact Assessment Standard. This Standard has been determined based on the requirements of IFC PS6. It is based on the relationship between the magnitude of impact and nature of receptor (sensitivity).

14.4 ASSESSMENT CRITERIA

The impact magnitude is a function of a range of considerations including extent (e.g. local, regional or national), impact duration (e.g. temporary, short-term, long-term or permanent), scale (i.e. size of the impact), frequency (i.e. constancy or periodicity of the impact), and likelihood (for unplanned events only, e.g. unlikely, possible, or likely).

Impacts to biodiversity are often discussed in terms of impacts to habitats and impacts to individual species or species groups. As such significance criteria are defined for both habitats and species. The Project impacts identified have been assessed for their significance according to the criteria provided in Figure 14.1 (for habitat areas) and Figure 14.2 (for specific species groups).

Table 14. 1 Magnitude Criteria for Effect on Baseline Habitats

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	**Small**	**Medium**	**Large**
Low	Habitats with no or local designation/recognition; habitats of significance for species of Least Concern; habitats which are common and widespread within the region.	Negligible	Negligible	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas; habitats of significant importance to globally Vulnerable, Near Threatened or Data Deficient species; habitats of significant importance for nationally restricted range species; habitats supporting nationally significant concentrations of migratory species and/or congregatory species; nationally threatened or unique ecosystems.	Negligible	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of importance to globally Critically Endangered or Endangered species; habitats of importance to endemic and/or globally restricted- range species; habitats supporting globally significant concentrations of migratory species and/ or congregatory species; highly threatened and/or unique ecosystems, areas associated with key evolutionary species (In accordance with IFC Critical Habitat definition)	Negligible	Moderate	Major	Critical
Magnitude of Effect Definition					
Negligible	Effect is within the normal range of variation				
Small	Affects a small area of habitat, but without the loss of viability/function of the habitat				
Medium	Affects a sufficient proportion of the habitat that the viability/function of part of the habitat or the entire habitat is reduced, but does not threaten the long-term viability of the habitat or species dependent on it.				
Large	Affects the entire habitat or a significant proportion of the habitat to the extent that the viability/function of the entire habitat is reduced and the long-term viability of the habitat and the species dependent on it are threatened.				

Table 14. 2 Magnitude Criteria for Effect on Baseline Species

Species Sensitivity/Value		Magnitude of Effect			
		Negligible	**Small**	**Medium**	**Large**
Low	Species which are included on the IUCN Red List of Threatened Species as Least Concern (LC) (IUCN 2011).	Not significant	Not significan t	Minor	Moderate
Medium	Species included on the IUCN Red List of Threatened Species as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD) (IUCN 2011). Species protected under national legislation. Nationally restricted range species. Nationally important number of migratory or congregatory species.	Not significant	Minor	Moderate	Major
High	Species included on the IUCN Red List of Threatened Species as Critically Endangered (CR) or Endangered (EN) (IUCN 2011). Species having a globally Restricted Range (i.e. plants endemic to a site or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km^2. Internationally important numbers of migratory or congregatory species. Key evolutionary species.	Not significant	Moderate	Major	Critical
Magnitude of Effect Definition					
Negligible	Effect is within the normal range of variation.				
Small	Affects a small proportion of a population, but does not substantially affect other species dependent on it, or the populations of the species itself				
Medium	Affects a sufficient proportion of a species population that it may bring about a substantial change in abundance and /or reduction in distribution over one or more generations, but does not threaten the long-term viability of that population or any population dependent on it.				
Large	Affects an entire population or species at sufficient scale to cause a substantial decline in abundance and/or change in distribution beyond with natural recruitment (reproduction, immigration from unaffected areas) may not return that population or species, or any population or species dependent upon it, to its former level within several generations, or when there is no possibility of recovery.				

14.5 Screening Of Key Project Activities/Aspects Relating To Potential Biodiversity Impacts

Table 14.3 summarizes the threats to biodiversity values related to the activities during construction and operation. These threats to biodiversity are derived from IFC PS6 and relate to the activities that are likely to occur during Project construction and operation. A number of the threats relate to both construction and operation activities and as such an assessment of significance has been undertaken in this section.

Table 14. 3 Threats to biodiversity values during Construction and operation

Term	Description
Permanent Loss of Habitat	Permanent loss of habitat or species due to permanent or temporary site activities for the Project
Disturbance and Displacement of Species	Disturbance to, or displacement/exclusion of a species from foraging habitat due to construction and operation activities, de-commissioning activities, and operational and maintenance activities.
Edge Effects on Habitats	Disturbance or damage to adjacent habitat and species caused by movement of vehicles and personnel, potential mobilisation of sediment, artificial lighting, dust, spillage of fuels and chemicals, emissions and noise, and subsidence.
Alteration of Water low Regimes	Effects on downstream habitats caused by alterations to natural flow regime.
Light/Noise Impacts	Effects on species caused by permanent alterations in night time light conditions;
Alien Species (Plants and Animals)	Introduction or spreading of alien species during the construction and operation works.
Air/Water Pollution	Contamination of the environment that has a direct or indirect impact on a species either through exposure to harmful substances.
Mortality	Mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during clearing activities.

The nature of impacts to biodiversity can be described in terms of direct and indirect impacts; and permanent and temporary impacts. Table 14.4 considers the construction and operation and operation of each component of the Project and which threats to biodiversity categories may apply. This table is used in the resulting impact assessment.

Table 14. 4 Screening of Key Project Activities/Aspects Relating to Potential Biodiversity Impacts

Activity/Aspect						
General Exploration/Construction Activities						
Land clearing activities (Habitat removal)						
Movement of vehicles (Noise, dust, light and strike)						
Storage of raw materials (Creation of new habitats/dust)						
Construction activities including building works, concrete works (Noise, vibration, dust)						
Labor influx (Hunting and poaching of wildlife)						
Waste management (Creation of new habitats/foraging resources)						
Stormwater runoff (Changes to aquatic habitats)						
Construction of transmission line (Associated facility)						
General Operation and Decommissioning Activities						
Movement of vehicles along haul roads and access roads (Vehicles strike/dust generation)						
Operation of Power Plant (Noise, light and air emissions)						
Waste management (Creation of new habitats/foraging resources)						
Stormwater runoff (Changes to aquatic habitats)						
Maintenance activities (Noise, vibration and light)						
Land clearing activities (Induced clearing)						
Labour influx (Hunting and poaching of wildlife)						

Notes:

	Screened in to impact assessment
	Negligible impact possible, screened out
	No impact possible, screened out

14.6 Impacts Screened Into This Assessment

The following impact types have been screened into this impact assessment:

- Habitat loss;
- Disturbance and displacement of fauna and flora;
- Degradation of habitat; and
- Mortality of resident species

14.7 Assessment Of Impacts

Habitat Loss

The impacts from the loss of habitat within the Project Area during the construction and operation phase are predominately related to the construction and operation of infrastructure necessary for the Project. The pipelines may traverse through agriculture field, leading to potential impacts on famers. Clearing of vegetation, disturbance of soils, and disruption of animals' habitats could occur during pipeline construction and maintenance activities.

14.7.1 Summary of Baseline Conditions

The distribution of habitat within the AoI consists of both Natural Habitat and Modified Habitat. Critical Habitat has been identified for mangrove areas in the intertidal zone. The Project Area consists of Modified Habitats being agriculture and village land classes. The area of Natural Habitat and Modified Habitat within the AoI and Project Area are shown in ***Table 14.5*** below.

Table 14. 5 Natural Habitat and Modified Habitat within the AoI and Project Area

Habitat Type	Project Area (ha)	Area of Influence (ha)
Natural Habitat	-	538.45
Modified Habitat	9.64	2231.70

14.7.2 Proposed Project activity

Clearing of land for the construction and operation of the power plant and associated facilities will remove vegetation cover available for species within the Project Area.

14.7.3 Receptor Identification and Sensitivity

The receptor for habitat loss is Modified Habitats which have a Low sensitivity. No species of conservation significance were identified within Modified Habitats within the Project Area.

Table 14. 6 Rating of Impacts on Habitat Loss

Impact	Potential impacts on habitat loss.			
Impact Nature	**Negative**	Positive	Neutral	
	Potential impacts to habitat loss would be considered to be adverse (negative).			
Impact Type	**Direct**	Indirect	Induced	
	Potential impacts would likely be direct impacts.			
Impact	Temporary	Short-term	**Long-term**	Permanent

Duration	The clearing of habitats will be permanent and ongoing.				
Impact Extent	**Local**		Regional		International
	The clearing of habitats will be restricted to the Project Area only.				
Impact Scale	It is anticipated that the impact will be limited to the Project Area during construction and operation. A total of 9.64ha will be cleared during construction and operation. The habitat will be agricultural land classes that are considered to be Modified Habitat.				
Frequency	The event will occur once prior to construction and operation.				
Impact Magnitude	Positive	**Negligible**	**Small**	Medium	Large
	The impact magnitude is likely to be negligible to small.				
Receptor Sensitivity	**Low**		Medium		High
	The Project Area is considered to be Modified Habitat and hence the sensivity of the receptor is Low.				
Impact Significance	**Negligible**	**Minor**	Moderate		Major
	The significance is likely to be negligible to minor.				

14.7.4 Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Strict rules against clearing vegetation will be imposed on all Project staff, workers, and all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws;
- The Project Proponent shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning restrictions related to unauthorized clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violate rules and regulations;
- The planned clearance area for the construction and operation works shall be clearly identified and marked to avoid accidental clearing;
- Use of the access road should be restricted to construction and operation vehicles only. Checkpoints should be used to manage access and inspect vehicles for timber and forest products taken from the Project Area.
- Implement mitigation measures such as habitat restoration, wildlife habitat enhancement, and the establishment of ecological buffers to minimize ecological impacts.

14.7.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation.

14.7.6 Comparison with applicable regulations, standards and guidelines

The applicable standard is the IFC Performance Standard 6. Paragraph 15 of the PS requires clients to apply the mitigation hierarchy to projects (avoid, mitigate and offset impacts to biodiversity values). The Project area is located within Modified Habitat and hence satisfies the requirement to avoid Natural Habitat and Critical Habitat as required by the Mitigation Hierarchy.

14.7.7 Monitoring plan

The Construction and operation Contractor, will schedule and implement a routine inspection program throughout construction and operation period to monitor vegetation clearing extent.

14.8 Disturbance And Displacement Of Fauna And Flora

Disturbance and displacement of species during construction and operation will be primarily caused by light, noise and vibration impacts during construction and operation activities. The use of machinery during day and night time operation will result in increases of light, noise and vibration impacts.

14.8.1 Summary of Baseline Conditions

Species detected within the AoI and Project Area that may be disturbed during construction and operation are shown in ***Table 14.7***. These species are considered threatened species as they have a higher extinction risk than other species detected.

Table 14. 7 Species that may be disturbed during construction and operation

Scientific Name	Common Name	IUCN
Fauna		
Psittacula alexandri	Red-Breasted Parakeet	NT
Macaca leonine	Northern Pig tailed Macaque	VU
Prionailurus viverrinus	Fishing Cat	VU
Flora		
Sonneratia griffithii	Lame (Mangrove)	CR

14.8.2 Proposed Project activity

The use of machinery, human presence and subsequent light, noise and vibration impact during construction and operation.

14.8.3 Receptor Identification and Sensitivity

The Project Area is considered to be Modified Habitat. The intertidal habitat containing mangrove species is considered to be Critical Habitat due to the presence of the species *Sonneratia griffithii*. The sensitivity of the receptor is therefore considered to be High.

Table 14. 8 Rating of Impacts on Disturbance and Displacement of Fauna and Flora

<table>
<tr><th>Impact</th><td colspan="4">Potential impacts on disturbance and displacement of fauna and flora.</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td colspan="2">Positive</td><td>Neutral</td></tr>
<tr><td colspan="4">Potential impacts to fauna and flora would be considered to be adverse (negative).</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
<tr><td colspan="4">Potential impacts would likely be indirect impacts.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">Only occurs during the construction and operation period.</td></tr>
</table>

Impact Extent	**Local**	Regional		International	
	Impact extent will be within the Project Area and adjacent habitats within the AoI.				
Impact Scale	Disturbance and displacement will be small in scale and limited to areas within the Project Area and adjacent habitats within the AoI				
Frequency	Occurs only once.				
Impact Magnitude	Positive	**Negligible**	**Small**	Medium	Large
	The impact magnitude is likely to be negligible to small.				
Receptor Sensitivity	Low	Medium		**High**	
	The presence of Critical Habitat downstream of the Project Area indicates a High sensitivity				
Impact Significance	**Negligible**	**Minor**		Moderate	Major
	The significance is likely to be negligible to minor.				

14.8.4 Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Operational vehicles will be maintained in accordance with industry standard to minimize unnecessary noise generation;
- Traffic signs will be maintained on all roads depicting speed limits;
- Access to facilities, including the access road should be restricted to operational vehicles only;
- For operational areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible; and
- Commitment will be made to raise awareness of the operator work force regarding flora and fauna values and plan for restriction of hunting and poaching.

14.8.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

14.8.6 Comparison with applicable regulations, standards and guidelines

The applicable standard is the IFC Performance Standard 6. Paragraph 15 of the PS requires clients to apply the mitigation hierarchy to projects (avoid, mitigate and offset impacts to biodiversity values). The Project area is located within Modified Habitat and hence satisfies the requirement to avoid Natural Habitat and Critical Habitat as required by the Mitigation Hierarchy.

14.8.7 Monitoring plan

Regular inspections of the application of require mitigation and management measures. No specific monitoring of species or habitats is required.

14.9 DEGRADATION OF HABITAT

A range of Project activities have the potential to lead to degradation of native flora and fauna habitats during operation. In general, the impacts will cause: dust; runoff; release of potential contaminants; and invasive species. These impacts will occur throughout all Project components; however, the majority of impacts will occur within the vicinity of construction site.

Dust

During construction and operation, activities have the potential to generate dust which may settle on vegetation adjacent to the operation areas. Excessive dust deposition on flora may act to suppress growth through limiting photosynthesis and the dusted foliage may also become unpalatable to foraging fauna. The construction and operation activities will be temporary and dust generation is likely to be localized to active work areas. Rainfall will generally remove dust from foliage.

Runoff

Runoff and maintenance of access roads will expose earth areas to be vulnerable to erosion (wind and/or runoff). Runoff erosivity is likely to be higher during the wet season. The maintenance of the access road is located adjacent to a natural watercourse. Erosive processes transport sediment downstream depositing mobilized sediment downstream/downslope of habitats (both aquatic and terrestrial). This indirect impact has potential to degrade downstream habitat areas or change habitat characteristics, and as such influencing suitability for native flora and fauna communities.

Release of Contaminants

Accidental release or spill of these materials can be toxic to flora and fauna locally and downstream if substances are released into the aquatic environmentave the potential to carry contaminants substantial distance downstream. Construction and operation activities such as refueling, storage and other activities that require oil and hazardous substances to be used, are undertaken at risk of accidental release. This will be most distinct adjacent to vehicle storage and maintenance areas.

Invasive Species

Invasive species (flora and fauna) have the potential to be introduced or spread throughout the Project area through increased movement of people, vehicles, machinery, vegetation and soil. The impacts from the introduction and proliferation of invasive species will be the same as described during construction and operation. Impacts within Natural Habitat areas adjacent to the Project area will be susceptible.

14.9.1 Summary of Baseline Conditions

The AoI contains Natural Habitat, Modified Habitat and Critical Habitat. The intertidal area downstream of the Project Area is considered to be Critical Habitat due to the presence of the species *Sonneratia griffithii*. The Project Area is Modified Habitat. Waterways flow from the Project Area towards the intertidal area.

Invasive species have been identified within the Project Area. These species are shown in Table 14.9 below.

Table 14. 9 Invasive species within the Project Area and Area of Influence

Scientific Name	Common Name	Origin
Mimosa invisa; M. pigra; M. pudica L.	Sensitive plant, Tigayon	South America
Oroxylum indicum	Cat's tongue, kyaungsha	India
Tridax procumbens L.	Coat button, ta-bin-shwe-htee, Hmwe zok-negya	
Ziziphus jujube L.	Jujube, Chinese	China, Native

14.9.2 Proposed Project activity

Construction and operation activities causing degradation of habitats from dust, runoff, release of contaminants and invasive species.

14.9.3 Receptor Identification and Sensitivity

The Project Area is considered to be Modified Habitat. The intertidal habitat containing mangrove species is considered to be Critical Habitat due to the presence of the species *Sonneratia griffithii*. The sensitivity of the receptor is therefore considered to be High.

Table 14. 10 Rating of Impacts Degradation of Habitats

Impact	Potential impacts on degradation of habitats.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to fauna and flora would be considered to be adverse (negative).				
Impact Type	**Direct**	**Indirect**	Induced		
	Potential impacts would likely be indirect and direct impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Only occurs during the construction and operation period.				
Impact Extent	**Local**	Regional	International		
	Impact extent will be within the Project Area and adjacent habitats within the AoI.				
Impact Scale	Habitat degradation will be small in scale and limited to areas within the Project Area and adjacent habitats within the AoI.				
Frequency	Occurs only once.				
Impact Magnitude	Positive	**Negligible**	**Small**	Medium	Large
	The impact magnitude is likely to be negligible to small.				
Receptor Sensitivity	Low	Medium	**High**		
	The presence of Critical Habitat downstream of the Project Area indicates a High sensitivity.				
Impact Significance	**Negligible**	**Minor**	Moderate	Major	
	The significance is likely to be negligible to minor.				

14.9.4 Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Construction and operation and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction and worker camp areas;
- For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilize disturbed soil surfaces;
- Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licensed waste management contractors;
- Invasive species management measures should be implemented in accordance to avoid introduction of weeds to natural and modified habitat areas;
- Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to limit noise and dust generation; and
- Construction and operation materials and chemicals will be appropriately secured to avoid accidental release to the natural environment (wind and water erosion).

14.9.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

14.9.6 Comparison with applicable regulations, standards and guidelines

The applicable standard is the IFC Performance Standard 6. Paragraph 12 requires the application of appropriate mitigation measures to reduce impacts on biodiversity values. Paragraphs 21 to 23 require the management of invasive alien species within Natural Habitats.

14.9.7 Monitoring plan

Regular inspections of the application of require mitigation and management measures. No specific monitoring of species or habitats is required.

14.10 Mortality Of Resident Species

Mortality of resident species can occur through vehicle and machinery strike as well as hunting and poaching.

Vehicle/Machinery Strike

Fauna mortality can occur during operation activities (e.g. excavation, vehicle movement) in the event individuals are struck by vehicles and machinery.

It is likely that most individuals will disperse from operation activity locations into adjacent habitats as a result of noise and other disturbance however some fewer mobile species may experience a localized reduction in abundance during this period, such as amphibians, reptiles and small mammals.

Hunting and Poaching

With greater human activity in the Project Area and increased access points to the Natural Habitats there is a risk of increased hunting and poaching activities leading to fauna mortality from workers and also local people who may have access to habitats that were previously restricted. Through increased ease of access, hunting and poaching may increase.

14.10.1 Summary of Baseline Conditions

Species detected within the AoI and Project Area that may be disturbed during construction and operation are shown in Table 14.11. These species are considered threatened species as they have a higher extinction risk than other species detected.

Table 14. 11 Species that may be disturbed during construction and operation

Scientific Name	Common Name	IUCN
Fauna		
Psittacula alexandri	Red-Breasted Parakeet	NT
Macaca leonine	Northern Pig tailed Macaque	VU
Prionailurus viverrinus	Fishing Cat	VU
Flora		
Sonneratia griffithii	Lame (mangrove)	CR

14.10.2 Proposed Project activity

Impacts on resident species during construction and operation, including vehicle machinery strike and hunting and poaching by workers and local people.

14.10.3 Receptor Identification and Sensitivity

Threatened species have been identified within the Project Area and AoI.

Table 14. 12 Rating of Mortality of Resident Species

Impact	Potential impacts on mortality of resident species				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to fauna and flora would be considered to be adverse (negative).				
Impact Type	Direct	**Indirect**	Induced		
	Potential impacts would likely be indirect impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Only occurs during the construction and operation period.				
Impact Extent	**Local**	Regional	International		
	Impact extent will be to resident species within the Project Area and adjacent habitats within the AoI.				
Impact Scale	Fauna mortality will be small in scale and limited to areas within the Project Area and adjacent habitats within the AoI.				
Frequency	Occurs only once.				
Impact Magnitude	Positive	**Negligible**	**Small**	Medium	Large
	The impact magnitude is likely to be negligible to small.				
Receptor Sensitivity	Low	Medium	**High**		
	The presence of Critical Habitat downstream of the Project Area indicates a High sensitivity.				
Impact Significance	**Negligible**	**Minor**	Moderate	Major	
	The significance is likely to be negligible to minor.				

14.10.4 Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to minimize potential for fauna strike;
- Commitment will be made to raise awareness of values of important species and habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection by staff;
- Access restriction should be applied to Project facilities for non- construction and operation vehicles;
- Hunting wild animals will be strictly prohibited for all staff; and
- Fishing and using of illegal fishing gear anywhere along the stream will be prohibited.

14.10.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

14.10.6 Comparison with applicable regulations, standards and guidelines

The applicable standard is the IFC Performance Standard 6. Paragraph 15 of the PS requires clients to apply the mitigation hierarchy to projects (avoid, mitigate and offset impacts to biodiversity values). The Project area is located within Modified Habitat and hence satisfies the requirement to avoid Natural Habitat and Critical Habitat as required by the Mitigation Hierarchy.

14.10.7 Monitoring plan

Regular inspections of the application of require mitigation and management measures. No specific monitoring of species or habitats is required.

14.11 Impacts To Species Of Conservation Significance

Species of conservation significance identified within the Project Area have been assessed based on the likely impact during construction and operation.

14.11.1 Summary of Baseline Conditions

Species detected within the AoI and Project Area that may be disturbed during construction and operation are shown in ***Table 14.11***. These species are considered threatened species as they have a higher extinction risk than other species detected.

Table 14. 13 Species that may be disturbed during construction and operation

Scientific Name	Common Name	IUCN
Fauna		
Psittacula alexandri	Red-Breasted Parakeet	NT
Macaca leonine	Northern Pig tailed Macaque	VU
Prionailurus viverrinus	Fishing Cat	VU
Flora		
Sonneratia griffithii	Lame (mangrove)	CR

Critical Habitat was triggered for the mangrove habitat within the intertidal zone due to the presence of the species *Sonneratia griffithii*.

The record of Fishing Cat (*Prionailurus viverrinus*) was identified through community interviews. Whilst this may mean that the record is unreliable, presence of the species is of interest as its distribution in Myanmar is not well understood. This record is outside of the currently known range of the species.

14.11.2 Proposed Project activity

Impacts on resident species during construction and operation, including vehicle machinery strike and hunting and poaching by workers and local people.

14.11.3 Receptor Identification and Sensitivity

Threatened species have been identified within the Project Area and AoI, including one (1) Critical Habitat candidate species.

Table 14. 14 Rating of Impacts on Species of Conservation Significance

Impact	Potential impacts on species of conservation significance.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to fauna and flora would be considered to be adverse				
Impact Type	Direct	**Indirect**	Induced		
	Potential impacts would likely be indirect impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Only occurs during the construction and operation period.				
Impact Extent	**Local**	Regional	International		
	Impact extent will be to resident species within the Project Area and adjacent habitats within the AoI. It is not expected that direct impacts will occur to individuals of *Sonneratia griffithii*.				
Impact Scale	Fauna mortality will be small in scale and limited to areas within the Project Area and adjacent habitats within the AoI.				
Frequency	Occurs only once.				
Impact Magnitude	Positive	**Negligible**	**Small**	Medium	Large
	The impact magnitude is likely to be negligible to small.				
Receptor Sensitivity	Low	Medium	**High**		
	The presence of Critical Habitat downstream of the Project Area indicates a High sensitivity				
Impact Significance	**Negligible**	**Minor**	Moderate	Major	
	The significance is likely to be negligible to minor.				

14.11.4 Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Management measures for the population of Sonneratia griffithii are to be outlined in a Biodiversity Action Plan;
- Individuals of *Sonneratia griffithii* are to be marked in the Project Area and avoided during construction and operation;
- During construction, monthly inspections are to occur of the intertidal zone for any

impacts from construction activities on individuals of *Sonneratia griffithii*. Where impacts are detected, measures must be undertaken to rectify the source of the impacts.

14.11.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation

14.11.6 Comparison with applicable regulations, standards and guidelines

The applicable standard is the IFC Performance Standard 6. Paragraph 16 – 18 of the PS requires clients to apply the mitigation hierarchy to potential impacts on Critical Habitat. The requirements include that the Project will not result in a net-reduction in the population of the Critical Habitat species; and that a biodiversity monitoring and evaluation program be implemented for the species and be contained in a Biodiversity Action Plan.

14.11.7 Monitoring plan

Individuals of *Sonneratia griffithii* within the AoI will be identified and monitored to determine their persistence in the landscape. Monitoring measures will occur on an annual basis to determine the population of the species and to identify any key threats. This plan is to be incorporated into a Biodiversity Action Plan for the species.

All monitoring will be outlined in a Biodiversity Action Plan for the species.

14.12 Assessment Of Residual Impacts To Biodiversity Values

It has been determined that no residual impacts to biodiversity values will result following mitigation. Impacts are restricted to Modified Habitats only. One Critical Habitat species has been identified; however, this species should be avoided during construction and operation. A Biodiversity Action Plan however will be required to be prepared for management of the species (*Sonneratia griffithii*).

14.13 Impacts On Phytoplankton, Zoopankton And Benthic Organisms (Aquatic Ecology)

During the operation phase, water for power plant cooling will be pumped daily at a rate of 340 cubic meter per hour. Density of phytoplankton and zooplankton at pumping station (Aung Dong Bridge) are 175,700 and 150,600 cell /m^3 respectively. This means maximum phytoplankton of 1.44 x 10^9 cells and zooplankton of 1.23x 10^9 cells would be pumped.

The project tries to mitigate this issue by installing a pumping pipe at the height of approximately 1m above the bed of Heinze River. This would reduce in quantity of plankton on pumped water because the most density of plankton was found at surface water. In addition, plankton has a short life cycle and can reproduce very quickly, then the impact on plankton is considered as low.

Impact on bethos is expected to be low because there is no direct disturbance on the bed of Heinze River which is habitat and food source for bethos. Only one texa of roundworm in family of Tubificidae was found with density of 44 individuals/m^2. In addition, the pumping pipe will lie on river floor, which will not cause any disturbance to benthos.

Impact on aquatic animals is also expected to be low since the project wil install two screens with mesh sizes of 10 cm. (bar screen) and 10 mm. (traveling screen) at the entrance of cooling water intake point in order to prevent large aquatic organizms and small aquatic organisms such as fish larvae from entrainment impact.

Mitigation Measures

Install the pumping pipe above the bed of Heinze Chaung River, stream within the power plant site during rainy season.

Install screen with mesh size of 10 cm. and 10 mm. at pumping pipe to prevent young aquatic animals from entrainment.

Regularly check and clean the screen of pumping pipe at least 4 times / year.

14.14 CONTAMINATION BY RUNOFF WATER AND DOMESTIC SEWAGE

During construction phase, the runoff water from construction activities and domestic sewage from sanitary facilities of construction of power plant will be led into septic tanks and then be drained off to the domestic sewage treatment station for treatment. The discharged wastewater quality after treatment will be within national emission guideline (NEQ) for discharging wastewater standard. In addition, the treated water would not be discharged outside the construction area. Therefore, impact of discharged wastewater on water quality of the power plant site and aquatic ecology can be considered as nil.

Aquatic organism's entrainment due to raw water pumping at nearby stream is an unavoidable consequence of the Project. However, the Project will mitigate this issue by installing a pumping pipe at the height of approximately 1 m. above the bed of Heinze River. This would reduce in quantity of plankton on pumped water because the most density of plankton was found at surface water and the project would install one fixed bar dereens with 10 cm. spacing, and one traveling screen with 10 mm mesh size ad bar entrance of cooling water intake point in order to prevent entrainment of small and large aquatic organisms such as fish larvae and fish.

The overall impact from the Project on aquatic ecology is local in extent, long term in nature and moderate in magnitude. Once mitigation measures are implemented the significance of the impacts will be low to moderate depending on the effectiveness of the implementation.

Mitigation Measures

Treat process wastewater from the power plant and auxiliary facilities by the Treatment process and control quality of the treated wastewater to meet that stated in National Emission Guideline (NEQ) Myanmar for discharging wastewater meet that before reuse.

Treat domestic sewage from sanitary facilities of the power plant in the domestic sewage treatment station. The treated wastewater will not be discharged into the stream at the power plant site.

Collect contaminated rain from disposal areas by the drainage ditch laid surround the power plant and retention pond.

Collect all treated wastewater into the effluent pond and reuse it as much as possible for housekeeping work of power plant i.e. tree watering or road washing.

CHAPTER 15 SOCIAL AND HEALTH ENVIRONMENT

15.1 Introduction

The predicted impacts to the social environment as a result of the proposed Project are described in this Chapter.

Settlements located closest to the Project infrastructure are likely to experience negative and positive impacts as a result of the Project activities including economic opportunities (employment and trading), changes to community health and safety (noise, air quality).

The presence of economical, industrial, touristic and religious activities in close proximity to the Project infrastructure has been considered as part of the assessment of impacts as well as the potential contamination of the environment by water used by the Project.

This Chapter also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall Environmental and Social Management Plan (ESMP, ***Chapter 19)*** for the Project.

15.2 Assumptions And Limitations

The assessment of potential impacts related to the social environment in this section is based on the physical and biological environmental baseline data (presented within ***Chapter 5***), socio-economic baseline data (presented within ***Chapter 6*)** and the information available from the Project Proponent at the time of writing the report. Judgements and assessments have been made based on professional knowledge and previous experience of ERM.

Limited secondary data focused on the Project area was available and the baseline draws from a range of secondary data at the national, regional and township level and primary data collected during social baseline activities. Secondary data information has been gathered from various sources including ministries, regional authorities, the Myanmar Information Management Unit or previous studies conducted for the Project.

The primary data used in this section of the report was collected during the baseline survey through Focus Group Discussions (FGDs), Key Informant Interviews (KIIs) and detailed household survey in a sample of household in the Project area. Ad-hoc and informal discussion were also conducted with community members, fishermen, hotel owners as well as other project developer in the area.

This approach reduces the risk of a distorted baseline and sufficient, credible social data was gathered on which to base the social impact assessment which follows.

15.3 Assessment Methodology

The Social Area of Influence (SAoI) can be defined as the area inhabited or used by stakeholders and likely to be positively or negatively affected by the Project. This includes short, long term or permanent changes, as well as direct, induced or in- direct impacts. The SAoI includes:

- The Project site(s) and related facilities that MUPA develops or controls and the additional areas in which aspects of the environment could conceivably experience significant impacts.
- Associated facilities that are not developed and funded as part of the proposed Project,

but are essential for the Project and without which the Project cannot proceed, and the associated areas in which the environment could conceivably experience significant impacts.

- Areas potentially affected by cumulative impacts resulting from other developments known at the time of the ESIA, further planned phases of the Project or any other existing circumstances.
- Areas potentially affected by impacts from predictable (but unplanned) developments as a result of the proposed Project (i.e., induced activities), occurring at a later stage or at a different location.

Box 15.1 provides a definition of the concept of area of interest from good practice guidance and the SAoI of the Project is shown in Figure 15.1.

Box 15. 1 IFC Definition of Area of Influence

The project's area of influence includes the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

Source: IFC PS1

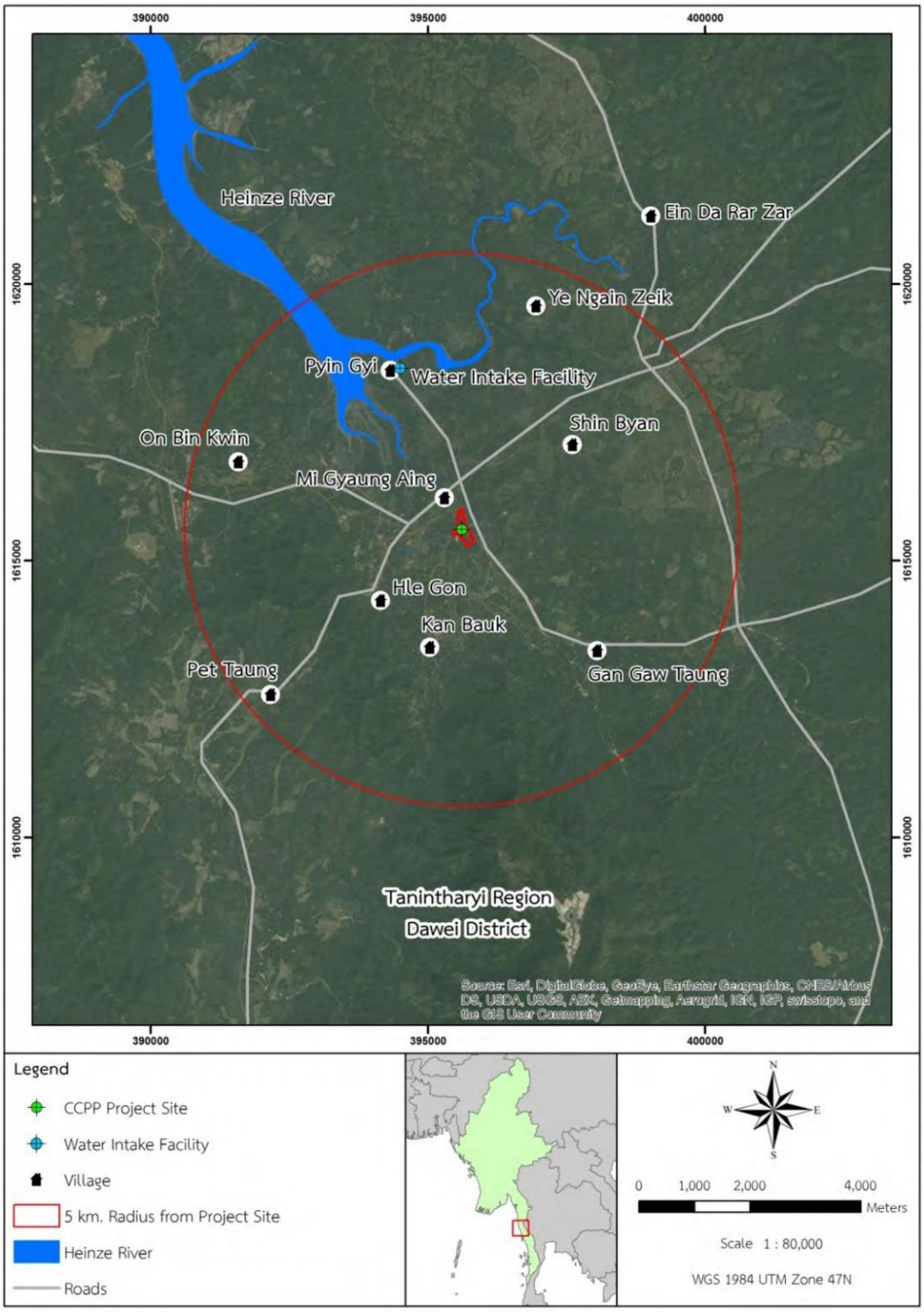


Figure 15. 1 Project Social Area of Influence

15.4 Assessment Of Impacts

15.4.1 Employment and Economy

Summary of Baseline Conditions

The agricultural sector is the primary employer in the Project area with fishing coming second and petty trading third. People are either self-employed or labourer for other owner of land or boat. Villagers in the Project SAoI generally have a primary school education background, but while some continue on to middle school and/ or high school located in Kanbauk, a very small number of villagers have obtained a university education.

Some villagers have been exposed to some extent to work for other industrial projects such as the Delco mine and the 3 existing pipelines construction but this only concern a limited number of stakeholders and often on un-skilled jobs.

Proposed Project activity

The Project will generate a range of employment opportunities. During construction, it is expected that approximately 600 workers will be required. The number of people employed by the Project will decrease at the end of the construction phase. It is anticipated that approximately 80 direct employment opportunities will be created during the operation phase. An additional, 90 workers will be required every three years for a 30 day period to undertake maintenance. Employment opportunities will exist for skilled, semi-skilled and unskilled positions.

In addition, the Project will require goods and services throughout its lifecycle. There are opportunities for local businesses to provide these goods and services (e.g. construction equipment, food for the accommodation camp). As a result, existing local businesses may expand or new businesses may be established locally to meet these demands – providing employment opportunities. This is referred to as indirect employment.

Receptor Identification and Sensitivity

The Project will generate skilled and unskilled positions, with the number of unskilled positions reducing after the construction period. Most of the local population being employed in the agricultural sector, the number of accessible opportunities, particularly during the operation phase, might be limited due to the skills required at every position.

In terms of indirect employment, the realization of opportunities will depend not only on the Project, but also on the initiative and business acumen of local entrepreneurs. Services for the employee (restaurant, shop) could also benefit from the Project.

The resulting impacts (e.g. increase in employment opportunities, increase in income for local people employed by the Project) were assessed as a **positive** one (Table 15.1).

Table 15. 1 Rating of Impacts on Employment and Economic

<table>
<tr><th>Impact</th><td colspan="3">Potential impacts on Employment and Economic</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td>Positive</td><td>Neutral</td></tr>
<tr><td colspan="3">Potential impacts to employment will be positive</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td>Indirect</td><td>Induced</td></tr>
<tr><td colspan="3">Potential impacts would likely be direct, indirect and induced impacts.</td></tr>
</table>

Mitigation / Management Measures

In order to maximize the benefits from this impact for the local population, wherever possible, the workforce will be sourced from areas close to the Project after a training and selection process; and thereafter at a regional or national level. Given that levels of educational achievement and formal employment experience in relevant sectors is low within the SAoI, it is assumed that the majority of the available local labour may be unskilled or at most semi-skilled. The Project will develop a Sourcing, Procurement and Recruitment Management Plan which will be developed for this Project with the aim to promote benefits to locals from recruitment and procurement activities for the Project (including information, training, engagement). A key element of this will be to promote equal opportunity and non-discrimination throughout the recruitment and procurement process.

Monitoring plan

Monitoring of the local content should be monitored at the beginning of the construction phase to ensure maximum opportunities are given to local population. Thereafter during operation, monitoring should continue on a yearly basis to ensure the level of local content stay, at the minimum, stable.

15.4.2 Impact on Livelihood

Summary of Baseline Conditions

The land for the plant is leased by EPGE to MUPA. The land for the Water Intake Facility, the temporary Jetty, the Construction area and the Water pipeline on the other hand belong to communities or private owners and are used for economic activities, in particular for plantations of rubber trees and palm trees.

Proposed Project activity

The temporary jetty, the construction site and the pipeline alignment will all temporarily prevent access to economic activities undertaken by local stakeholders. The Water Intake Facility and the pipeline Right of Way will stop permanently or strongly restrict activities that could be conducted at these sites.

Receptor Identification and Sensitivity

Land owner and users of the concerned area are the main receptor of these impacts. Employee or labourer of the land users are also concerned by this impact.

Potential Impacts

Based on the above information, the impact of the Project pre-mitigation on livelihood is considered a **Negligible Negative Impact** as described in Table 15.2.

Table 15. 2 Rating of Impacts on Livelihood

Impact	Potential impacts on livelihood.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to livelihood would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	**Short-term**	Long-term	**Permanent**	
	Temporary land use for jetty, construction area and water pipeline will only last during the construction period. Land take for the pipeline RoW and the Water Intake Facility will be permanent.				
Impact Extent	**Local**	Regional	International		
	The impact is only relevant for the area used for Water Intake Facility, the temporary Jetty, the Construction area and the Water pipeline.				
Impact Scale	The land to be impacted is fairly small in size and for most of it will be used only temporarily.				
Frequency	N/A				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be small.				
Receptor	**Low**	Medium	High		

Sensitivity	Receptors to this impact will only have a temporary restriction of access to their land in most cases or are likely to still have access to other livelihood activities. MUPA will, if necessary, buy the land and compensate owners based on a willing buyer-seller contract.			
Impact Significance	**Negligible**	Minor	Moderate	Major
	The significance is likely to be negligible.			

Mitigation / Management Measures

Although the impact is expected to be Negligible, MUPA must make sure that the owner or users of the land they will use, lease or acquire will not be left without livelihood activity and are properly compensated for any loss of livelihood. People losing permanently or temporarily their land should be given preference in the recruitment process.

15.4.3 Impact on Community Health

Summary of Baseline Conditions

There are a number of communicable diseases prevalent in the Project area, which are contributing to the current rates of morbidity and mortality. This includes tuberculosis (TB) which has been identified as a key contributor in the local villages to rates of morbidity, and to a lesser extent mortality.

Vector Borne Diseases

Another factor that will influence the prevalence and rates of communicable diseases is the creation of vector habitat during construction and potentially operation. Standing water (i.e. vector habitat) can be created in a variety of ways, such as alterations to drainage patterns during earth moving activities and establishment of trenches (which can fill with water during rainy periods).

Vector habitat is of particular note in a location such as Myanmar – where heavy rainfall occurs during the wet season creating large areas of standing water. This could be exacerbated by the Project – e.g. if trenches are filled with water during the wet season.

There are a number of vectors borne diseases likely to exist in the Project area given their prevalence within the country. Of particular note is malaria, identified within the local area by villagers. Malaria is prevalent in much of the country – this includes the multi-drug resistant form of malaria. Other vector borne diseases common in Myanmar include dengue fever and Chikungunya virus, which are spread by two species of day-time feeding mosquitoes - Aedes aegypti and Aedes albopictus. Unlike the mainly rural-dwelling mosquitoes that spread malaria, the Aedes mosquitoes thrive in cities as well as rural areas.

Sexually Transmitted Infections

An increase in the commercial sex trade is often associated with large scale developments, particularly when a large (often mainly male) workforce is required for a short period of time. If appropriate precautions are not taken, this too can increase the rates of communicable diseases in the Project area.

This includes sexually transmitted infections such as HIV/ AIDS. Myanmar has one of the highest rates of HIV/ AIDS infection in Southeast Asia, which increases the risk of HIV/ AIDS being transmitted.

Other Related Issues

The transmission of diseases can be exacerbated by a number of factors. Health care facilities are limited in the Project area. Most of the villages in the Project area do not have their own health care facility. Most of local people in Kanbauk village tract usually go to Kanbauk rural Healthcare centre and private clinic. Yebyu General Hospital is used for difficult health issues.

The facilities that do exist are largely set up to address day to day health issues. Capacity (e.g. availability of diagnostic equipment, availability of medicine) to respond to an increase in the transmission of communicable diseases is limited.

Proposed Project activity

The presence of MUPA workforce may result in interactions between the workforce and local people. As it is unlikely that the entire workforce will come from the Project SAoI, workers from outside of the local area will be present. These workers may have higher prevalence rates of communicable diseases and STDs.

In the event of an outbreak of an airborne (e.g., TB) or food-borne illness among the workers, the home villages of the local workers, and any settlement visited by Project workforce may also become susceptible to these infectious diseases.

Potential influx of population attracted by the Project will add pressure on already weak sanitation system, health facilities and increase population density. This could contribute to higher incidence of infectious disease as well as increase pressure on poor local health services.

The Project is also likely to result in in-migration. Similar to the workforce, there is potential for in-migration to introduce and/ or increase the rate of spread of communicable diseases in the Project area.

Receptor Identification and Sensitivity

The entire population within the Project SAoI is a potential receptor of this impact. In particular this includes the population interacting directly with the Project staff such as restaurant and shop owners, households of project staff, and medical staff. People with disability, young children and old people are particularly at risk if exposed.

Potential Impacts

An increase in the transmission of communicable diseases may occur as the result of the introduction of workers into the area, creation of vector habitat, and/ or the presence of commercial sex workers.

In terms of communicable diseases, of particular note and concern are tuberculosis, malaria, and HIV/ AIDS, given their current prevalence within the country and local area. The receptors located closest to the Project site are likely to be most affected by an increase in vector habitat.

If left untreated communicable diseases can lead to long-term health issues and/ or in some instance’s death. In other words, the impact can be characterized as being long-term and, in some instances, permanent.

The existing local health care facilities have limited capacity to respond to an increase in the transmission of communicable diseases, leaving the local villagers vulnerable to an increase in the presence of communicable diseases. This is exacerbated by the fact that few villagers recognize the symptoms – which is what drives someone to seek treatment.

To minimize the impact, a number of steps can be taken – most of the measures largely centre around (1) reducing the interaction between the workforce and local villagers and (2) minimizing the creation of vector habitat. In terms of vector habitat, it may be difficult to minimize habitat during the wet season.

Given the existing management measures, the local extent and scale of the impact, the impact was assessed as **moderate** and **negative**. The impact would have been assessed as minor, however, the duration (and consequence) of the impact was identified as potentially long-term – i.e. long-term health issues and in some cases death (Table 15.3).

The workforce will be larger during construction, when compared to the operation phase. This increases the potential for the impact to occur (i.e. as there are more potential disease carriers) during the construction phase. This would typically increase the impact rating for the construction phase, for this reason the construction and operation phases were both assessed as moderate and negative.

Table 15. 3 Assessment of Impacts on Community Health

<table>
<tr><th>Impact</th><td colspan="5">Impact on Community Health</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td colspan="2">Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="5">Increase of communicable diseases in the local area is negative.</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td colspan="2">Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="5">The impact is direct.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td colspan="2">Permanent</td></tr>
<tr><td colspan="5">The impact could be long lasting, even permanent, if left untreated.</td></tr>
<tr><th rowspan="2">Impact Extent</th><td>Local</td><td colspan="2">Regional</td><td colspan="2">Global</td></tr>
<tr><td colspan="5">The impact is limited to local villages.</td></tr>
<tr><th>Impact Scale</th><td colspan="5">The impact scale is medium.</td></tr>
<tr><th>Impact Frequency</th><td colspan="5">The impact likely occurs during the construction phase with the rare frequency.</td></tr>
<tr><th rowspan="2">Impact Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">The impact magnitude is likely to be small.</td></tr>
<tr><th rowspan="2">Vulnerabilit yof Receptors</th><td>Low</td><td colspan="2">Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">The vulnerability of receptor is likely to be high.</td></tr>
<tr><th rowspan="2">Significance</th><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">The significance is likely to be moderate.</td></tr>
</table>

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Training for all workers on the transmission routes and common symptoms of communicable diseases. This can help reduce the potential for workers to unknowingly transmit communicable diseases. This may also help to increase knowledge within Project area villages – e.g. through the training of workers that have been sourced from the local villages;
- Establish amenities at the camp to help minimize the interaction between the workforces (particularly temporary construction workers) and local villagers. This includes recreation facilities and health care infrastructure;
- Establish a workforce code of conduct. Include in the code specific measures that target anti-social behaviour, such as becoming involved with commercial sex workers;

- Undertake pre-employment screening to ensure fitness for work. It is important that the pre-screening process does not result in discrimination, but instead is used as a tool to minimize the transmission of communicable diseases;
- Vector management procedures, including measures to reduce the presence of vector habitat and consideration of whether pesticides will be utilized to reduce the presence of vectors onsite;
- Provision of onsite health care and medical facilities, to ensure that basic medical attention and first aid treatment can be sought during the hours that the work is being undertaken at the Project site. This will also help reduce the potential pressure on local health care facilities;
- Pre-placement medical examination of all workers, supported by periodic medical examinations. A regular voluntary Worker Medical Screening Program onsite and a Monitoring and Evaluation (M&E) system. In addition, a workplace policy and training and awareness programme on risks described above and prevention and mitigation of HIV impacts will be implemented with Project staff.
- In collaboration with the local and regional Government, local emergency providers and local health care facilities, MUPA will develop and implement Emergency Prevention, Preparedness and Response Plans (EPPRPs) to cover all incidents presenting risks to public safety and the affected communities in proximity to the Project Sites and the environment.
- Develop and implement a *Workforce Code of Conduct*. The *Workforce Code of Conduct* will be adhered to by all Contractors and MUPA employees. Any employee or Contractor found in violation of the Code shall face disciplinary hearing which may result in dismissal.
- Ensure there is access to free condoms (including female condoms) at the worker camp to promote safe sexual practices.
- In partnership with local health officials and relevant NGOs, MUPA will undertake information, education and communication campaigns around hygiene, sanitation, safe sexual practices and transmission of STIs and HIV/AIDS as well as condom distribution (including female condoms).
- Conduct information, education and communication campaigns amongst Project personnel on hygiene and sanitation.

Where appropriate the community health management plan should be implemented in close coordination with government authorities and local health care providers.

In addition to the community health plan, it is recommended that a complementary occupational health and safety plan be developed – to focus on managing potential issues that may affect the Project workforce. The plan should include measures to minimize the potential for the workforce to contract a communicable disease. This will help reduce the potential for the workforce to contract a communicable disease and subsequently introduce the disease in their home village/ community.

Residual Impact (Post-mitigation)

Once management measures have been implemented, it is predicted that the impact will be reduced to minor and negative during construction and operation. However, on-going monitoring and evaluation of the management measures and community health situation will be needed. If monitoring indicates an increase in the transmission of communicable diseases, the management measures will need to be revised. This includes monitoring the Project's direct activities as well as Project contractors and in-migration.

15.4.4 Impact on Community Safety and Security

Summary of Baseline Conditions

Currently the level of traffic in the Project SAoI is low and limited mainly to motorbike and a few cars and small trucks. Industrial activities are also limited to the Delco mine site south of Kanbauk and the Oil and Gas infrastructure to the North West. Waste management offer is non-existing in the area and population rely on surface and ground water for domestic use.

Proposed Project activity

The Project will increase the number of vehicles using local roads and waterways through the transport of workers, goods, materials and machinery to and from the Project site, in particular during the construction phase.

Heavy cargo (e.g. gas turbine, gas turbine generator, steam turbine) will be transported via the Heinze River. A barge will carry cargo from Dawei Port to the temporary Jetty, from which point it will be transported to the construction site and then to the Project site.

Materials (such as structure steel, piping, and electrical equipment) will be transported from Dawei or Yangon to the Project site using existing roads.

With an increase in vehicles, particularly heavy haulage vehicles, comes the increased potential for accidents and injuries to occur. This can be exacerbated by people living immediately adjacent to roads networks in particular people of Pyin Gyi and Gan Gaw Taung. The limited understanding and awareness of traffic can increase the likelihood of an accident occurring.

There is also potential for contamination to occur as a result of a spill or leak. This could occur during routine activities onsite as well as during the transport of goods/materials to the site. This may be exacerbated by the poor quality of the existing road infrastructure – e.g. hitting a substantial pothole could jostle cargo.

Given the reliance on existing water sources, it is unlikely that the local villages would have the ability to adapt to any sort of contamination – i.e. be able to find an alternative drinking water source.

In addition, the Project will require security. Security personnel will be employed during construction and operation. It is anticipated that a total of 12 people will be required during the operation phase; the number required during construction has not yet been determined. If conflict arises, there is potential for security personal, as has been seen in other development Projects, to use excessive force.

Receptor Identification and Sensitivity

The entire population within the Project SAoI is a potential receptor of this impact but, people of Pyin Gyi and Gan Gaw Taung for the traffic during construction and people of My Gyaung Aing and Hle Gone for contamination, are particularly at risk.

Potential Impacts

Impacts to community safety and security can result from an increase in traffic, the establishment of onsite infrastructure and the management of hazardous materials. To a lesser extent, given the small number of security personnel required, the presence of security forces could also present a risk to the community.

There are measures in place to ensure that hazardous materials are managed and disposed of appropriately by the Project. This will help minimize the potential for local water sources to be contaminated.

In addition, the Project site will be fenced, this will help ensure that accidents associated with new infrastructure will be minimized.

Given this, the issue to which the local villagers are most vulnerable is the increase in traffic – as villagers live immediately adjacent to the existing roads and are unaccustomed to heavy vehicles traversing the area. This can lead to accidents, injuries and, in some instances, fatalities. The potential outcome of the impact is an injury and in some instances a fatality.

Due to the existing management measures, the local extent and scale of the impact, the impact was assessed as **moderate** and **negative** during construction, while **minor** and **negative** during operation (Table 15.4 and Table 15.5). The impact would have been assessed as minor, however, the duration (and consequence) of the impact was identified as potentially long-term – i.e. the outcome of a traffic accident can have long-term implications.

The vehicle movements/ transport requirements will be greater during construction, when compared to the operation phase. This increases the potential for the impact to occur (i.e. as there are more potential disease carriers) during the construction phase and increases the impact rating.

Table 15. 4 Assessment of Impacts on Community Safety and Security – Construction

<table>
<tr><th>Impact</th><td colspan="4">Impact on Community Safety and Security</td></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td>Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="4">The potential increase in safety and security risks in the local area is negative.</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td>Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="4">The impact is direct to the community health.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="4">Impact has the potential to have a lasting effect.</td></tr>
<tr><th rowspan="2">Impact Extent</th><td>Local</td><td>Regional</td><td colspan="2">Global</td></tr>
<tr><td colspan="4">The impact is limited within the local villages.</td></tr>
<tr><th>Impact Scale</th><td colspan="4">The impact scale is medium.</td></tr>
<tr><th>Impact Frequency</th><td colspan="4">The impact likely occurs during the construction phase with the rare frequency.</td></tr>
<tr><th rowspan="2">Impact Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium / Large</td></tr>
<tr><td colspan="4">The impact magnitude is likely to be medium.</td></tr>
<tr><th rowspan="2">Vulnerability of Receptors</th><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="4">The vulnerability of receptor is likely to be medium.</td></tr>
</table>

Significance	Negligible	Minor	**Moderate**	Major
	The significance is likely to be **moderate.**			

Table 15. 5 Assessment of Impacts on Community Safety and Security – Operation

Impact	Impact on Community Safety and Security				
Impact Nature	**Negative**	Positive	Neutral		
	The potential increase in safety and security risks in the local area is **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the community health.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact has the potential to have a lasting effect.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact Scale	The impact scale is medium.				
Impact Frequency	The impact likely occurs during the operation phase with the rare frequency.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be **Small.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor.**				

Mitigation / Management Measures

The following mitigation measures should be implemented so as to reduce the significance of the impact:

- Develop and implement a traffic management plan. The plan should set out measures to minimize the risks associated with transporting materials, goods, and workers to and from site. This includes:
  - Restrictions on vehicle speeds;
  - fatigue management;
  - Forbidding non-Project passenger transport;
  - Forbidding alcohol and drug use (including *Bettel*);
  - Forbidding reckless driving;
  - Forbidding cellular telephone use whilst driving;
  - Forbidding stopping at any location except MUPA controlled compounds; and
  - General safe driving practices.
- Ensure all employees complete training prior to driving any Project vehicles. The content of the training should be tailored to the employee's role;
- Explore opportunities to work with local stakeholders to increase awareness within local villages about the hazards associated with traffic;
- Provide appropriate training for security personnel and monitor implementation of the

training over time (to minimize any potential use of excessive force);

- Develop and implement waste management plan. The plan should set out procedures for appropriately managing and disposing of hazardous materials and other forms of waste.
- Develop and implement a Road Safety Awareness Campaign. MUPA will implement a road safety awareness campaign in the Project SAoI to improve community knowledge of the dangers of industrial road traffic and safe behaviour in and around roads. This programme will be implemented with a suitable and experienced local partner or NGO and in partnership with the local government. Such a program may be targeted at schools to help disseminate road safety information to children who may be particularly vulnerable to vehicle traffic.
- MUPA will establish a livestock compensation framework that defines the process and rates for compensation for livestock that are injured or killed in Road traffic accidents. The Project Stakeholder Engagement Programme will include engagement activities with potentially affected communities to discuss and agree this framework.
- MUPA will implement a stakeholder engagement, consultation and information disclosure process prior to use of the proposed road connection during construction. This will allow stakeholders to understand the upcoming increases in vehicle traffic, the plans for vehicle movements and driving policies, and to provide feedback on construction / transportation plans.
- MUPA will establish an Emergency Response Plan (ERP) for the Project SAoI that details the agreed protocols, process, engagement and investigation processes for various relevant potential emergencies (Road Traffic Accidents - RTAs, spillage etc.). The ERP will include management and monitoring requirements as well Key Performance Indicators (KPIs) related to emergencies and emergency response.
- Develop and communicate to local community the Grievance mechanism to report grievance from local population and employee regarding the Project activities.

Residual Impact (Post-mitigation)

Assuming that the above management measures will be implemented and monitored over time, the residual impact was assessed as minor and negative. Ongoing monitoring should occur to track implementation and evaluate the management measures. This includes monitoring Sembcorp's direct activities as well as Project contractors.

Monitoring plan

Monitoring and review of accidents & incidents from the access road connecting site and complaints from neighbouring communities around the Project activity areas throughout the construction and operation phase.

15.4.5 Impact from Environmental Emissions

Summary of Baseline Conditions

Currently the air shed in the Project SAoI is non-degraded and limited industrial pressure exists. Vibrations are limited to the light vehicle traffic on the local roads. Noise levels are already significantly high in Kanbauk due to the traffic and in Hle Gone and in My Gyaung Aing due to the existing 6 gas turbines in activity.

Proposed Project activity

The construction and operation of the Project will generate:

- Noise: which can result from a variety of onsite activities (e.g. construction of infrastructure, reversing sensors on large vehicles). Noise can lead to hearing loss and disrupt community activities (such as sleep). Ongoing disruptions have been linked to increases in depression and anxiety;
- Vibrations: which can result from construction activities (e.g. piling, drilling, operation of compressors and generators). Vibrations if strong enough can damage the foundation of nearby infrastructure (e.g. businesses, community centres, monastery); and
- Dust: which can be generated through vegetation clearing, site grading, driving on dry, dirt roads. This can impact the surrounding air quality, disrupting the amenity value of an area and potentially impacting community health (e.g. further aggravating existing respiratory illnesses).

Receptor Identification and Sensitivity

Villagers of Gan Gaw Taung, Hle Gone and My Gyaung Aing for vibration and noise and Hle Gone, Pyin Byi and My Gyaung Aing for Noise and dust are particularly at risk. Buildings nearest to the roads and project site in particular could be impacted by vibration while households closest to dirt roads and project site could see their health degraded due to the dust.

Potential Impacts

In terms of noise, the closest receptors are Village House in Kanbauk Village. It is anticipated that during construction and operation the predicted noise levels do not comply with the assessment noise criteria. The use of noise barriers / silencers will be an effective means to mitigate the noise impact arising from the construction works and operation plant items. For this reason, the impact is expected to be **negligible**. Further details are provided in Chapter 9 (Noise IA***)***.

In terms of dust, dust can reduce the amenity of the area and exacerbate existing respiratory illnesses (e.g. asthma). It is not anticipated that the receptors will experience impacts associated with the generation of dust. This is largely due to the management measures that will be put in place. The Project will establish site hoardings, sufficient set-backs, and implement other dust suppression techniques to minimize fugitive dust. (Further details are provided in Chapter 8 (Air Quality IA) In addition, respiratory illnesses were not identified as an issue within the local villages. Given the short-term nature of the impacts, the impacts associated with dust are expected to be **minor** (Table 15.6).

Table 15. 6 Assessment of Impacts from Environmental Emissions

Impact	Impact from Environmental Emissions				
Impact Nature	**Negative**	Positive	Neutral		
	Increase of environmental emissions has the potential to result in **negative** impacts in the local area.				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the community health.				
Impact Duration	**Temporary**	Short-term	Long-term	Permanent	
	Impact is likely to be temporary (i.e. while the emissions are occurring).				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact Scale	The impact scale is medium.				
Impact Frequency	The impact likely occurs during the construction phase with the rare frequency.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be **small.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor.**				

Mitigation / Management Measures

Mitigation measures have already been proposed in ***Chapter 8*** and ***Chapter 9*** but MUPA will also need to develop and implement a Stakeholder Engagement Plan as part of the Project. The plan should include measures to notify local stakeholders in advance of any particularly noisy activities (e.g. pile driving). This will ensure stakeholders anticipate (and can appropriately respond to) the disruption associated with noise. The Project should also develop a Grievance Mechanism to collect grievances from local villagers impacted by noise, dust and vibration.

Residual Impact (Post-mitigation)

Assuming that the above management measures will be implemented and monitored over time, the residual impact was assessed as **minor** and **negative**. Ongoing monitoring should occur to track implementation and evaluate the management measures. This includes monitoring MUPA's direct activities as well as Project contractors.

Monitoring plan

Monitoring of air quality and noise have been described in the relevant chapters. In addition, MUPA will need to monitor weekly during construction and monthly during operation the grievance log.

15.4.6 Impact on Local Infrastructures

Summary of Baseline Conditions

Unemployment represented approximately 40% of the economically active population of the Tanintharyi region in 2014 and economic migration is fairly common at the regional scale. Northern Yebyu Township is also the area with the most important number of Internally

Displaced People with 23,000 out of 71,650 in the entire region. Existing infrastructures and services in the Project SAoI are limited in number or non-existent (sanitation, waste management) and most of the time at full capacity.

Proposed Project activity

During construction, the workforce will reach 600 workers. Although the company will try to source workforce from local villages, when possible, it is anticipated that a number of workers will come from other areas. These workers will be accommodated at the construction site and benefits from on-site amenities. However, during both the construction and operation phase, the Project may place additional pressure on existing local infrastructure and services. Impact on road during construction will also be important in particular the road from Kanbauk to Pyin Gyi, only used by a very limited number of vehicles at the moment and which will be the main road for heavy cargo during construction.

The introduction of projects such as the one proposed may induce the arrival of unskilled workers (indirectly related to the Project) and opportunistic job-seekers into the Project SAoI. Influx in the SAoI could also place additional pressure on existing infrastructure and services.

During the construction period of MUPA, various services may be affected by the presence of workers and construction activities. These services could include:

- Transportation: Construction workers may require transportation services to commute to and from the construction site. Increased traffic volume and congestion may impact local road networks and public transportation routes.

- Utilities: Construction activities may require temporary disruptions or re-routing of utilities such as water, electricity, and gas to facilitate construction work. This could potentially affect nearby residents and businesses relying on these services.

- Waste Management: Construction activities generate waste materials that need to be properly managed and disposed of. Temporary storage areas or waste collection points may be established, impacting local waste management services.

- Emergency Services: Emergency response services such as fire, police, and medical services may need to adjust their routes or response times to accommodate construction-related traffic congestion or access restrictions.

- Environmental Services: Construction activities may result in environmental impacts such as noise, dust, and air pollution, requiring monitoring and mitigation measures by environmental agencies.

- Communication Services: Construction sites may require temporary communication infrastructure such as telephone lines, internet connectivity, and radio communication, which could affect existing communication services in the area.

- Community Services: Nearby community facilities such as schools, recreational centers, and libraries may experience changes in accessibility or disruption due to construction activities, potentially affecting service delivery.

Receptor Identification and Sensitivity

The impact of influx is widespread and the entire community in the Project SAoI could be affected. Vulnerable community stakeholders and public infrastructures and services could be particularly impacted as well as users of the road between Kanbauk and Pyin Gyi.

Potential Impacts

Based on the above information, the impact of the Project pre-mitigation on community health is considered a **Moderate Negative Impact** as described in Table 15.7.

Table 15. 7 Rating of Impacts Local Infrastructures

<table>
<tr><th>Impact</th><td colspan="5">Potential impacts on local infrastructures</td></tr>
<tr><th rowspan="2">Impact Nature</th><td colspan="2">Negative</td><td colspan="2">Positive</td><td>Neutral</td></tr>
<tr><td colspan="5">Potential impacts to local infrastructures would be considered to be adverse (negative).</td></tr>
<tr><th rowspan="2">Impact Type</th><td colspan="2">Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
<tr><td colspan="5">Potential impacts would likely be direct and indirect impacts.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td colspan="2">Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impact may occur throughout the construction phase mainly, even if the effect could persist a little longer with induced in-migration.</td></tr>
<tr><th rowspan="2">Impact Extent</th><td colspan="2">Local</td><td colspan="2">Regional</td><td>International</td></tr>
<tr><td colspan="5">This impact will be experienced by stakeholders living in villages across the Project SAoI and transport route.</td></tr>
<tr><th>Impact Scale</th><td colspan="5">The number of Households that could be impacted is limited, but entire village could still be impacted.</td></tr>
<tr><th>Frequency</th><td colspan="5">Daily impact will concern the villagers during construction, in particular</td></tr>
<tr><th rowspan="2">Impact Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">The impact magnitude is likely to be medium.</td></tr>
<tr><th rowspan="2">Receptor Sensitivity</th><td colspan="2">Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">Local infrastructures are poorly equipped and manned, are in limited number and cannot absorb the needs of all the construction workers. The road between Pyin Gyi and Kanbauk is a dirt road mainly used by motorcycle.</td></tr>
<tr><th rowspan="2">Impact Significance</th><td>Negligible</td><td colspan="2">Minor</td><td>Moderate</td><td>Major</td></tr>
<tr><td colspan="5">The significance is likely to be moderate.</td></tr>
</table>

Mitigation / Management Measures

The following mitigation measures are suggested in order to mitigate impact on local infrastructures and services:

- Provide appropriate amenities at the workforce accommodation camp – e.g. recreational opportunities. This will help reduce the need for workers to utilize local infrastructure and services;
- MUPA will ensure that company medical services have sufficient capacity and capability to treat a reasonable number of workers at the same time.
- Develop and implement a *Worker Code of Conduct* for all employees, contractors and visitors directly related to the Project. This will be a contractual and enforced requirement for all staff and subcontractors.
- MUPA will communicate on its recruitment approach emphasizing that priority for unskilled position will be given to inhabitant from local villages.

- MUPA will engage with local authorities and public service providers to discuss specific influx impact calming measures and to develop a Project in- migration plan.
- MUPA will conduct a traffic survey on the Pyin Gyi to Kanbauk road and develop the design of the road to ensure other users can still benefit from the road.
- Develop and implement a traffic management plan to minimize the impact experienced by road users as a result of the Project. The traffic management plan should be developed in consultation with local stakeholders. Stakeholders should be notified in advance of the Project commencing of traffic routes that will be utilised and, where known, periods of increased traffic volumes. Where possible, traffic movements will be coordinated so as to limit disruptions to local activities;
- Develop and implement a social investment/ corporate social responsibility plan/ program in consultation with local stakeholders. As part of the plan, MUPA should explore opportunities to enhance community infrastructure and services; and
- Develop and implement a community health management plan and an occupational health and safety plan in consultation with relevant stakeholders (e.g. local health practitioners). These plans will ensure that appropriate and adequate health care services are provided on site and at the accommodation camp to address/ manage worker illnesses and injuries.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a **Negligible Negative Impact** post mitigation.

**Examination of Effects on Infrastructure and Mitigation Methods: **

With an increase in population due to the construction of the combined cycle power plant, infrastructure demands such as water, electricity, and public transportation may rise. This increased demand could impact various components of infrastructure, including health clinics. Here's how the effects can be examined and mitigated:

- **Water Infrastructure**: Increased population may lead to higher demand for water supply. The existing water infrastructure may need to be upgraded or expanded to meet the increased demand. Mitigation methods could include improving water distribution networks, implementing water conservation measures, and exploring alternative water sources such as groundwater or desalination.

- **Electricity Infrastructure**: The construction of the power plant may affect the local electricity grid. Upgrades or reinforcements to the grid may be necessary to accommodate the additional electricity generation capacity. Mitigation methods could involve investing in smart grid technologies, renewable energy integration, and energy efficiency measures to optimize electricity distribution.

- **Public Transportation**: With the population increase, there may be a higher demand for public transportation services. This could result in overcrowding, longer wait times, and decreased service reliability. Mitigation methods might include expanding public transportation infrastructure, increasing the frequency of service, and improving accessibility for commuters, including those traveling to and from health clinics.

- **Health Clinics**: The increased population may put additional strain on local health clinics, leading to longer wait times for appointments and reduced quality of care. Mitigation methods could involve expanding healthcare facilities, increasing staffing levels, and implementing telemedicine services to improve access to healthcare for the growing population.

- **Mitigation Methods**: Common mitigation methods for addressing the effects on infrastructure include comprehensive planning and coordination among relevant stakeholders, conducting impact assessments to identify potential issues, implementing infrastructure upgrades and improvements, investing in resilient and sustainable infrastructure solutions, and engaging with the community to address concerns and ensure effective mitigation measures are implemented.

By identifying the services affected by construction activities and examining the effects on infrastructure components such as health clinics, stakeholders can develop appropriate mitigation methods to minimize adverse impacts and ensure the successful construction and operation of the combined cycle power plant while supporting the needs of the surrounding community.

Monitoring plan

Monitoring of impact on local infrastructures and services will be done through:

- Monthly engagement with local authorities and service providers;
- Weekly review of grievance log; and
- Regular inspection of infrastructures and in particular the road between Pyin Gyi and Kanbauk.

15.4.7 Impact on Occupational Health and Safety

Summary of Baseline Conditions

Health and safety standards are relatively low in Myanmar. National occupational safety and health legislation is very limited with the main laws to consider for the Project being the Prevention and Control of Communicable Diseases Law (Law No.1/95), Law Amending the Factories Act 1951 (Pyidaungsu Hluttaw Law No. 12/2016) and Prevention from Danger of Chemical and Associated Materials Law, 2013 (28/2013). Myanmar has ratified 23 out of 189 ILO conventions. Experience of industrial health and safety standards is limited except for those who have experience working at the mine site and on the pipelines setting.

Proposed Project activity

During construction, the workforce will reach 600 workers. As much as possible the company will try to source workforce from local villages although some expatriate workers are expected on certain jobs. The nature of the activities means that there is the potential for accidents and injuries to occur if occupational health and safety systems are not developed and strictly enforced for all Project personnel. The main sources of risks are the activities at the temporary jetty, industrial developments (power plant and water intake facilities) and the risks related to the truck movement.

Receptor Identification and Sensitivity

International employees are likely to have a better understanding of national and international health and safety standards, and therefore understand the relevance of any training and mitigation measures and appropriate working conditions. Employees sourced from the SAoI may have a higher sensitivity to the impact due to a poorer understanding of OHS standards and working conditions, and lower literacy levels.

Potential Impacts

The potential impacts on the workers (unskilled, semi-skilled and skilled) of the Project are likely to result from the civil construction activities, operations of the plant and its maintenance, waste storage and disposal and any accidental events which may occur during the construction and operations phase of the Project. These impacts are likely to increase in proportion to the increase in activity and can be mitigated with appropriate mitigation measures on an ongoing basis, including measures like training and awareness etc.

Table 15. 8 Assessment of Impacts on Occupational Health and Safety

Impact	Impact on Occupational Health and Safety				
Impact Nature	**Negative**	Positive	Neutral		
	The potential increase in Health and safety of workforce and Labour and working conditions are **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct**.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact has the potential to have a lasting effect.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the Project area.				
Impact Scale	The impact scale is medium.				
Impact Frequency	The impact likely occurs during the construction and operation phase with the rare frequency.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be **Small.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor.**				

Mitigation / Management Measures - Construction

The Project will develop and implement an Occupational Health and Safety Management Plan (OHSMP) in line with good industry practice and corporate policies.

- The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilisation, construction sequence and safety arrangements.
- Measures will be implemented to reduce the likelihood and consequence of the potential hazards. This shall include (but not limited to) the following hazards:
    - falling from height;
    - falling into water;
    - entanglement with machinery;
    - tripping over permanent obstacles or temporary obstructions;
    - slipping on greasy walkways;
    - falling objects;
    - asphyxiation;

  - explosion;
  - contact with dangerous substances;
  - electric shock;
  - variable weather conditions;
  - lifting excessive weights; and
  - traffic operations.
- A Permit to Enter system will be established to ensure that only authorized persons gain entry to the site.
- Competent and adequately resourced sub-contractors will be used where construction activities are to be sub-contracted.
- All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor.
- The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilization, construction sequence and safety arrangements.
- All workers will be properly informed, consulted and trained on health and safety issues.
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips.
- Before starting work all the appropriate safety equipment and the first-aid kits will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the manufacturer.
- All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded.
- All scaffolding will be erected and inspected in conformity with the Factories Act (1951) and the appropriate records maintained by the Contractor.
- Safety hoops or cages will be provided for ladders with a height in excess of two metres.
- When there is a risk of drowning lifebelts shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are present when work is proceeding (near the temporary jetty site).
- All breathing apparatus, safety harnesses, life-lines, reviving apparatus and any other equipment provided for use in, or in connection with, entry into Confined Spaces, and for use in emergencies, will be properly maintained and thoroughly examined at least once a month, and after every occasion on which it has been used.
- Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate a Leq of more than 85 dB(A). When hearing protection is used, arrangements will be made to ensure the wearers can be warned of other hazards.
- The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations.

- The EPC contractor will comply with the IFC Performance Standard 2.
- Develop and monitor an internal standard to guide labour practices and apply this to supply chain to ensure that no child and/or forced labour will be employed by the EPC contractor and its sub-contractors.

In addition, an OHS monitoring programme should be put in place to verify the effectiveness of prevention and control strategies.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact is considered to be a Minor and Negative Impact post mitigation.

Monitoring plan

Monitoring of impact on Occupational Health and Safety will be done through:

- Yearly review of training log to confirm all employee are trained on the company H&S standard;
- Monitoring and review of accidents/ incidents due to construction activities; workers' health by daily monitoring and monthly review of near- misses, incidents, occupational diseases, dangerous occurrences, accidents at project activity areas and construction workers camp, as per construction phase Health and Safety Plan, which will be prepared by the EPC contractor.
- Development of the Occupational health and safety monitoring and surveillance programme.

15.4.8 Impacts on Cultural Heritage

There are no known archaeological or ancient above ground resources in the area; but a number of items of living heritage sites were identified within the cultural heritage study area. In particular, a monastery is located next to the site for the Water Intake Facility, a Pagoda next to the Project Site and 2 Monastery within 400 metres from it but none of them are located directly within the Project foot print. Therefore, no direct impact during the construction and operation phases is anticipated except the one described above (noise, dust, vibration) as well as a limited restriction of access during the Water Pipeline laying operations.

MUPA will have to monitor the condition of these living cultural heritage sites and offer alternative access point to the monastery located next to the Water Intake Facility during the pipeline laying operation.

No significant intangible cultural heritage was identified and no adverse impact is anticipated through interview with villagers and stakeholder's meeting. However, as most of the festivals and ceremonies take place at the pagoda complex and monasteries, traffic impact may be an issue on the track along the proposed water intake pipeline. Transport will increase during construction phase for transferring cargos from the temporary Jetty to the construction site and then to the plant site, which may potentially influence the accessibility to monasteries and Pagoda during festivals or ceremonies period. However, the impact is expected to be temporary and avoidable by better logistic arrangement planning, as only a handful of cargo shipments will be required during the construction phase. No adverse impact on intangible cultural heritage is anticipated during operational phase.

Table 15. 9 Assessment of Impacts on Cultural Heritage

<table>
<tr><th>Impact</th><th colspan="5">Impact on Cultural Heritage</th></tr>
<tr><td rowspan="2">Impact Nature</td><td>Negative</td><td>Positive</td><td colspan="3">Neutral</td></tr>
<tr><td colspan="5">Environmental emission and restriction of access will have a negative impact on cultural heritage in the study area.</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td>Indirect</td><td colspan="3">Induced</td></tr>
<tr><td colspan="5">The impact is direct.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Long-term</td><td colspan="2">Permanent</td></tr>
<tr><td colspan="5">Impacts will be temporary.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td colspan="3">Global</td></tr>
<tr><td colspan="5">The impact is limited within a monastery and a pagoda within the Project area.</td></tr>
<tr><td>Impact Scale</td><td colspan="5">The impact scale is small.</td></tr>
<tr><td>Impact Frequency</td><td colspan="5">The impact likely occurs during the construction phase with the rare frequency.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">The impact magnitude is likely to be Negligible.</td></tr>
<tr><td rowspan="2">Vulnerability of Receptors</td><td>Low</td><td>Medium</td><td colspan="3">High</td></tr>
<tr><td colspan="5">The vulnerability of receptor is likely to be medium.</td></tr>
<tr><td rowspan="2">Significance</td><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">The significance is likely to be negligible.</td></tr>
</table>

Mitigation / Management Measures

All the measures described in section 15.4.5 will be implemented for impact by environmental emissions. In addition:

- The EPC contractor during construction and the Project proponent during operations will monitor the state of religious buildings near the Project sites, in particular the monastery closest to the Water Intake facility. If damage is done to the buildings, compensation (in kind or in cash) should be organized to restore the building to its state before the damage occurs.
- The EPC contractor will develop the construction planning for the water intake pipeline in discussion with the monastery in Pyin Gyi in order to make sure that the pipeline laying activities near the monastery do not take place during special religious activities.
- The EPC contractor will maintain access to the monastery during the pipeline laying activities and limit the time at which the principal access is blocked by the trench digging and pipeline laying activities.

CHAPTER 16 WASTE

16.1 Introduction

During the construction and operation phases, there are a range of activities which have the potential to generate a range of liquid and solid hazardous and non- hazardous waste streams. This Chapter identifies in detail the various types of waste that will be generated, potential impacts associated with their generation and disposal, and identifies appropriate mitigation, management and monitoring measures required to reduce residual impacts to an acceptable level.

Impacts associated to all liquid waste streams (both planned and unplanned) were noted as occurring to a range of receptors such as surface water, groundwater and soils. Due to this, the impact screening undertaken has meant that all impacts associated with the generation, storage and disposal of all liquid hazardous and non- hazardous waste streams are assessed elsewhere. Specifically:

- Wastewater discharges from on-site sanitary facilities during construction are assessed within ***Chapter 10 (Surface Water)***;
- Surface water containing unconsolidated sediment generated during construction is assessed within ***Chapter 10 (Surface Water)***;
- Waste water generated from washing of equipment on-site, as well from the concrete batching plant is assessed within ***Chapter 10 (Surface Water)***;
- Contaminated surface water discharged due to inappropriate waste storage and disposal is assessed within ***Chapter 10 (Surface Water)*** for construction and operations; and
- Wastewater generated during the operations phase is treated within the Wastewater Treatment System (WTS) including Sanitary Wastewater. Storm water Drainage System and Oily Water is treated using water/oil separator prior discharge. All impacts associated with the management and discharge of these liquid waste streams are identified and assessed within ***Chapter 10 (Surface Water)***.

Therefore, this Chapter is exclusively focused upon impacts associated with the generation and management of solid waste.

16.2 Assumptions And Limitations

Potential impacts associated with the generation and management of solid waste during the construction and operation phase have been reviewed in Chapter 4. Based upon this review, potential sources of impacts associated with solid waste that may arise during the construction and operation phases of the Project have been identified and are presented in the following sections. All the identified sources of potential impacts are then evaluated and their impact significance is determined considering the factors of the nature and magnitude of impacts. The temporal and spatial spread of activities will mean that the actual volumes and types of solid waste generated will be dependent on the specific activities being undertaken at the time. Accordingly, to identify clearer identification of impacts and development of management and mitigation measures specific to each activity, the potential impacts are described on an activity basis.

16.3 Assessment Methodology

The methodology used for assessing impacts to waste is aligned with the general impact assessment methodology presented in Chapter 7.

16.4 Summary Of Baseline Conditions

Chapter 5 provides the details of the baseline conditions for waste in the Project Area of Influence.

The overall generation of waste within the area of influence is a mixture of domestic, agricultural and industrial waste. In terms of waste in the Project area, wastewater is largely directed back into the ground or into the nearest stream. Solid waste disposal is the responsibility of each household. Specific disposal areas exist in Kanbauk, Hle Gone and Mi Chaung Aing but there is no collective system or collect organized. Burning within the compound, landfilling or disposal into the nearest stream are common practice.

16.5 Assessment Of Impacts

16.5.1 Construction Phase

Proposed Project Activities with Potential Impact

Construction of the power plant will be carried out by the EPC contractor appointed by MUPA. Construction is expected to start mid-2019 and be complete in the region of 30 months with SCOD end of 2021. The maximum number of workers onsite during construction is anticipated to be 600 persons.

The following impacts are anticipated during the construction phase:

- Impacts due to improper storage and disposal;
- Impacts associated with the removal of potentially contaminated soils from the site; and
- Impact associated with the generation, storage and disposal of solid hazardous and non-hazardous waste.

Impacts due to Improper Biomass Storage and Disposal

Whilst the site can be described as generally sparsely vegetated, there are small trees, shrubs and groundcover scattered throughout the site which will need to be removed prior to soil disturbing works commencing. Impacts direct to terrestrial biodiversity are addressed within Chapter 14, however the removed vegetation represents a solid waste stream which needs to be disposed of. Presently, it is estimated that up to 800 m^3 of biomass such as trees, shrubs and grass will be removed. In cases where there are limited municipal waste options, often the removed vegetation is gathered into piles and burnt. The generation of smoke can lead to human health impacts.

Receptor Identification and Sensitivity

The resources (physical, biological, human or cultural environment) and receptors that may be impacts in relation to solid waste generation and management are detailed within Table 16.1 below.

Table 16. 1 Resources and Receptors for Waste Management

Resources	Receptors
• Physical environment including land, air quality and water resources (addressed elsewhere). • Biological environment, primarily being the terrestrial environment. • Human environment including subsistence resources, community health, welfare, amenity and safety, employment and incomes, business and economic activity, existing government services, land use and traffic	• Construction workers • Full time and temporary workers during operation • Contractors and visitors to the site • Residents within the area of influence • Adjoining industrial facilities • Workers in or near waste disposal locations • Residents near waste disposal locations • Government bodies/businesses providing waste management services

Potential Impacts

Table 16. 2 Potential Impacts Due to Improper Disposal of Removed Biomass

Impact	Potential impacts due to improper disposal of removed biomass				
Nature	**Negative**	Positive	Neutral		
	Potential impacts associated with improper disposal of biomass (i.e. burning) are considered to be negative				
Type	**Direct**	Indirect	Induced	Cumulative	
	Impacts would be direct				
Duration	Temporary	**Short-term**	Long-term	Permanent	
	Construction is expected to start mid-2019 and be completed in the region of 30 months; however, biomass removal will only take place during the preparation and earthworks stage, so the duration is considered short-term.				
Extent	**Local**	Regional	International		
	Potential impacts would likely be limited to the location where biomass is stored and disposed of.				
Scale	• The anticipated volume of biomass to be removed and requiring management is in the order of 800m^3. • The impact would initially be limited to the footprint of where the biomass is stored, with any smoke from burning likely to be very locally restricted.				
Frequency	It is likely that this impact will occur only once.				
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Improper disposal of biomass, particularly through vegetation, can result in a small change in air quality when measured at nearby receptors.				
Receptor / Resource	Low	**Medium**	High		
	The receptors in the event that the vegetation is burnt will be the local communities situated within 1km of the site.				
Significance	Negligible	**Minor**	Moderate	Major	
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.				

Mitigation / Management Measures

The following measures will be put in place for the Project during construction phase:

- No vegetation is to be disposed of by burning under any circumstances
- Generally, biomass such as trees, shrubs and grass are utilized by the local community for a variety of purposes. MUPA will engage with the local community to ensure that they are provided with priority access to all of the biomass. In order to ensure public safety and limit access to the site, MUPA will first clear of the biomass and store it in a designated area where the local community are easily able to access it.
- Any biomass not taken by the local community biomass is to be appropriately stored (or immediately mulched) for later use within site stabilization and rehabilitation activities.

Residual Impact (Post-mitigation)

If the recommended mitigation measures are implemented, residual impact significance would be negligible.

Monitoring plan

As specified in the ESMP, monitoring of waste during both the construction and operation phases should consist of the following:

- Monitoring of waste segregation, transportation and disposal practices in the Project activity areas and disposal location, as to be defined in a Waste Management Plan to be prepared specifically for the Project.
- Monitoring of appointed waste contractors using chain-of custody documentation, as to be defined in a Waste Management Plan to be prepared specifically for the Project.

Impacts of Solid Waste Generation, Storage and Disposal upon the Existing Waste

Management Network

During the construction phase, a range of waste materials will be generated either due to the daily activities of the construction workforce (e.g. generation of putrescible waste) as well as a range of general construction waste such as concrete, steel pipes, plastic pipes, steel plates, structural steel and wooden crates during the civil works phase of construction. Whilst most of these are likely to be non- hazardous, some of these may be hazardous include used paint, engine oils, hydraulic fluids, spent solvents, spent batteries etc. The total approximate quantities of hazardous and non-hazardous waste during construction (assuming an average of 600 workers per day) include:

- 600kg/day of solid (non-hazardous waste); and
- 135kg/month hazardous waste.

Based on data gathered and presented within the environmental and social baseline chapters, the municipal waste management network within the area is limited. Therefore, any additional waste streams generated by the Project are likely to place additional stress on this already struggling waste management network. Whilst the Project plans to put in place contracts with local service providers to collect the waste, this may simply be exporting impacts off site. These impacts could include soil and groundwater impacts (depending on the nature of the final disposal site), human health impacts, impacts to surface water and indirect impacts to community health and safety due to contamination of drinking water or food.

Additionally, it is noted that the improper storage of waste on-site can also give rise to a number of impacts. These include:

- Indirect impacts to community and work health and safety due to contamination of drinking water or food; accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters; and
- Soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored.

As discussed within ***Section 16.1***, these impacts associated with improper storage are related directly to management of impacts to soils, groundwater and surface water and are therefore addressed separately and in an integrated manner within these chapters.

Receptor Identification and Sensitivity

The resources (physical, biological, human or cultural environment) and receptors) that may be impacts in relation to solid waste generation and management are detailed within ***Table 16.3*** below.

Table 16. 3 Resources and Receptors for Waste Management

Resources	Receptors
• Physical environment including land, air quality and water resources (addressed elsewhere). • Biological environment, primarily being the terrestrial environment. • Human environment including subsistence resources, community health, welfare, amenity and safety, employment and incomes, business and economic activity, existing government services, land use and traffic	• Construction workers • Full time and temporary workers during operation • Contractors and visitors to the site • Residents within the area of influence • Adjoining industrial facilities • Workers in or near waste disposal locations • Residents near waste disposal locations • Government bodies/businesses providing waste management services

The significance of potential impacts to the capacity of the existing waste management network to deal with hazardous and non-hazardous waste streams from the Project construction phase are assessed in the following table, and mitigation measures are presented.

Table 16. 4 Potential Impacts Due to Solid Waste Generation, Storage and Disposal upon the Existing Waste Management Network

Impact	Impacts of Solid Waste Generation, Storage and Disposal upon the Existing Waste Management Network.				
Nature	**Negative**	Positive	Neutral		
	Potential impacts to soil would be considered to be adverse (negative).				
Type	**Direct**	Indirect	Induced	Cumulative	
	Impacts to the existing waste management network would be direct				
Duration	Temporary	Short-term	**Long-term**	Permanent	
	Construction is expected to start mid-2019 and be complete in the region of 30 months, which would be considered long-term.				
Extent	**Local**	Regional	International		
	Potential impacts would likely be restricted to the local area				
Scale	Construction activities will take place within the Project area. Based on experience with similar projects, the total approximate quantities of waste that could be a potential source of impact during this stage (assuming an average of 600 workers per day) include: • 600 kg/day of solid waste • 135 kg/month hazardous waste The scale of potential impacts due to release of waste is potentially large due to the quantities present during this stage, particularly when considered in light of the limited waste management network in the area.				
Frequency	Impacts would occur intermittently but repeatedly throughout the day for the duration of the construction phase.				
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts to soil quality in Project area due to inappropriate waste disposal is expected to be of small magnitude.				
Receptor/ Resource Sensitivity	Low	Medium	**High**		
	The existing waste network in the area is almost non-existent and is therefore very sensitive with regards to accepting additional waste streams.				
Significance	Negligible	Minor	Moderate	Major	
	The combination of a High Resource Sensitivity and Small Impact Magnitude will result in an overall Moderate Impact.				

Mitigation and Management Measures

The following measures will be put in place for the Project during construction phase:

- All waste collection and storage measures as detailed within ***Chapter 10*** and ***Chapter 11*** (Surface Water, Soil and Groundwater) will be implemented;
- Prior to construction commencing, MUPA is to engage with local authorities and other stakeholders to determine the capacity of the local waste management network to absorb the new waste streams during construction;
- A waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the construction phase for all of the waste streams identified;
- Education of all workers on site shall be undertaken to avoid, reduce and reuse wastes

generated;

- Waste disposal facilities shall be sited and signposted throughout the construction site;
- Waste clean-up measures are to be undertaken on at least a fortnightly basis to collect any waste or unused materials from the construction site. All waste collected should be managed and disposed of in accordance with the accepted best practice for waste collection and disposal;
- Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing IFC requirements;
- Monitoring of appointed waste contractors using chain-of custody documentation for the disposal of waste to ensure that it is able to be disposed of in an environmental responsible manner and in accordance with all prevailing regulations; and
- The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.

Residual Impacts

If the recommended mitigation measures are implemented, residual impact significance would be Minor.

Monitoring plan

As specified in the ESMP, monitoring of waste during both the construction and operation phases should consist of the following:

- Monitoring of waste segregation, transportation and disposal practices in the project activity areas and disposal location, as to be defined in a Waste Management Plan to be prepared specifically for the Project.
- Monitoring of appointed waste contractors using chain-of custody documentation, as to be defined in a Waste Management Plan to be prepared specifically for the Project.

16.5.2 Operation Phase

Proposed Project Activities with Potential Impact

The operation phase is expected to continue for approximately 30 years. The average number of permanent workers present during operation is expected to be approximately 49, with small numbers of additional staff for security, cleaning, technical assistance, and occasional maintenance. The assessment of operational phase impacts includes those arising from routine operations and maintenance of the power plant. During the operation phase, the plant is expected to produce limited additional waste streams than those anticipated within the construction phase. These waste streams would be mainly materials generated either due to the daily activities of the workforce (e.g. generation of putrescible waste) or a range of general construction waste such as paper from offices and scraps of steel/plastic during maintenance activities. Whilst most of these are likely to be non-hazardous, some of these may be hazardous, for example, used paint, engine oils, hydraulic fluids, spent solvents, spent batteries etc. Whilst these volumes are anticipated to be lower than the construction phase, there is still the matter of the capacity of the existing waste management network in the region to absorb the additional waste being generated.

An additional waste stream during operation is the generation of sludge from process operations. The local municipality will be engaged for appropriate disposal of the dried sludge from process wastewater, and disposal will be by a licensed waste contractor.

Table 16.5 presents details of the solid (non-hazardous) waste and approximate quantities as anticipated during operation. The solid waste generated during the operation phase will be collected and segregated for recycle and non-recycle waste (i.e. paper, plastic). Project will use incineration on site and compost. There will also be minimal other waste such as wood crates from maintenance activities which will be provided to the local community as fire wood.

Table 16. 5 Solid (Non-Hazardous) Waste during Operation

Waste Type	Anticipated Quantity	Employees	Total Solid Waste
Domestic Solid Waste	1.65kg per employee per week	49	80.85 kg/week

The hazardous materials to be stored on site during operation are presented in ***Table 16.6***. The chemicals will be transported appropriately to the Project site and Material Safety Data Sheets (MSDS) will be prepared from chemical suppliers in Myanmar.

Table 16. 6 Hazardous Materials during Operation

Hazardous Material	Use of Hazardous Materials	Storage Location Onsite	Quantities to be Stored Onsite
Oxygen Scavenger	Chemical Dosing System	Chemical Storage House	$1m^3$
Phosphates	Chemical Dosing System	Chemical Storage House	$1m^3$
Fouling Agent	Chemical Dosing System	Chemical Storage House	$1m^3$
Anti-corrosion	Chemical Dosing System	Chemical Storage House	$1m^3$
Biocides	Chemical Dosing System	Chemical Storage House	$1m^3$
Hydrochloric Acid	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Chemical Dosing System	Chemical Storage House	$3m^3$
Sodium Hydroxide	Water Treatment System and Demineralized Water System	Chemical Storage House	$10m^3$
Hydrogen Chloride	Water Treatment System and Demineralized Water	Chemical Storage House	$10m^3$

Hazardous Material	Use of Hazardous Materials	Storage Location Onsite	Quantities to be Stored Onsite
	System		
Diesel oil	Liquid fuel for emergency diesel engine generator, emergency diesel generator	Storage Tank	Estimate at 2x7200 litres x 3 days for fuel tank = 43,200 litres.

The design will aim to reduce, wherever practicable, the volume of hazardous and non-hazardous solid waste generated during construction and operation, and to provide the basis for the management of waste in accordance to the regulatory procedures for solid waste storage and disposal.

Hazardous wastes will be disposed of by to appropriate hazardous waste treatment facilities available in Myanmar. MUPA will handle, store and dispose of all waste in accordance with applicable guidelines.

Receptor Identification and Sensitivity

The resources (physical, biological, human or cultural environment) and receptors that may be impacts in relation to solid waste generation and management are detailed within ***Table 16.7*** below.

Table 16. 7 Resources and Receptors for Waste Management

Resources	Receptors
• Physical environment including land, air quality and water resources (addressed elsewhere). • Biological environment, primarily being the terrestrial environment. • Human environment including subsistence resources, community health, welfare, amenity and safety, employment and incomes, business and economic activity, existing government services, land use and traffic	• Construction workers • Full time and temporary workers during operation • Contractors and visitors to the site • Residents within the area of influence • Adjoining industrial facilities • Workers in or near waste disposal locations • Residents near waste disposal locations • Government bodies/businesses providing waste management services

Potential Impacts

The significance of potential impacts to the capacity of the existing waste management network to deal with hazardous and non-hazardous waste streams from the Project operation and maintenance phase are assessed in the following table, and mitigation measures are presented.

Table 16. 8 Potential Impacts of Solid Waste Generation, Storage and Disposal during Operations

Impact	Impacts of Solid Waste Generation, Storage and Disposal upon the Existing Waste Management Network during Operation and Maintenance				
Nature	**Negative**	Positive	Neutral		
	Potential impacts would be considered to be adverse (negative).				
Type	**Direct**	Indirect	Induced	Cumulative	
	Impacts to the existing waste management network would be direct				
Duration	Temporary	Short-term	**Long-term**	Permanent	
	The operation phase is expected to continue for approximately 30 years, which would be considered long-term.				
Extent	**Local**	Regional	International		
	Potential impacts would likely be restricted to the local area.				
Scale	Operation activities will take place within the Project area. The scale of potential impacts due to release of waste is potentially large due to the quantities present during this stage, particularly when considered in light of the limited waste management network in the area.				
Frequency	Impacts would occur intermittently but repeatedly throughout the day for the duration of the operation phase.				
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts to soil quality in Project area due to inappropriate waste disposal is expected to be of small magnitude.				
Receptor/ Resource Sensitivity	Low	Medium	**High**		
	The existing waste network in the area is almost non-existent and is therefore very sensitive with regards to accepting additional waste streams.				
Significance	Negligible	Minor	**Moderate**	Major	
	The combination of a High Resource Sensitivity and Small Impact Magnitude will result in an overall Moderate Impact.				

Mitigation and Management Measures

The following measures will be put in place for the Project during operation phase:

- All waste collection and storage measures as detailed within ***Chapter 10*** and ***Chapter* 11** (Surface Water and Soil and Groundwater) will be implemented;
- A waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the construction phase for all of the waste streams identified;
- Education of all workers on site shall be undertaken to avoid, reduce and reuse wastes generated;
- Waste disposal facilities shall be sited and signposted throughout the site;
- Waste clean-up measures are to be undertaken on at least a fortnightly basis to collect any waste or unused materials from the construction site. All waste collected should be managed and disposed of in accordance with the required regulations;
- Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing regulations;

- Monitoring of appointed waste contractors using chain-of custody documentation for the disposal of waste to ensure that it is able to be disposed of in an environmental responsible manner and in accordance with all prevailing regulations; and
- The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.

Residual Impacts

If the recommended mitigation measures are implemented, residual impact significance would be **minor**.

Monitoring plan

As specified in the ESMP, monitoring of waste during both the construction and operation phases should consist of the following:

- Monitoring of waste segregation, transportation and disposal practices in the project activity areas and disposal location, as to be defined in a Waste Management Plan to be prepared specifically for the Project.
- Monitoring of appointed waste contractors using chain-of custody documentation, as to be defined in a Waste Management Plan to be prepared specifically for the Project.

CHAPTER 17 UNPLANNED EVENT

17.1 INTRODUCTION

The unplanned event is defined as 'a reasonably foreseeable event that is not planned to occur as part of the Project" but which may conceivably occur as a result of Project activities (e.g. accidents), even with a low probability". During construction and operation, there are a range of activities that could lead to unplanned and accidental events. This Section identifies those activities, potential impacts, and identifies appropriate mitigation, management and monitoring measures required to reduce residual impacts to an acceptable level.

17.2 ASSUMPTIONS AND LIMITATIONS

As described in the Project Description in ***Chapter 4,*** the Project is being designed, and will be constructed and operated, according to the best practice for preventing the risk and impact on health, safety, and environment. However, there is a potential for accidents, malfunctions or unplanned events to occur during any Project phase that cause impacts to the health and safety of community and employee of the Project. This is required to consider in this ESIA report.

The assessment of significant impacts of unplanned events considers the probability of events occurring and an estimate of the severity of the consequences of the events. In assessing the severity of impacts "A worst case scenario" is taken into consideration. This chapter presents the probable impacts of unplanned events associated with construction and operation of the Project. The unplanned events are considered separately from routine and non-routine activities as they arise as a result of a technical failure, human error, or as a result of natural phenomena.

17.3 ASSESSMENT METHODOLOGY

As discussed in ***Chapter 3***, the IFC Environmental, Health and Safety (EHS) standards and guidelines are considered throughout the assessment and provide the overarching guidance and principles for undertaking the assessment. The key documents considered are as follows:

- IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts: The ESMS will establish and maintain an emergency preparedness and response system so that the client, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations associated to prevent and mitigate any harm to people and/or the environment;
- IFC Performance Standard 2 Labor and Working Conditions: It is required the Project to prevent risk and impacts on the staffs working in the Project area. Considering inherent risks in its particular sector/ classes of hazards in the client work area including physical, chemical, biological, radiological hazards, threats to women;
- IFC Performance Standard 4 Community Health and Safety and Security: The project must avoid and minimize risk and impact caused by the Project on health and safety of the community;

- IFC (2007) Environmental, Health, and Safety Guidelines: Thermal Power Plants[58]; and
- Environmental, Health, and Safety (EHS) General Guidelines.

Assessment of significant impact associated to unplanned event considers the likelihood (or frequency) of incident occurrence and the consequence of the incident should it occur. The assessment of likelihood takes a qualitative approach based on professional judgement, experience from similar projects. The assessment of consequence is based on specialists' input and professional experience. The details are provided in the next sections. Since the Project activities during the construction and operation period are varied. The unplanned events will be assessed based on the Project phase listed in the following sections.

17.4 Assessment Of Impacts

The unplanned events associated to construction activities are listed as follows:

- Chemical Spill or Leak; and
- Fire and Explosion

There are a number of chemicals used, stored, and handled in the various construction and operation phase. If handle and store inappropriately, these chemicals may spill or release into environment and cause the contamination to the environmental receptors for instance soil, surface water, or groundwater.

When community or workers exposed to the spills or contaminated environment, it may cause short/ long term health depending on the time of exposure, type of contaminants, and amount released. The severity of the impact can be ranged from irritation to fatality.

17.4.1 Chemical Spill or Leak

Potential Impact

During the construction, the chemicals including fuel oil, paint, solvent, water repellents etc. will be handled and stored onsite. It is anticipated that none of these chemicals are highly toxic or carcinogenic. In addition, the volume of chemicals to be handled or stored will be small. The Project will establish and also implement appropriate control strategies to minimize the risks associated to the use of chemicals. The examples of the control measures are listed as follows:

- Store chemicals in the appropriate container with clear label;
- Install bund in the chemical area, and the floor is impermeable with respect to the liquids stored;
- Prepare chemical spill response kit adequately and appropriately;
- Provide fire-fighting equipment at readily accessible locations at the storage area; and
- Prepare the emergency response plan to cover the event of chemical spill/ leakage.

For operation phase, a list of hazardous chemicals to be handled onsite is provided in ***Section 4.6.3.*** When considering the properties of these chemicals, some e.g. hydrochloric acid, and sodium hydroxide etc. is severely corrosive agent which could cause severe burning to skin,

[58] International Finance Corporation (IFC) (2007) Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines: Introduction [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+manage ment/ehsguidelines [Accessed 22 March 2017]

respiratory system, or gastronomy. The remaining items can cause the irritating effects to respiratory, skin, or eyes. To minimize the risk of incident to be lowest as possible, the hazardous material management plan will be implemented similar to the construction period.

For the sensitivity of receptor, ground water is the major source of drinking water with stored water from stream in the study area. Given the reliance on existing water sources, it is unlikely that the local villages would have the ability to adapt to any sort of contamination – i.e. be able to find an alternative drinking water source.

Due to the management measures provided below, the impact was assessed as **minor** and **negative** (***Table 17.1***). The duration (and consequence) of the impact was identified as potentially long-term.

Table 17. 1 Assessment of Impacts on Chemical Spill or Leak

Impact	Potential impacts from accidental releases of hazardous substances could be contamination to environments and cause the health effect to human				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts would be considered to be adverse (negative).				
Impact Type	**Direct**	Indirect	Induced	Cumulative	
	Impacts would be direct impacts from Project activities.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The duration of potential impacts is long-term as it can have long lasting impacts on health or the environment.				
Impact Extent	**Local**	Regional	International		
	Potential impacts would be limited to the Project footprint and vicinity area in the worst case hence would be considered to be local.				
Impact Scale	The impact is limited within the local villages. The impact scale is medium.				
Frequency	NA, the impacts is not expected to occur.				
Likelihood	The likelihood of road accident to occur is unlikely.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impact due to accidental releases in the Project area is expected to be small magnitude.				
Receptor Sensitivity	Low	**Medium**	High		
	Overall sensitivity is rated as Medium as there is limited alternative in the area.				
Impact Significance	Negligible	**Minor**	Moderate	Major	
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.				

Mitigation and/or Management Measures

- Contractor will prepare unloading and loading protocols and train staff to prevent spills and leaks;
- Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oils, fuels or chemicals;
- Fuel tanks and chemical storage areas will be sited on sealed areas and provided with locks to prevent unauthorized entry;
- Use of spill or drip trays to contain spills and leaks;

- Use of spill control kits to contain and clean small spills and leaks;
- The storage areas for fuel oil and chemicals will be surrounded by bunds or other containment devices to prevent spilled oil, fuel and chemicals from percolating into the ground or reaching the receiving waters;
- Implement a construction materials inventory management system to minimise over-supply of the materials;
- Provide dedicated storage areas for construction materials to minimize the potential for damage or contamination of the materials;
- Ensure storage areas have impermeable floor and containment, of capacity to accommodate 110% of the volume of the largest storage container;
- Provision of grounding and lightning protection for equipment that handles flammable materials;
- Establish a first-aid center with first-aid trained staff on site. The First-aid centre shall be equipped with sufficient first-aid equipment, first-aid kit and medicines;
- Emergency response plan should include informing the public and relevant parties; and
- Employee and contractor must be trained on emergency response procedure.

Monitoring Plan

No Monitoring plan is required

17.4.2 Fire and Explosion

The operation of the Project involves certain flammable or explosive substances that have potential to cause serious danger to person or damage to properties due to the fire, explosion, and toxic release.

The Project identify the sources of major hazards referred to World Bank Technical Paper Number 55 (World Bank, 1998) by considering 3 major activities which are (1) process activities (2) chemical storage and (3) transportation of hazardous materials. The criteria for identifying potential sources of fire and explosion are listed as follows:

- Properties of hazardous substances- toxic substances, flammable substances, highly reactive substances and explosive substances;
- Threshold quantities of hazardous substances – chemical inventory from World Bank Guidelines (World Bank, 1988) are used for screening the potential hazard unit/ equipment; and
- Operating condition (temperature, pressure higher than atmospheric conditions).

By considering the criteria mentioned above, the major source of major hazards including fire and explosion, is the natural gas pipeline which is an existing gas supply pipeline owned by the Project Proponent. The pipeline is approximately 2.6 km in length, and 25 cm diameter. The existing condition of the pipeline is buried underground mostly.

Potential Impact

When natural gas released to the atmosphere, the consequence of the release depends on (1) volume of released gas, (2) nearby ignition source, and (3) surrounded environment. In worst case, released hydrocarbon may be ignited as a jet fire or fireball. The heat intensity will cause the health effects to human within the radiation. The damages are based upon correlations with radiation flux and damage levels as shown in ***Table 17.2***

Table 17. 2 Representative thermal radiation levels

Thermal Description	Radiation (Btu/hr-ft)
12,000	100% mortality in approximately 30 sec
5,000	1% mortality in approximately 30 sec
4,000	Eventual wood ignition
1,600	Onset of injury after approximately 30 sec

Source: Stephens, M.J. "A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines" C-FER Topical Report 99068 prepared for Gas Research Institute, Contract 8174, October 2000.

However, the Project will prepare the control measures to minimize the risk associated to the fire or explosion in the case of gas leak. Therefore, it is anticipated that the likelihood of the pipe leak will be small. When considering the surrounding receptor, the land use along the pipeline consists of the agricultural land and light residential area.

As a consequence, the potential impact from fire and explosion was assessed as **minor** and **negative** (***Table 17.3***). The duration (and consequence) of the impact was identified as potentially long-term.

Table 17. 3 Assessment of Potential Impacts due to Fire and Explosion

<table>
<tr><th>Impact</th><th colspan="5">The health impact due to the thermal radiation from the hydrocarbon gas released from the pipeline.</th></tr>
<tr><th rowspan="2">Impact Nature</th><td>Negative</td><td>Positive</td><td colspan="3">Neutral</td></tr>
<tr><td colspan="5">Threaten life or property of communities is considered to be Negative</td></tr>
<tr><th rowspan="2">Impact Type</th><td>Direct</td><td>Indirect</td><td colspan="3">Induced</td></tr>
<tr><td colspan="5">Potential impacts would likely be direct impacts from Project activities.</td></tr>
<tr><th rowspan="2">Impact Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td colspan="2">Permanent</td></tr>
<tr><td colspan="5">The impact duration is long-term due to the damage after the accident</td></tr>
<tr><th rowspan="2">Impact Extent</th><td>Local</td><td>Regional</td><td colspan="3">International</td></tr>
<tr><td colspan="5">The radius of distanced to be affected by fire will be the project area and adjacent. Thus, it is considered to be Local.</td></tr>
<tr><th>Impact Scale</th><td colspan="5">The impact can be ranged from minor injury to death.</td></tr>
<tr><th>Frequency</th><td colspan="5">NA. This incident is not expected to occur.</td></tr>
<tr><th>Likelihood</th><td colspan="5">The likelihood of explosion to occur is unlikely.</td></tr>
<tr><th rowspan="2">Impact Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">The impact magnitude is Small.</td></tr>
<tr><th rowspan="2">Receptor Sensitivity</th><td>Low</td><td>Medium</td><td colspan="3">High</td></tr>
<tr><td colspan="5">The sensitivity of receptor is high.</td></tr>
<tr><th rowspan="2">Impact Significance</th><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">The significance is Negligible.</td></tr>
</table>

Mitigation and/or Management Measures

- Pipelines will be built and maintained according to American Petroleum Institute (API) or the American Society of Mechanical Engineering (ASME) standards;

- Install a system pressure monitor to detect leaks for pipeline.
- Conduct routine inspections and preventive maintenance for all pipelines and associated equipment at least once per year;
- Set up the communication procedure between project staff and external parties;
- Train operators to strictly follow the working procedures both for normal operation and emergency; and
- Emergency response plan should include informing the public and relevant parties.

17.4.3 Unplanned Natural Occurrence (Earthquake)

Project area is situated within the Zone I (Low Zone) and there is no earthquake in history according to the MIMU 2019. The origin and occurrence of earthquakes occurred all over the Myanmar except the southern part of the country in where the project exists. Earthquake intensity of the area is 0.06 to 0.07 g. Although the project is under the Zone I, the project has to consider possible risks and to fulfill all engineering requirements of the buildings to stand earthquakes as well as to prevent damages affected by earthquakes as the project involves construction of high buildings.

Potential Impacts

1. Structural Damage: Earthquakes can cause structural damage to power plant buildings, equipment, and pipelines. This damage can disrupt operations, lead to leaks or spills, and pose safety hazards to workers and nearby communities.

2. Safety Risks: Seismic events can trigger fires, explosions, or other safety incidents at power plants and along gas pipelines. These events can result in injuries, loss of life, and environmental damage.

3. Environmental Contamination: Earthquakes may cause spills or leaks of hazardous materials, such as fuel or chemicals used in power plant operations or transported through gas pipelines. These releases can contaminate soil, groundwater, and surface water, leading to environmental damage and requiring remediation efforts.

4. Disruption of Services: Seismic events can disrupt the supply of electricity and natural gas to communities served by the power plant and pipeline. This disruption can have economic and social impacts, affecting businesses, households, and critical infrastructure.

5. Infrastructure Damage: Earthquakes can damage roads, bridges, and other infrastructure essential for power plant operations and pipeline maintenance. Repairing and restoring this infrastructure can be costly and time-consuming, delaying recovery efforts.

6. Emergency Response and Preparedness: Natural disasters require emergency response and preparedness measures to ensure the safety of workers, nearby communities, and the environment. The EIA report may evaluate the adequacy of emergency response plans, evacuation procedures, and risk mitigation measures to address earthquake-related hazards.

7. Long-Term Resilience: Assessing the resilience of power plant facilities and pipeline infrastructure to seismic events is essential for ensuring their long-term viability and minimizing the risk of future disruptions. This may involve implementing seismic retrofitting measures, incorporating earthquake-resistant design features, and conducting regular inspections and maintenance.

Overall, addressing the potential impacts of earthquakes and other natural disasters in the EIA report is crucial for identifying risks, implementing appropriate mitigation measures, and safeguarding the environment, public health, and safety in the operation of combined cycle power plants and gas pipelines.

Mitigation Measures

Mitigation measures for the potential impacts of natural disasters, such as earthquakes, on combined cycle power plants and gas pipelines can include:

1. Seismic Design Standards: Ensure that power plant buildings, equipment, and pipeline infrastructure meet or exceed seismic design standards to withstand the forces generated by earthquakes.

2. Structural Reinforcement: Retrofit existing structures and equipment with additional reinforcement, bracing, or anchoring to enhance their resistance to seismic forces.

3. Pipeline Integrity: Implement pipeline integrity management programs to inspect, monitor, and maintain gas pipelines regularly. This includes conducting integrity assessments, repairing defects, and replacing aging infrastructure to reduce the risk of leaks or ruptures during seismic events.

4. Emergency Response Planning: Develop and implement comprehensive emergency response plans to address potential safety hazards, environmental contamination, and service disruptions caused by earthquakes. Ensure that emergency responders are trained, equipped, and prepared to respond effectively to seismic-related incidents.

5. Backup Power Systems: Install backup power systems, such as generators, to ensure continued operation of critical power plant equipment and pipeline facilities during power outages resulting from earthquakes.

6. Supply Chain Resilience: Assess and strengthen the resilience of supply chains for fuel, spare parts, and other critical supplies to minimize disruptions to power plant operations and pipeline maintenance following seismic events.

7. Community Outreach and Education: Engage with local communities to raise awareness about earthquake risks, emergency preparedness, and evacuation procedures. Provide training and resources to help communities mitigate the impacts of earthquakes and respond effectively to emergencies.

8. Environmental Monitoring and Remediation: Implement environmental monitoring programs to detect and mitigate any releases of hazardous materials from power plant facilities or gas pipelines during seismic events. Develop contingency plans and resources for environmental cleanup and remediation as needed.

By implementing these mitigation measures, combined cycle power plants and gas pipelines can reduce their vulnerability to the impacts of earthquakes and enhance their resilience to seismic-related hazards.

CHAPTER 18 CUMULATIVE IMPACT ASSESSMENT

18.1 INTRODUCTION

The cumulative impact assessment (CIA) for the Project is undertaken in accordance with the IFC Performance Standards, the IFC's *Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for Private Sector in Emerging Markets* dated August 2013 (the "IFC Handbook").

Cumulative impacts generally arise as a result of an impact from the Project interacting with an impact from another activity. This interaction will create significant adverse and/or beneficial impact that would not be expected from a stand-alone project.

In order to gain an understanding of the Project's overall contribution to impacts within Kanbauk village, Yebyu Township, Dawei district and the broader Tanintharyi region, a cumulative impact assessment (CIA) is undertaken. Whilst total cumulative impacts due to multiple developments/activities within a given area should be identified within government led spatial planning efforts (generally as part of a Strategic Environmental Assessment), the Project Proponent needs to determine the degree to which it is contributing to these overall cumulative impacts on Valued Environmental and Social Components (VEC). In this regard, the objectives of the CIA are:

- Use the outcomes of the preceding chapters of this ESIA to determine spatial and temporal boundaries, identify VECs and all development and external natural and social stressors affecting them;
- Recognize and identify how the Project, along with other existing and future developments may contribute to cumulative impacts on the predicted future condition of the identified VECs; and
- Develop measures to ensure these are avoided and/or minimized to the greatest extent possible.

To achieve these objectives and gain an understanding of the complexities of cumulative impacts, this Chapter presents a Rapid Cumulative Impact Assessment (RCIA), which has been undertaken largely in accordance with the IFC Handbook.

18.2 METHODOLOGY

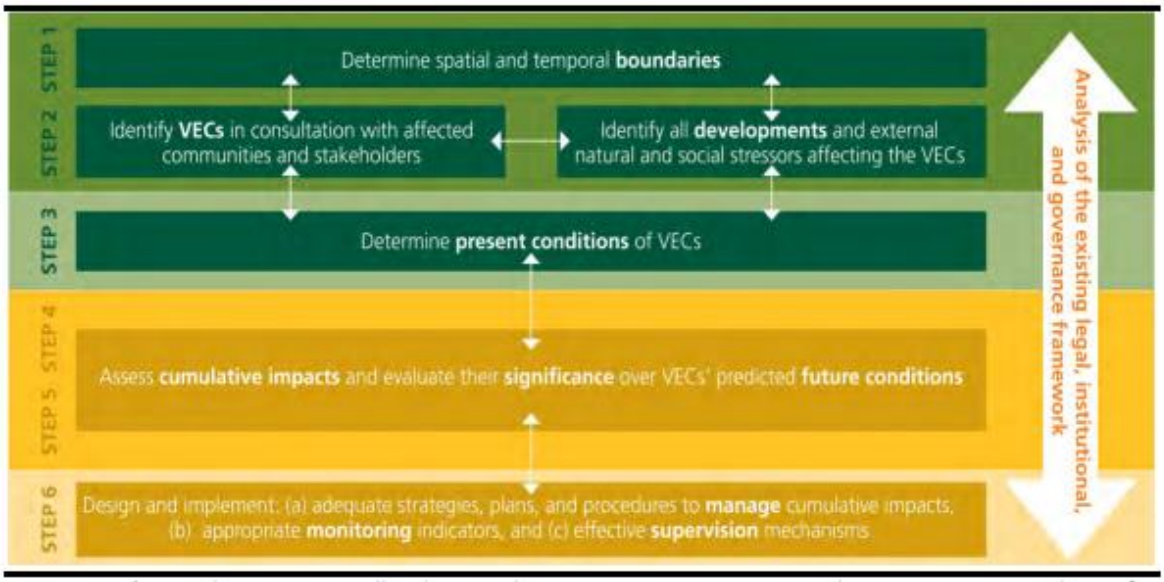
18.2.1 Overview

This chapter presents a RCIA in accordance with the IFC Handbook which consists of a six-step process including scoping (Steps 1 and 2), VEC baseline determination (Step 3), assessment of the contribution of the Project under evaluation to the predicted

cumulative impacts (Step 4), evaluation of the significance of predicted cumulative impacts to the viability or sustainability of the affected VECs (Step 5), and design and implementation of mitigation measures to manage the development's contribution to the cumulative impacts and risks (Step 6), as illustrated in Figure 18.1.

The development of the ESIA has established Step 1 to Step 3 (Scoping Report, Chapters 5 to 6 and Chapters 8 to 17 for the Project, as with the impact assessment and the proposed mitigation, management and monitoring measures (Chapter 19). Given this, this RCIA places emphasis on the steps pertaining to cumulative impact assessment and management.

Due to a lack of information available to pursue a quantitative cumulative impact assessment (such as determining numerical thresholds for various VECs), emphasis in developing the methodology has therefore been placed upon following a largely qualitative approach, allowing for identification of general trends and developing appropriate management, mitigation and monitoring measures. Given this approach, the majority of the methodology relies upon the use of professional judgements, complemented by ERM's understanding of the Project, experience with similar projects in similar settings, and the elements of the ESIA based on quantitative assessment.



Source: IFC's *Good Practice Handbook, Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets*, August 2013

Figure 18. 1 General RCIA Methodology

18.2.2 Determine Spatial and Temporal Boundaries and VECs

The methodology used in the setting of the spatial and temporal boundaries is largely qualitative and based on the general "rules of thumb" suggested within Box 7 ('Rules of Thumb – How to set Geographical and temporal boundaries') of the IFC Handbook. The following factors have been set within the methodology:

- Temporal boundaries have been set based on desktop review of available information pertaining to other developments/activities within the area (see below), the present activity schedule, understanding of Government strategy with regard to the long-term development of the area, and the continual nature of some of the external stressors; and
- Geographic boundaries are a composite of the locations of the identified VECs (see Section 18.2.3 below), assessed impacts of the Project and the degree to which they may overlap with other external developments/activities and stressors to impact upon an identified VEC.

18.2.3 Identify VECs and their Present Conditions

Throughout this Chapter, VECs refer to the following:

- Any physical features, habitats, wildlife population identified as sensitive receptors within the ESIA. For example, any villages, houses or hospitals identified as air/noise sensitive receptors; and/or any critical habitats/species assessed within the biodiversity chapter;
- Any particular resources or ecosystem services identified as being utilized by sensitive receptors. An example of this would be a groundwater resource used by the local community for domestic purposes;
- Social conditions such as health and economics of the nearby affected communities; and

- Those identified as part of stakeholder engagement, regardless of whether or not they meet either of the above definitions.

The identification of VECs has been largely completed during the development of the ESIA and the information will be used to inform the RCIA.

18.2.4 Identify all Developments and External Natural and Social Stressors Affecting the VECs

External developments, known as reasonably foreseeable future actions, are also identified utilizing knowledge gained through the ESIA process (including field observations), stakeholder engagement and the interpretation of readily available external data. The outcomes of these considerations will be a simple binomial decision, i.e. yes, the external development/activity is likely and therefore will be included within the CIA, or no, it is unlikely and therefore will not be included within the CIA.

The subsequent step is to determine the extent of the various impacts of the external developments/activities. This will facilitate judgement as to whether there is a potential for the impacts from the external developments/activities to be overlapped with the Project's impacts and leading to a measurable cumulative impact.

The key elements to determine whether an external development/activity will have cumulative impacts with the Project include the following:

- **Identification of appropriate geographical/spatial boundaries.** Where potentially interacting external developments/activities are not located close enough, or sufficiently linked through various ecological and social processes, for relevant impacts to overlap, cumulative impacts are less likely;
- **Identification of temporal boundaries.** Where the schedules of various components of external developments/activities do not overlap in time, particularly the construction phase where impacts are likely to be significant, cumulative impacts are less likely. Additionally, where activities are going to be short term, cumulative impacts will generally be of limited duration;
- **Consideration of impact type.** Whilst there may be no direct geographical overlap in boundaries, there is a possibility that offsite impacts from external developments/activities may directly overlap elsewhere and cause offsite cumulative impacts. Examples are sediment discharges into river systems, air pollutant emissions, and social impacts associated with overall migration influx;
- **Determination of any "aggravating factors"** that may be evident within a particular external development/activity identified for inclusion within the CIA. This includes elements such as the size of the external development/activity, environmental management performance, and the regulatory regime under which it operates; and
- **Identification of potential externalities,** the external development/activity has an ability to influence (either positively or negatively) the behaviors of other operations in the area.

The other element identified as part of this scope is external natural and social stressors which are not related to a single project or source. As these are ongoing stressors it has been assumed that they have already been captured as part of the Project baseline conditions (refer to ***Chapters 5 and 6***) and the impact assessment (refer to ***Chapters 8 to 17***). Specific additional identification and assessment of the natural and social stressor is therefore not considered necessary as part of this RCIA.

18.2.5 Identification and Assessment of Impacts

Impact scoping and identification for the RCIA will align with those assessed throughout the main body (***Chapters 8 to 17***) of the ESIA, and will include those that are recognized as important based on genuine scientific concerns and the views of affected communities and other stakeholders. This will allow impacts to be appropriately grouped and added to impacts identified as likely to occur from external developments/activities.

The RCIA adopts a qualitative approach that enables identification of impact trends across the various external developments/activities within the study boundary, their temporal and spatial interactions with the Project and how these will likely impact the identified VECs. Quantitative method is adopted where possible. Whilst certain impacts arising from the Project have been approached through a quantitative method in the ESIA, it is challenging to adopt the same approach for cumulative impacts. This is due to a high degree of uncertainty in interactions between the Project and the external developments and activities, as well as a lack of emission information of these external developments and activities. Rather than assessing impacts based on VECs, the cumulative impacts are assessed based on the identified trends and grouped according to impact type. This is also consistent with the overall approach adopted by the ESIA.

It is recognized at this stage that this approach may not accurately define the cumulative impacts from a purely VEC-centered perspective (i.e. proposed actions impact on VEC + other past, present and future impacts on VEC = Cumulative Impacts). However, given the clustered nature of the human VECs (e.g. villagers identified in ***Chapter 6***), the large-scale extent of the environmental VECs (such as the groundwater system, which is also heavily relied upon by human VECs), it is considered safe to assume that all impacts will accumulate to each VEC. Therefore, attempting to address impacts by nature is a suitable approach and is able to produce effective management, mitigation and monitoring measures.

18.2.6 Development of Management, Mitigation and Monitoring Measures

Based on identification of broad impact trends, broad scale mitigation measures will need to be developed. Generally, these include:

- Effective application of, and adherence to, the mitigation hierarchy in environmental and social management of the specific contributions by the Project expected cumulative impacts. This is generally achieved through stringent implementation of the measures developed specifically for the Project; and
- Development of best efforts to engage in, enhance and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions which are beyond the capacity of an individual project proponent.

Any measures developed to address concerns identified within this CIA will consider these general concepts. The recommended measures need to be developed further when detailed information regarding external developments/activities have become available.

18.3 Identification Of VECs And Their Present Conditions

The ESIA identifies and describes the current condition of a range of Sensitive Receptors, defined as VECs for the purposes of this RCIA. These are:

- The residents of the villages of Mi Gyaung Auing, Hle Gone, Kanbauk, Shih Byan, Pyin Gyi, Gan Gaw Taung, Pet Taung, On Bin Kwin and Ya Ngan; and
- The ecological receptors, critical habitat, natural habitat and threatened species within the area of influence and Project area as discussed in Chapter 5;
- Given the high dependency of the local community on groundwater for domestic purposes

including drinking, the groundwater resource is considered as a VEC; and

- Soil is being used as topsoil of rubber plantations at the local community and is therefore considered as a VEC despite its low sensitivity;
- Surface water bodies such as Heinze river; and
- Various ecosystem services provided by the local ecosystems such as provisioning services, regulating services, habitat/supporting services and cultural services are also defined as VEC's.

18.4 Identification Of All Developments And External Natural And Social Stressors

18.4.1 Associated Facilities

The Project will include various associated facilities such as an overhead transmission line from the Project site to the Kanbauk sub-station and pipelines supplying natural gas from the offshore Yadana and Zawtika gas fields and an associated metering station.

The overhead transmission line has not been covered within the ESIA. For the purpose of this CIA, this is considered as an external development/activity and is further assessed and discussed in ***Table 18.1***.

Whilst the ESIA has covered the Fuel Supply Infrastructure consisting of the Gas Metering Station located within the MOGE Gas Receiving Station boundary and the Gas Supply Pipeline from the Gas Metering Station to the Project Site, it has not included the portion of the gas pipeline connecting the offshore gas fields and the MOGE Gas Receiving Station. Therefore, this portion of the gas pipeline is further discussed in ***Table 18.1***.

18.4.2 External to the Sponsor

The Kanbauk village, where the Project will be located at, has been discovered with abundant mineral deposits in particular tin and tungsten. A tin and tungsten mine site has been identified at a location approximately 2.5 km southwest of the Project site. Due to its close proximity to the Project site, cumulative impacts will likely arise and this mine site is further discussed in ***Table 18.1***.

The offshore gas fields located in the Andaman Sea, namely Yadana, Zawtika and Yetagun, have been screened out of this RCIA considering their distances from the Project site are more than 100 km.

Table 18. 1 Assessment of Impacts

Project Name	Comments	Anticipated Impact Types
Onshore and offshore pipelines between the MOGE receiving station and offshore gas fields	Natural gas produced from the offshore gas fields is transferred to the MOGE Gas Receiving Station through various onshore and offshore pipelines that have been operational for several years. The Project's demand will not result in any physical changes to these pipelines and their related infrastructure. Besides transferring natural gas and regular maintenance of the pipelines, operational activities in relation to the pipelines are minimal. As such, cumulative impacts will likely be limited and the pipelines between the MOGE receiving station and offshore gas fields have therefore been removed from further consideration in this CIA.	None
Overhead transmission line	The proposed overhead transmission line will connect to the Kanbauk sub-station and will be developed by the local/national authorities. As the final option/alignment has not yet been chosen, the impacts associated with the overhead transmission line infrastructure will be assessed based on an understanding of the surrounding area and typical impacts associated with transmission line infrastructure. Construction activities will potentially involve land clearance, pilling, installation of power towers and wire stringing which could result in elevated noise, generation of dust emissions and surface water runoff etc. Operational impacts for the transmission line would be negligible and therefore not considered within the CIA.	Impacts in relation to construction activities such as noise, air quality, surface water and groundwater and soil as well as operational impacts relating visual.
Tin and Tungsten mine site operated by Savitar	Based on limited information available online, it is assumed that the mine site was historically operated by Delco Ltd and presently covered under the license belongs to Savitar exploration Ltd. Savitar exploration Ltd possesses a mining license of 9.9 km^2 and a contiguous exploration area of 278.6 km^2 Several incidents in relation to environmental and social impacts have been reported from this mine site during the ownership of Delco and these included a fatality due landslide and flooding, illegal dumping of excavated soil, pollution of nearby water resources etc. It is understood that Savitar has commissioned an Environmental Scoping Study, this report is however not available on public domain. Besides the reported incidents, mining activities could also result in elevated noise due to blasting and explosion, dust emissions etc. It is noted from Savitar's official website that drilling activities are currently underway with some exploration activities at other part of the mine site. In view of the large exploration area, it is likely that the mining operation will coincide with the Project construction and operation.	Operational impacts in relation to generation of dust, greenhouse gases, noise, surface water, soil and groundwater, biodiversity and social.

18.5 Summary Of Trends, VECs And Scope Refinement

18.5.1 Summary of Trends

Some basic key trends and issues have been identified through investigating the nature of existing and proposed development within the area. These trends and issues, which will be used for qualitative cumulative impact assessment, are:

- The Project will not result in any physical changes to the existing pipeline connection between the MOGE Gas Receiving Station and the offshore gas fields. These pipelines have been operational for several years and their operational impacts are minimal due to limited operational activities;
- There will likely be an overlap in construction activities of the Project and the overhead transmission line (associated facility), construction impacts will likely be cumulative;
- A tin and tungsten mine site have been identified in Project vicinity. Various environmental and social issues have been reported from this mine site. Operation impacts will be cumulative especially if tighten regulations have not been implemented to the mining activities within the site.
- VECs that could be affected by the cumulative impacts include villagers reside within the nearby communes and environmental receptors such as soil, groundwater and surface water sources. Ecological receptors unique to the local ecosystems, critical habitats, natural habitats and species of conservation identified within the study area could also be impacted and are considered as core VECs.

18.5.2 Scope Finalization

Table 18.2 presents the outcomes of scoping, based upon identified VECs, assessed Project impacts, the identified external developments/activities, and the summary of trends. The core outcome of this table is that cumulative impacts will be assessed with respect to the following key impact types:

- Air quality;
- Landscape and visual;
- Waste; and
- Social impacts divided into employment and business opportunities and community health and safety.

Impacts that have been either assessed in a cumulative manner within the ESIA, or assessed to have negligible significance are not expected to contribute to any broader cumulative impacts to VECs. These impacts are therefore not further assessed in the RCIA.

Table 18. 2 Scoping for RCIA

Impact Type	VECs Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
Air quality impacts	Representative air sensitive receptors identified within ***Chapter 5 and 6;***	**Chapter 8** presents the findings of the air quality assessment for the construction and operation impacts from the Project. The assessment approach includes semi-quantitative and detailed modelling. The assessment takes into consideration the baseline survey results that captured emissions from the nearby activities including the tin and tungsten mine site that was operational during the survey period. Cumulative impacts from tin and tungsten mine site have therefore been covered. However, emissions from construction of the transmission line infrastructure have not been assessed.	A qualitative impact assessment will be undertaken for emissions generated during the construction of the Project and the overhead transmission line. The qualitative impact assessment will focus on identification of ways in which cumulative impacts may occur to the air quality VECs, and develop appropriate mitigation strategies. No further assessment required for emissions to air quality from operational activities.
Greenhouse Gases	With regard specifically to greenhouse gases and the nature of their impacts, none of the identified VECs will likely be directly impacted by either the Project or the external projects identified.	***Chapter 13*** considers the greenhouse gas emissions from the Project in the overall context of Myanmar.	No further assessment required as the existing impact assessment in ***Chapter 13*** is considered cumulative.
Noise	Representative noise sensitive receptors identified within ***Chapter 5.***	***Chapter 9*** presents the findings of the noise assessment for the construction and operation impacts from the Project. The approach is largely quantitative. The assessment takes into consideration the baseline survey	No further assessment required as impacts due to construction noise from the Project was assessed to be of Negligible Significance and therefore unlikely to contribute to overall cumulative impacts.

Impact Type	VECs Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
		results that captured noise levels from the nearby activities including the tin and tungsten mine site that was operational during the survey period. Cumulative impacts from tin and tungsten mine site have therefore been covered. Whilst there will likely be an overlap in construction activities of the Project and the overhead transmission line, the Project construction noise levels were predicted to have a Negligible Significance after implementation of mitigation measures. Furthermore, the nature of the transmission line construction is such that the construction at any one location along the selected alignment would only occur for a limited amount of time before moving to another location along the alignment. The duration of construction activities at any one location would typically range from a few hours to a few days. Therefore, the period where the construction activities of the Project and overhead transmission line coincide is expected to be temporary.	Cumulative impact assessment covering the Project operation activities and the nearby tin and tungsten mine site has been discussed in ***Chapter 9***.
Surface Water	Given the high dependency of the local community on a range of surface water bodies for domestic and agricultural purposes, surface water bodies in adjacent to the Project site, such as Heinze Chaung river, Mi Gyaung Auing Chaung river are considered as VECs.	***Chapter 10*** presents the surface water impact assessment for the Project. The assessment is largely qualitative and takes into consideration the existing baseline condition. Impacts associated with wastewater discharges, inappropriate waste storage	No further assessment required as impacts to surface water receptors due to the Project construction and operation activities were assessed to be of Negligible Significances and therefore unlikely to contribute to overall cumulative impacts.

Impact Type	VECs Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
		and disposal and pressure on local water supplies during construction and operation phases were assessed and these impacts were concluded to be of Negligible significances after implementation of mitigation measures.	
Soil and Groundwater	Soil is being used as topsoil of rubber plantations at the local community and is therefore considered as a VEC despite its low sensitivity. Given the dependency of the local community on groundwater for domestic purposes, the groundwater resource is defined a sensitive receptor and therefore considered as a VEC.	***Chapter 11*** presents the soil and groundwater impact assessment for the Project. The assessment is largely qualitative and takes into consideration the existing baseline condition. Impacts to soil and groundwater due to site clearance activities, erosion, improper construction waste storage and disposal, wastewater discharges and accidental leaks were assessed and these impacts were concluded to be of Negligible significances. Although not required due to Negligible significances, mitigation measures were recommended to further control and minimize the impacts to soil and groundwater due to Project construction and operation activities.	No further assessment required as impacts to soil and groundwater receptors due to the Project construction and operation activities are assessed to be of Negligible Significances and therefore unlikely to contribute to overall cumulative impacts.
Landscape and Visual	Representative visual sensitive receptors identified within Section 5.7.2.	The visual impact assessment outlined in chapter 12 was undertaken using a qualitative approach. The assessment considered baseline condition that included the tin and tungsten mine site. However, the presence of the	A qualitative impact assessment will be undertaken for visual impacts with regard to the Project and the overheard transmission line. The qualitative impact assessment will focus on identification of ways in

Impact Type	VECs Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
		transmission line infrastructure has not been assessed.	which cumulative impacts may occur to the Landscape and Visual VECs, and develop appropriate mitigation strategies.
Waste	VECs that will be impacted by liquid waste generated from the Project have been assessed in their respective aspects i.e. surface water, soil and groundwater. In addition to surface waterbodies, soil and groundwater, VECs that will be impacted by solid waste includes residents near waste disposal locations.	Chapter 16 describes the impact assessment in relation to solid waste generated from the Project. The types of construction waste that will be generated from the Project include biomass due to removal of vegetation onsite and construction waste such as concrete, steel pipes, used paint, engine oils etc. Cumulative assessment covering construction waste from the overhead transmission line development is to be assessed. The Project operation is expected to generate domestic waste and hazardous waste such as used chemicals. The impact assessment was performed in a holistic manner that included the existing waste streams from all surrounding developments. As such, cumulative assessment of operation phase is not deemed necessary.	A qualitative impact assessment will be undertaken for impacts in relation to construction waste from the Project and the overheard transmission line. The qualitative impact assessment will focus on identification of ways in which cumulative impacts may occur, and develop appropriate mitigation strategies. No further assessment required for waste generated from operational activities.
Biodiversity	VECs include ecological receptors unique to the local ecosystems, critical habitats, natural habitats and species of conservation.	Chapter 14 presents a detailed biodiversity impact assessment for the construction and operation phases of the Project. The assessment takes into consideration the baseline condition that included the tin and tungsten mine site. Impacts to biodiversity due to habitat loss, disturbance and displacement of fauna and flora, degradation of habitat	No further assessment required as impacts to ecological receptors due to the Project construction and operation activities are assessed to be of Negligible Significances and therefore unlikely to contribute to overall cumulative impacts.

Impact Type	VECs Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
		and mortality of resident were assessed. The Significances of these impacts were deemed Negligible after implementation of mitigation measures.	
Employment and Business Opportunities	VECs are mainly villages within the affected communes due to increased employment opportunities and in turn a boost to local business and economy.	***Section 15.4.1*** discusses positive social impacts from the Project to employment and economy during both the construction and operation phases. However, no discussion pertaining to cumulative impacts from other external developments/activities was made.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VECs, and develop appropriate mitigation strategies.
Community Health and Safety	VECs are mainly villages within the affected communes due to an increase in population associated with foreign worker influx.	***Sections 15.4.3 and 15.4.4*** present detailed assessments in relation to community health and safety during construction and operations phase. However, no discussion pertaining to cumulative impacts from other external developments/activities was made.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VECs, and develop appropriate mitigation strategies.

18.6 Air Quality Cumulative Impact Assessment

18.6.1 Project Impacts

The Project construction phase will involve various dust and particulate matter generation activities such as earthworks, concrete batching and vehicular movement along unpaved roads. The impacts to air quality due to emissions of dust and particulate matters was approached through a qualitative assessment considering a number of variables including, but not limited to the activities being undertaken, the duration of activities, the size of the site and the specific meteorological conditions at the time of the activity. The impact assessment concluded that the impacts of dust and particulate matter emissions from the Project construction activities will likely result in a Major Significance. The overall impacts are expected to be reduced to Minor Significance through the implementation of various mitigation measures including application of water suppression, provision of wheel washing bay, continuous monitoring of PM10 etc.

18.6.2 Relevant Cumulative Impacts with Other Projects

The overhead transmission line connecting to the Kanbauk substation will be constructed by the national/local authorities. Detailed information pertaining to the construction activities and timeline was not available to inform the CIA. However, it is likely that the construction activities of the overhead transmission line and the Project would coincide given that the overhead transmission line is an associated facility for the Project.

Given the lack of information at the time of writing, the overhead transmission line development was assumed to follow the construction method commonly adopted and this would comprise key phases such as vegetation clearance of selected alignment, structure foundation installation, erection of power tower and wire stringing. Various phases will involve ground disturbance/ soil exposing activities and this would result in dust and particular matter emissions. Given the close proximity of the overhead transmission line to the Project site, air quality impacts related to dust and other airborne particulates will likely accumulate.

18.6.3 Specific Mitigation Measures for Cumulative Impacts

Given the likelihood of cumulative air quality impacts during the construction phase, it is critical that the Project proponent and the party responsible for the construction of the overhead transmission line place emphasis on controlling their own emissions. Mitigation measures relating to dust and particular emissions should be effectively communicated to all EPC Contractors. In addition to this, the following mitigation measures will need to be applied to address cumulative impacts:

- Communicate, to the degree possible, with the contractor's undertaking development of the overhead transmission line through EPGE to determine when will be the period of greatest overlap in soil disturbing/exposing activities. Based on the information provided by contractors this will then be disclosed as part of regular stakeholder engagement activities; and
- The Projects grievance response plan will include provisions to monitor air quality impacts and respond to air emission related complaints accordingly.

18.7 Landscape And Visual Cumulative Impact Assessment

18.7.1 Project Impacts

The presence of the Project features, in particular structures with large dimensions would impact the existing landscape and visual environment. Mitigation measures were considered necessary to reduce the visual impacts, which include erection of hoarding during construction, careful design of lighting system for the Project site and plantation of trees and shrubs along Project boundary. The impacts are anticipated to be reduced after implementation of the mitigation measures.

18.7.2 Relevant Cumulative Impacts with Other Projects

A significant numbers of transmission towers would be erected at locations in adjacent to the Project site. The height of the transmission towers typically ranges between 15 to 55 m. Depending on the exact alignment of the transmission line; cumulative visual impacts could arise particularly if the alignment is positioned along existing vegetated areas.

18.7.3 Specific Mitigation Measures for Cumulative Impacts

It is understood that several considerations (e.g. safety) need to be given when considering the alignment of the transmission line. As such, no specific mitigation measures are proposed for cumulative landscape and visual impacts. The measures described within Chapter 12 are considered sufficient for the Project to reduce its own contribution to the overall landscape and visual impacts.

18.8 Waste Cumulative Impact Assessment

18.8.1 Project Impacts

The Project construction activities are anticipated to generate approximately 600 kg/day of solid waste and 135 kg/month of hazardous waste. As there is limited waste management network in the area, improper management of waste would likely lead to a significant impact. A range of mitigation measures have been developed to address the potential concern.

18.8.2 Relevant Cumulative Impacts with Other Projects

As discussed in Section 18.7.2, the construction of the Project and the overhead transmission line would likely overlap. There is a potential that the total amount of construction waste generated from these projects would be more than the aforementioned forecasts, especially if large scale of vegetation clearance is required for the development of the overhead transmission line.

18.8.3 Specific Mitigation Measures for Cumulative Impacts

The Project Proponent has committed to a large range of waste management measures, which will greatly minimize the overall contribution that it will make to cumulative waste impacts. In addition to this, the following measures will be implemented to ensure that the construction of the overhead transmission line will also be undertaken in a manner that limits cumulative impacts:

- Ensuring that both projects comply with all prevailing regulations for waste management is critical in minimizing the overall cumulative impacts. In this regard, the Project Proponent should, to the degree possible, work with local regulatory authorities to ensure that relevant regulations are being complied with; and
- The Project Proponent grievance response plan will include provisions to identify where the cause of grievance originates from another project, means to communicate this to the relevant project owner(s) and, if possible, a way to cooperatively ensure that the grievance is responded to and closed out.

18.9 Social Environment Cumulative Impact Assessment – Economy And Employment

18.9.1 Project Impacts

During the construction of the Project, it is estimated that up to 600 employment opportunities would be created and 80 employment opportunities during the operation stage. In addition, it was also identified that there would be opportunities for local businesses to provide goods and services both directly and indirectly to the Project.

The Project therefore has the opportunity to capitalize on local content opportunities to provide local people employment and business opportunities, all of which would result in positive impacts.

18.9.2 Relevant Cumulative Impacts with other Projects

The Project, when developed at the Project area, would provide a significant boost to the local and regional economics. There would be substantial opportunities for skilled and unskilled labor with both of these projects.

18.9.3 Specific Mitigation Measures for Cumulative Impacts

It is suggested for the Project Proponent to consider sharing information regarding its local content plan and skills training program with the nearby project owner(s). A collaborative and integrated approach can lead to better outcomes rather than each project undertaking their own separate activities and ensure that potential cumulative positive economic impacts are realized and appropriately distributed throughout the local population.

18.10 Social Environment Cumulative Impact Assessment – Community Health And Safety

18.10.1 Project Impacts

The potential impacts to community health and safety, which would be caused by the Project during operation, include the following:

- An increase in vehicles leading to a potential increase in road accidents.
- This is exacerbated by the fact that people living immediately adjacent to roads and not being used to the presence of large vehicles and heavy volumes of traffic. An increase in traffic volumes may also lead to increased exposure of the community to noise levels and potentially dust.
- Securing risks and health issues as a result of the influx of foreign workers;
- and
- The existing local healthcare facilities have limited capacity to respond to an increase in volumes or an increase in the transmission of communicable diseases, leaving the local villagers vulnerable.

18.10.2 Relevant Cumulative Impacts with other Projects

All of the impacts caused by the Project will likely be caused by other external developments/activities at the same time. This would mean that impacts caused by the Project, particularly with regard to traffic, in-migration and community health would be cumulative with the precise same impacts with the Project.

18.10.3 Specific Mitigation Measures for Cumulative Impacts

The best approach to manage cumulative impacts associated community health and safety with is through a collaborative approach between the Project Proponent, the relevant project owner(s), and the local government authorities.

18.11 CONCLUSION AND RECOMMENDATIONS

This RCIA has been prepared based upon the impact assessment presented within the ESIA, plus an understanding of external projects and natural stressors. Whilst presented mostly qualitatively, it has identified a number of cumulative impacts (grouped by impact type) on a range of VECs. Management and mitigation measures have been developed to mitigate these impacts. These rely upon the Project meeting all of its commitments with regards to implementation of the ESMP, plus adopting a collaborative approach to management of impacts with adjoining developments. This recognizes the fact that the Project owner, being committed to complying with international best practice, is well placed to try to positively influence the practices of other users in the area.

CHAPTER 19 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Through a systematic assessment, the ESIA has identified a number of significant environmental and social impacts which may potentially result from the construction and operation of the Project. In order to manage and mitigate these impacts, a range of measures have been developed to reduce the overall residual impacts to acceptable levels and as low as reasonably practicable. Implementing and tracking the effect of these management and mitigation measures is an essential element to ensuring that the assessed residual impact levels are confirmed.

19.1 Objectives

The key objectives of this Environmental and Social Management Plan (ESMP) are to:

- Collate the various mitigation and management measures developed throughout the ESIA into a single point;
- Identify all of the detailed management plans which will need to be developed for implementation throughout the various phases of the Project;
- Define monitoring requirements to determine the efficacy of all mitigation and management measures; and
- Provide clarity to all stakeholders as to what impacts have been identified, how they will be mitigated and managed, and through what means.

19.2 Scope Of This Esmp

The scope of this ESMP covers both construction and operation phases of the Project, which have the potential to affect, positively or negatively, the environment and communities in which the Project Proponent and/or its contractors/sub-contractors will operate.

For decommissioning, the detailed mitigation measures will be determined in details at later stage when the future of the infrastructures is known. In addition, a Decommissioning Management Plan framework will be developed.

As required by this ESMP, a range of detailed management plans will be developed and implemented for each specific phase of the Project. The responsibility for the implementation of these plans will lay variously with the Project Proponent, contractors and sub-contractors. It is noted that this is only a framework ESMP into which the full range of management and monitoring activities will eventually fit into.

In addition, it is to be noted that environmental, social and governance (ESG) considerations are embedded in the Project Proponent's business decisions and processes. The ESMP for the Project will also align with the Sustainability and HSE Policies of the Project Proponent, which are presented in contents 19.2.1 and 19.2.2, respectively. The Project will also follow these policies and specific actions will be planned to align with them.

19.2.1 Sustainability Policy of the Project Proponent

MUPA intends to provide the best service and experience to our customers while continuously improve the health, safety and environment quality. Our operation and practices lead to reduce the use of natural resources, efficient energy conservation and foster innovations technologies to add value for our customer, community and the plant.

MUPA is committed to performing, promoting, maintaining and improving a culture of sustainability practices and environmental responsibility.

MUPA believes that in the operational and procedural practices with innovation and efficiency, MUPA can provide and create the best performance and reduce adverse environmental impact as well as social and economic sustainability.

Source: MUPA, 2017

19.2.2 Health, Safety and Environment Policy of the Project Proponent

OUR COMMITMENTS

We have committed to effective implementation and maintain the business with reasonably practicable in health, safety and environment "HSE" policy and to continual improvement in our HSE performance.

HEALTH and SAFETY

We implement and manage health, safety and environment as the first priority. We inspire "Zero Accident" to all employee levels and all workplaces. Focusing on our employees and relevant stakeholders' responsibility and accountability for safe performance. Providing sufficient education and training to all person to realize and understand safety risks and health hazards and the potential impact on the environment.

ENVIRONMENT

We committed to the most efficient use of all resources, preventing pollution and minimize the environmental impact of our operation.

COMMUNITY

We strived to be valued corporate citizens in our communities. We committed to supporting children and youth for better education and opportunity and we always respect the values and cultural heritage of local people.

The company pledges to provide sufficiently resources and management supports to operation of the HSE Management System. Thus, strictly conduct of this policy is responsibility and duty of employees at all levels and all business partners.

Source: MUPA, 2017

19.3 Summary Of Impacts And Mitigation/ Management Measures

Key environmental and social impacts have been identified and reported in the following chapters:

- Chapter 8: Air Quality;
- Chapter 9: Noise;
- Chapter 10: Surface Water Quality;
- Chapter 11: Soil and Groundwater;
- Chapter 12: Landscape and Visual;

Chapter 13: Greenhouse Gas;
Chapter 14: Biodiversity;
Chapter 15: Social and Health;
Chapter 16: Waste;
Chapter 17: Unplanned Events; and
Chapter 18: Cumulative.

A summary of mitigation measures identified for the construction and operation phases of the Project is presented in *Table 19.1*. This also identifies lead responsibility for implementing the mitigation measures and sources of funds for such implementation. Many of the mitigation measures suggested during the construction phase of the Project are associated with good construction and housekeeping practices. Most of the mitigation measures for the operation phase (such as those for air emissions and noise generation) of the Project are already incorporated into the Project design specifications.

The construction phase of the Project is anticipated to start from July 2027 and be completed in the region of 36 months, whereas the operation phase of the Project is 30 years, as per the Power Purchase Agreement.

The Project Proponent will be responsible for ensuring that the mitigation measures in the ESMP are implemented throughout the life span of the Project.

19.4 Detailed Management Plan

Based upon the outcomes of the ESIA, detailed management plans are required to guide the Project Proponent and its contractors in the implementation of all mitigation and management measures. This is essential to ensure that the key outcomes of the impact assessment process are put in place throughout the life of the Project, and their overall efficacy tracked. These detailed management plans will be leveraged by EPC contractors in developing their own management plans. The management plans to be prepared are the Project Proponent and its Contactors commitment to the mitigation and management measures.

As identified with the summary of impacts and mitigation and management measures, the following detailed management plans are considered necessary to effectively implement the outcomes of the ESIA throughout the life of the Project:

- Air Quality Management Plan;
- Plant and Vehicle Management and Maintenance Plan;
- Traffic Management Plan;
- Noise and Vibration Management Plan;
- Soil and Groundwater Management Plan;
- Biodiversity Action Plan
- Waste Management Plan (Hazardous Waste);
- Waste Management Plan (Non-Hazardous Waste);
- Oil and Chemical Spill Contingency Management Plan;
- Emergency Response Plan (including Community Emergency Response Plan);
- Fire Management Plan
- Worker Occupational Health and Safety Management Plan;
- Stakeholder Engagement Plan (including Grievance Management Plan);
- Community Development Plan (CDP);
- Community Health Management Plan;
- Workers' Accommodation Management Plan;
- Local Recruitment and Procurement Plan;

- Influx Management Plan;
- Worker Training Plan (including Induction Training Program);
- Cultural Heritage Chance Find Procedure;
- Security Plan; and
- Decommissioning Management Plan Framework.

It is intended that these documents will be prepared to cover the site clearance and construction phases of the Project. Prior to operation commencing documents will be developed to cover the operation phase and when details are known for decommissioning, Decommissioning Management Plan Framework will be developed.

Specific plans will be disclosed to stakeholders at the appropriate time.

It is to be noted that commitments and framework for the implementation of Emergency Response Plan (ERP) and Stakeholder Engagement Plan (SEP), including Grievance Management Plan, have been disclosed to the relevant stakeholders during the public consultation during 28th – 31st March 2017.

19.5 ENVIRONMENTAL AND SOCIAL MONITORING PROGRAMME

Monitoring is a means verifying overall effectiveness of the management and mitigation measures contained within the management plans listed above. Key objectives of the monitoring process are to:

- Confirm effectiveness of management and mitigation measures;
- Ensure compliance with Applicable Standards (Myanmar NEQ, IFC Performance Standards and IFC EHS Guidelines) and the Project Proponent's objectives;
- Monitoring the status of, and impacts on, identified sensitive receptors;
- Provide an early warning that any of the control measures or practices are failing to achieve their desired performance and ensure changes can be implemented to remedy these practices;
- Determine whether environmental and social changes are attributable to Project activities, or as a result of other activities or natural variation; and
- Provide a basis for continual review and improvements to Project design and execution.

19.5.1 Performance Indicators and Monitoring Schedule

Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented in Table 19.2.

This includes the tentative parameters to be measured, methods to be utilized, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

However, it is to be noted that the detailed and specific monitoring measures will be developed and included within the relevant management plans. The monitoring components of the various management plans will be refined and finalized during plan development.

Impact monitoring will be undertaken during the life of the Project to verify the predicted levels of residual impacts from the Project and the effectiveness of the various management plans.

19.5.2 Reporting Mechanism for Environmental and Social Monitoring Programme

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flow of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Prior to the commencement of the construction activities, the Project Proponent will finalize the format and frequency for reporting on the status and progress of environmental and social monitoring.

During construction and operation phases, it is recommended that the report shall be submitted to the relevant authorities and funding agencies on a regular basis. Frequency will be agreed with relevant authorities and funding agencies.

According to the EIA procedure (2015), the project proponent shall submit the monitoring report to the relevant authorities every six months or as per the instructions of the Ministry of Natural Resources and Environmental Conservation during both the construction and operation phases.

The format will be designed to meet all the compliance conditions associated with the local and international requirements. The contractor will be required to submit the duly filled up reporting form on the agreed frequency to the Project Proponent.

Table 19. 1 Environmental and Social Management Plan of the Project

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
A	***Site Preparation and Construction Phase***							
1.1	Air Quality	Construction activities	Impact to air quality due to dust emissions	• Water suppression or surface binding agents on construction site and access road at least 2 times a day during dry season period. • Use of localized dampening and activity specific dampening should be used where movement of friable material occurs to reduce localized emissions of dust. • Where unpaved roads are utilized by vehicles, water suppression at a rate of two (2) liters/m^2/hr. should be used where rainfall of less than two (2) mm in the last hour has occurred or surface binding agents should be used to more permanently reduce dust generation, where vehicles are to use that road in the next hour. • Wheel washing should be used prior to entry onto a sealed road section to avoid tracking dirt onto sealed roads and generating dust. • Vehicles transporting dusty materials should be covered. • Stockpiling of material, for example, rocks, sand and soils should be minimized. • Stockpiles, machinery and dust causing activities should be located as far away from air sensitive receivers as possible. • The design of stockpiles should be optimized to retain a low profile with no sharp changes in shape; • Drop heights of material should be minimized. • Wind breaks should be erected around the key construction activities and in the vicinity of potentially dusty works. • Any impacts to air quality during the construction phase of the Project should be investigated, the cause determined and actions taken to reduce those emissions in a timely manner. • The main stack (33T/78RH-100GT) will be fitted with continuous emission monitoring capable of real-time measurement of NOx and transmitted to the operator control room • The stack shall be fitted with sampling platform and two sampling ports at 90 degrees. Sampling ports should be four-inch (minimum)	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				inner diameter threaded pipe connections with a cap.				
1.2	Air Quality	Operation phase	Impact to air quality due to NOx emissions	• Emission concentrations of NOx from the proposed power plant stack will not exceed those outlined and where feasible NOx concentrations should be reduced. • Emergency diesel generators will be designed, operated and maintained in line with the IFC General EHS Guidelines for Air Emissions and Ambient Air Quality (1) and will be situated as far as reasonably practicable from air sensitive receivers in the study area. • Continuous emission monitoring and real-time measurement of NOx.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
1.3	Air Quality	Monitoring	Impact to air quality due to dust and NOx, SO2 and PM emissions	• Monitoring of PM10 should be undertaken using hand-held monitors to confirm the effectiveness of the site controls during the site walkovers. • Weekly inspections for dust soiling should be carried out at receptors within 100m of the construction site boundary and results recorded. • Meteorological monitoring should be performed at one location, unaffected by site buildings etc. to inform use of mitigation on site during construction period.	Appointed EPC Contractor	Designated EHS team on site	Monthly monitoring report to the Project Proponent	EPC Contractor Cost
2.1	Greenhouse Gas	Construction activities including Operation of heavy machinery and transport vehicles	GHG emissions	• Implement the same mitigation measures to minimize impacts to Air Quality. • Develop and implement preventive maintenance plan for machines, and engines to ensure combustion efficiency. • Develop vehicle maintenance plan.	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost
2.2	Greenhouse Gas	Monitoring	GHG emissions	• Conduct annual pollutant release inventory to monitor the GHG emissions from the Project. The GHGs emission shall be reported as CO2eq unit. • Where feasible, arrange emissions offsets (including the Kyoto Protocol's flexible mechanisms and the voluntary carbon market), including reforestation, afforestation.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Annual internal reporting	Project proponent Cost
3.1	Surface	Wastewate	Impacts to surface	• Install silt trap to treat surface run-off from bunded areas prior to discharge to the stormwater system.	Appointed	On site	Monthly	EPC

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
	Water Quality	r Discharges and Runoff	water due to wastewater discharges and runoff, inappropriate waste storage and disposal, and water use	• Implement adequate sanitary facilities for the construction workforce. • Liquid effluents arising from construction activities will be treated to the applicable IFC guideline prior to discharge. • Exposed soil surfaces should be protected by paving or fill material as soon as possible to reduce the potential of soil erosion and subsequent sedimentation. • Use methods for minimizing sediment runoff, as appropriate to the conditions on-site, including: • wheel cleaning facilities, sand bag barriers, mulching, and re-vegetation, protect temporary trafficked areas on-site with coarse stone ballast or equivalent, open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. • Regularly, and particularly following rainstorms, inspect and maintain drainage systems and erosion control and silt removal facilities to ensure proper and efficient operation at all times. • Surface run-off from bunded areas should pass through oil/water separators prior to discharge to • the stormwater system. • Oil-contaminated water, if any, will be collected and handled by local licensed wastewater sub- contractors (if available, to be determined at a later stage). • Provide training to laborers for waste disposal in designated areas and use of sanitation facilities. • Implement proper storage of the construction materials and wastes to minimize the potential damage or contamination of the materials. • Ensure that storage areas have impermeable floors and containment, of capacity to accommodate • 110% of the volume of the largest waste container. • Implement construction materials inventory management system to minimize over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period. • Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odor nuisance).	EPC Contractor	Project Management team and designated EHS team	report to the Project Proponent	Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Dispose of waste by appropriate contractors. Install oil/water separators to treat surface run-off prior to discharge to the stormwater system. • Implement adequate sanitary facilities for onsite personnel. • Install onsite wastewater treatment facilities or processes such as filtration, flocculation or biochemical treatment before discharge.				
3.2	Surface Water Quality	Operation phase	Impacts to surface water due to Wastewater Discharges and runoff, and inappropriate waste storage and disposal	• Liquid effluents arising from operations will be treated to the applicable NEQ and IFC guideline prior to discharge. • Conduct monitoring of temperature at the cooling water discharge point at a frequency of once every 15 days. • Implement discharge system shutdown in event that discharge temperature of effluent exceeds standard. • Efforts to be made to increase the cycle of concentration to reduce the volume of blow down and consequently the volume of make-up water required by the cooling tower. • Stormwater drainage and wastewater will be treated in accordance to the applicable WB/IFC EHS Guidelines for Thermal Power Plant (2008). • Separated oil will be disposed of as part of oily wastes and handled as a hazardous waste stream. • The treated de-oiled water will be discharged with the plant wastewater. The Project will study the possibility to transfer to cooling water basin and used as part of cooling water stream during detailed engineering. • The sewage from the entire plant area will be collected and treated in a sewage treatment plant • (STP). No untreated sewage will be directly discharged into the Heinze River or surrounding the site, or disposed of on land, for the duration of the project life cycle. • In order to monitor STP performance, continuous evaluation and monitoring of discharge • parameters will be undertaken at the outlet point of STP. • Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odor nuisance).	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Store wastes in closed containers away from direct sunlight, wind and rain. • Store waste systematically to allow inspection between containers to monitor leaks or spills. • Ensure that storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container. • Dispose of waste by appropriate contractors.				
3.3	Surface Water Quality	Operation Phase	Pressure on local water supply due to Project's water intake requirements and increased impervious surfaces	• The Project commits to comply with following WB/IFC EHS Guideline measures or equivalent of them that are pertinent to river water intake systems. • Ensure that drainage channel has enough capacity to accommodate the increased rainfall runoff from the Project's impervious surface.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
3.4	Surface Water Quality	Monitoring of surface water quality	Impacts to surface water due to wastewater discharges and runoff, inappropriate waste storage and disposal, and water use	• As detailed in the ESMP chapter, monitoring for surface water during the construction phase should consist of half-yearly monitoring up and downstream of the pumping station in the Heinze River, using standard analytical methods.	EPC Contractor through 3rd Party Environmental Consultant	On site Project Management team and designated EHS team	Monitoring report to the Project Proponent	EPC Contractor Cost
3.5	Surface Water Quality	Monitoring of surface water quality	Impacts to surface water due to wastewater discharges and runoff, inappropriate waste storage and disposal, and water	• As detailed in the ESMP chapter, monitoring for surface water during the operation phase should consist of the following: ○ Temperature monitoring at cooling water discharge point, bi-weekly, using standard analytical methods. • Quarterly monitoring at wastewater discharge point, using standard analytical methods.	Project Proponent or LTSA through 3rd Party Environmental	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
			use		Consultant			
4.1	Noise	Overall construction activities inc. heavy machinery operations for construction works	Increase in ambient noise levels	• The use of noise barriers will be an effective means to mitigate the noise impact arising from the construction works. ○ Noise barriers should be installed at the site boundary (facing the villages) and high enough which completely hides the noise sources from the NSR. ○ The noise barrier material should have a superficial surface density of at least 7kg/m^{-2} and have no openings or gaps. • Well-maintained equipment to be operated on-site. • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components. • Shut down or throttled down between work periods for machines and construction plant items (e.g. trucks) that may be in intermittent use. • Reduce the number of equipment operating simultaneously as far as practicable; • Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors far as practicable. • Locate noisy plant (such as hydraulic hammer and lorry mounted concrete pump) as far away from receptors as practicable. • Avoid transportation of materials on- and off-site through existing community areas; and • Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.	Appointed EPC Contractor	On site Project Management team and designated EHS team	Monthly report to the Project Proponent	EPC Contractor Cost
4.2	Noise	Operation phase	Increase in ambient noise levels	Other than implementation of noise barriers and installation of silencers, good site practices are recommended to be implemented by the EPC contractor to minimize the potential noise impacts during the operation phase, including: • Selecting equipment with lower SWLs. • Improving the acoustic performance of constructed buildings, apply sound insulation. • Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas. • Re-locating noise sources to less sensitive areas to take advantage of	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				distance and shielding. • Installing vibration isolation for mechanical equipment. • Installing acoustic enclosures for equipment casing radiating noise. • Siting permanent facilities away from community areas if possible. • Taking advantage of the natural topography as a noise buffer during facility design. • Reducing noise of ground operations at the source or through the use of sound barriers and deflectors.				
4.3	Noise	Monitoring	Increase in ambient noise levels	• Monthly noise monitoring should be conducted at the representative NSRs by the EPC contractor to check noise levels and compliance at the NSRs throughout the construction phase. • Noise commissioning test should be conducted for the operation plant items by the EPC contractor prior to the operation of the Project to ensure compliance with the relevant noise criteria at the representative NSRs.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
5.1	Landscape and Visual	Construction activities	Visual impacts due to construction activities and the construction of project infrastructure	• For temporary earthworks areas, including outside the Project site, minimize clearing of vegetation as far as practical • Reinstate temporary areas outside the Project site (if any) • Good construction practice, including hoarding of construction site(s) • Landscape extensive areas within the proposed site with a variety of planting • Manage lighting of construction site(s) and any flare testing activity to consider minimization of light pollution/ light spill ○ e.g. minimize test flaring activity and conduct during the day ○ e.g. Use shielding, directional alignment and window coverings (eg at worker accommodation) that minimize external visibility of indoor lighting ○ e.g. Minimize lighting use and light intensity to as low as reasonably practicable	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
5.2	Landscape and Visual	Operation phase	Visual impacts during operations due to the physical presence of new facilities, light emissions (including any flaring) and disturbance.	• Careful design to contain light to areas that need illumination and prevent light spill/ glare e.g. consider: ○ Shielding, directional alignment and window coverings that minimize external visibility of indoor lighting. ○ Minimize lighting use and light intensity to as low as reasonably practicable. • Careful design to improve aesthetics e.g. consider:	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				○ Texture of building material to blend with landscape/sky. ○ Paint/ Treat large components (e.g. flare stack, offices, storage buildings, stacks) to blend in with the landscape/sky. ○ Establishing viewing corridors between buildings to maintain view through the site/ to key views such as pagodas etc. • Manage lighting on site and flare activity to consider minimization of light pollution and horizon glow. • Maintain all facilities in good repair. • Ensure trees/ shrubs are planted along the boundary of the site to act as screening. • Ensure all soft landscaping within the site is well maintained. Replace any soft landscaping if not in good health.				
5.3	Landscape and Visual	Monitoring	Visual impacts from construction activities and operation of the Project	• General site inspections during construction. • Preparation of a landscape plan for the proposed Project Site. • Preparation of Lighting Management Plan for construction activities. • Preparation of Lighting Management Plan for operation of the CCPP Plant. • Ensure the Water Supply site is included in Landscape Plan prepared for the whole Project. • Ensure the Water Supply facilities are included in Lighting Management Plan prepared for the whole Project.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
5.4	Landscape and Visual	Monitoring	Visual impacts from construction activities and operation of the Project	• Preparation of Lighting Management Plan for operation of the CCPP Plant. • Ensure the Water Supply facilities are included in Lighting Management Plan prepared for the whole Project.	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
6.1	Waste	Disposal of Removed Biomass	Impacts due to improper disposal of removed biomass	• No vegetation is to be disposed of by burning under any circumstances. • Generally, biomass such as trees, shrubs and grass are utilized by the local community for a variety of purposes. • MUPA will engage with the local community to ensure that they are provided with priority access to all of the biomass. In order to ensure public safety and limit access to the site, MUPA will first clear of the biomass and store it in a designated area where the local community are easily able to access it.	Appointed EPC Contractor	On site Project Management team	Report to the Project Proponent during site clearance	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Any biomass not taken by the local community biomass is to be appropriately stored (or immediately mulched) for later use within site stabilization and rehabilitation activities.				
6.2	Waste	Solid Waste Generation, Storage and Disposal during construction	Impacts to community and worker health and safety due to contamination of drinking water or food Accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters Soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored.	• All waste collection and storage measures as detailed within Chapter 9 and Chapter 12 (Surface Water, Soil and Groundwater) will be implemented. • Prior to construction commencing, MUPA is to engage with local authorities and other stakeholders to determine the capacity of the local waste management network to absorb the new waste streams during construction. • A waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the construction phase for all of the waste streams identified. • Education of all workers on site shall be undertaken to avoid, reduce and reuse wastes generated. • Waste disposal facilities shall be sited and signposted throughout the construction site. • Waste clean-up measures are to be undertaken on at least a fortnightly basis to collect any waste or unused materials from the construction site. All waste collected should be managed and disposed of in accordance with the accepted best practice for waste collection and disposal. • Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing IFC requirements. • Monitoring of appointed waste contractors using chain-of custody documentation for the disposal of waste to ensure that it is able to be disposed of in an environmental responsible manner and in accordance with all prevailing regulations. • The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.	Appointed EPC Contractor	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
6.3	Waste	Solid Waste	Impacts to community and	• All waste collection and storage measures as detailed within Chapter 9 and Chapter 12 (Surface Water, Soil and Groundwater) will be implemented.	Project Proponent or	On site Project	Monthly internal	Project proponent

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
		Generation, Storage and Disposal during operation	worker health and safety due to contamination of drinking water or food Accidental leaks or spills of oil, fuel or other hazardous materials could potentially pollute surface waters Soil may be contaminated by pollution from spills or leaks of fuel, oil and other hazardous liquid wastes which are incorrectly stored.	• An operation waste management plan is to be developed which includes specific requirements to manage, avoid, reduce and reuse waste during the operation phase for all of the waste streams identified. • Education of all employees on site shall be undertaken to avoid, reduce and reuse wastes generated. • Waste disposal facilities shall be sited and signposted throughout the site. • Waste clean-up measures are to be undertaken on at least a fortnightly basis to collect any waste. All waste collected should be managed and disposed of in accordance with the accepted best practice for waste collection and disposal. • Contractors employed to manage the waste should clearly identify within their bidding documents how the collected waste will be managed. All end points for collected waste are to be inspected and audited and noted to be developed such that all waste is able to be disposed of in an environmental responsible manner and in accordance with all prevailing NEQ and IFC requirements. • Monitoring of appointed waste contractors using chain-of custody documentation for the disposal of waste to ensure that it is able to be disposed of in an environmental responsible manner and in accordance with all prevailing regulations. • The appointed waste contractor shall report on an annual basis on any cross-boundary transport of waste.	LTSA	Management team and designated EHS team	reporting	Cost
6.4	Waste	Monitoring	Impacts of solid waste generation, storage and disposal upon the existing waste management network during construction, operation and maintenance	As specified in the ESMP, monitoring of waste during both the construction and operation phases should consist of the following: • Monitoring of waste segregation, transportation and disposal practices in the Project activity areas and disposal location, as to be defined in a Waste Management Plan to be prepared specifically for the Project. • Monitoring of appointed waste contractors using chain-of custody documentation, as to be defined in a Waste Management Plan to be prepared specifically for the Project.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost during Construction; The Project Proponent (Operator) Cost during Operation

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7.1	Soil Quality	Construction activities	Impacts to soil due to topsoil loss	• Delineation of clearance boundaries to limit the areas to be cleared. • Scheduling clearance activities (if possible) to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Revegetation areas with temporary land use, conducting progressive rehabilitation. • Demarcate routes for movement of heavy vehicles to minimize disturbance of exposed soils and compaction of sub-surface layers. • Reuse topsoil as much as possible within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins. And • Where topsoil is to be stored for later use in rehabilitation activities, the following basic principles are to be applied. • Stockpiles to be separated into topsoil and sub-soil and be located at least 50m from any surface water source or groundwater well. • To the extent possible, stockpiles are to be located in areas surrounded by natural wind barriers to minimize the potential for wind erosion. • Stockpile storage areas are to be prepared in advance of the removal of topsoil as much as possible. • Topsoil heights are to be restricted in height to 2m above ground level to minimize wind erosion, and they are only to be partially compacted on the upper layer in order to promote aeration, maintain soil vertical structures, reduce runoff and encourage infiltration.	Appointed EPC Contractor	On site Project Management team	Route plans and top soil management inventory submitted to EHS and Project Management team	EPC Contractor Cost
7.2	Soil and sediment Quality	Operation phase	Impacts to soil due to loss of soil due to increased erosion potential	• Ensure that drainage channel have enough capacity to accommodate the increased rainfall runoff from the Project's impervious surfaces	Project Proponent or LTSA	On site Project Management team and designated EHS team	Monthly internal reporting	Project proponent Cost
7.3	Soil and sediment Quality	Monitoring	Impacts to soil due to loss of soil due to increased erosion potential	As detailed in the ESMP chapter, monitoring for soil during the operation phase should consist of half-yearly monitoring at locations of accidental spillage, waste storage areas, using standard analytical methods. • No groundwater monitoring is anticipated to be required during the operation phase.	Project Proponent or LTSA	On site Project Management team and designated	Half yearly internal reporting	Project proponent Cost

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						EHS team		
8.1	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Loss of habitat	• Strict rules against clearing vegetation will be imposed on all Project staff, workers, and all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws. • The Project Proponent shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning restrictions related to unauthorized clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violate rules and regulations. • The planned clearance area for the construction and operation works shall be clearly identified and marked to avoid accidental clearing. • Use of the access road should be restricted to construction and operation vehicles only. Checkpoints should be used to manage access and inspect vehicles for timber and forest products taken from the Project Area.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.2	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Disturbance to fauna behaviors	• Operational vehicles will be maintained in accordance with industry standard to minimize unnecessary noise generation. • Traffic signs will be maintained on all roads depicting speed limits. • Access to facilities, including the access road should be restricted to operational vehicles only. • For operational areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible. And • Commitment will be made to raise awareness of the operator work force regarding flora and fauna values and make arrangements for restriction of hunting and poaching.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.3	Terrestrial and Marine	Site Preparation and	Impacts to species of conservation significance	• Management measures for the population of *Sonneratia griffithii* are to be outlined in a Biodiversity Action Plan; • Individuals of *Sonneratia griffithii* are to be marked in the Project Area and avoided during construction and operation;	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site	Monthly report to the Project	EPC Contractor Cost

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	Biodiversity	Construction activities		• During construction, monthly inspections are to occur of the intertidal zone for any impacts from construction activities on individuals of *Sonneratia griffithii*. Where impacts are detected, measures must be undertaken to rectify the source of the impacts.		Project Management team	Proponent	
8.4	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Degradation of habitat	• Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction and camp areas. • For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilize disturbed soil surfaces. • Oil, chemical and solid waste will be stored, and handled and disposed of by appropriate waste management contractors. • Invasive species management measures should be implemented in accordance to avoid introduction of weeds to natural and modified habitat areas. • Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to limit noise and dust generation. • Construction and operation materials and chemicals will be appropriately secured to avoid accidental release to the natural environment (wind and water erosion).	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
8.5	Terrestrial and Marine Biodiversity	Site Preparation and Construction activities	Mortality of resident species through vehicle/ machinery strike as well as hunting/ poaching	• Speed limits to maximum of 40 km/hr for construction and operation vehicles will be enforced to minimize potential for fauna strike. • Commitment will be made to raise awareness of values of important species and habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection by staff. • Access restriction should be applied to Project facilities for non-construction and operation vehicles. • Hunting wild animals will be strictly prohibited for all staff. • Fishing and using of illegal fishing gear anywhere along the stream will be prohibited.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

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9.1	Occupational Health and Safety	General construction activities	Health and safety of construction workforce	The Project will develop and implement an Occupational Health and Safety Management Plan (OHSMP) in line with good industry practice and corporate policies. • The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilisation, construction sequence and safety arrangements. • Measures will be implemented to reduce the likelihood and consequence of the potential hazards. • A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site. • Competent and adequately resourced sub-contractors will be used where construction activities are to be sub-contracted. • All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor. • The Contractor will prepare and implement a Health and Safety Plan prior to commencing work.This plan will include method statements for work activities, plant utilisation, construction sequence and safety arrangements. • All workers will be properly informed, consulted and trained on health and safety issues. • Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips. • Before starting work all the appropriate safety equipment and the first-aid kits will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the manufacturer. • All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded. • All scaffolding will be erected and inspected in conformity with the Factories Act (1951) and the appropriate records maintained by the Contractor. • Safety hoops or cages will be provided for ladders with a height in	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

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				excess of two meters. • When there is a risk of drowning lifebelts shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are present when work is proceeding (near the temporary jetty site). • All breathing apparatus, safety harnesses, life-lines, reviving apparatus and any other equipment provided for use in, or in connection with, entry into Confined Spaces, and for use in emergencies, will be properly maintained and thoroughly examined at least once a month, and after every occasion on which it has been used. • Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate a Leq of more than 85 dB(A). When hearing protection is used, arrangements will be made to ensure the wearers can be warned of other hazards. • The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations. • The EPC contractor will comply with the IFC Performance Standard 2 Requirement 1: Environment for labor and working conditions. • Develop and monitor an internal standard to guide labour practices and apply this to supply chain to ensure that no child and/or forced labour will be employed by the EPC contractor and its sub- contractors.				
9.2	Occupational Health and Safety	Monitoring and review of accidents/ incidents due to construction activities; workers' health		• Yearly review of training log to confirm all employee are trained on the company H&S standard; • Monitoring and review of accidents/ incidents due to construction activities; workers' health by daily monitoring and monthly review of near-misses, incidents, occupational diseases, dangerous occurrences, accidents at project activity areas and construction workers camp, as per construction phase Health and Safety Plan, which will be prepared by the EPC contractor. • Development of the Occupational health and safety monitoring and surveillance programme.	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost
10.1	Community Health	Influx of construction workers	Increased prevalence of disease	• Training for all workers on the transmission routes and common symptoms of communicable diseases. This can help reduce the potential for workers to unknowingly transmit communicable diseases. This may also help to increase knowledge within Project area villages	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site	Monthly report to the Project	EPC Contractor Cost

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				– e.g. through the training of workers that have been sourced from the local villages. • Establish amenities at the camp to help minimize the interaction between the workforces (particularly temporary construction workers) and local villagers. This includes recreation facilities and health care infrastructure. • Establish a workforce code of conduct. Include in the code specific measures that target anti-social behaviors, such as becoming involved with commercial sex workers. • Undertake pre-employment screening to ensure fitness for work. It is important that the pre- screening process does not result in discrimination, but instead is used as a tool to minimize the transmission of communicable diseases. • Vector management procedures, including measures to reduce the presence of vector habitat and consideration of whether pesticides will be utilized to reduce the presence of vectors onsite. • Provision of onsite health care and medical facilities, to ensure that basic medical attention and first aid treatment can be sought during the hours that the work is being undertaken at the Project site. This will also help reduce the potential pressure on local health care facilities. • Pre-placement medical examination of all workers, supported by periodic medical examinations. A regular voluntary Worker Medical Screening Program onsite and a Monitoring and Evaluation (M&E) system. In addition, a workplace policy and training and awareness programme on risks described above and prevention and mitigation of HIV impacts will be implemented with Project staff. • In collaboration with the local and regional Government, local emergency providers and local health care facilities, MUPA will develop and implement Emergency Prevention, Preparedness and Response Plans (EPPRPs) to cover all incidents presenting risks to public safety and the affected communities in proximity to the Project Sites and the environment. • Develop and implement a Workforce Code of Conduct. The Workforce Code of Conduct will be adhered to by all Contractors and MUPA employees. Any employee or Contractor found in violation of the Code shall face disciplinary hearing which may result in dismissal.		Project Management team	Proponent	

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Ensure there is access to free condoms (including female condoms) at the worker camp to promote safe sexual practices. • In partnership with local health officials and relevant NGOs, MUPA will undertake information, education and communication campaigns around hygiene, sanitation, safe sexual practices and transmission of STIs and HIV/AIDS as well as condom distribution (including female condoms). • Conduct information, education and communication campaigns amongst Project personnel on hygiene and sanitation. • Where appropriate the community health management plan should be implemented in close coordination with government authorities and local health care providers. • In addition to the community health plan, it is recommended that a complementary occupational health and safety plan be developed – to focus on managing potential issues that may affect the Project workforce. The plan should include measures to minimize the potential for the workforce to contract a communicable disease. This will help reduce the potential for the workforce to contract • a communicable disease and subsequently introduce the disease in their home village/ community.				
11.1	Community Safety and Security	Construction activities, construction material transportation	Community disturbance and potential safety hazard due to road traffic	• Develop and implement a traffic management plan. The plan should set out measures to minimize the risks associated with transporting materials, goods, and workers to and from site. This includes: ○ Restrictions on vehicle speeds. ○ fatigue management ○ Forbidding non-Project passenger transport. ○ Forbidding alcohol and drug use (including Bettel). ○ Forbidding reckless driving. ○ Forbidding cellular telephone use whilst driving. ○ Forbidding stopping at any location except MUPA controlled compounds. And ○ General safe driving practices. • Ensure all employees complete training prior to driving any Project vehicles. The content of the training should be tailored to the employee's role. • Explore opportunities to work with local stakeholders to increase	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				awareness within local villages about the hazards associated with traffic. • Provide appropriate training for security personnel and monitor implementation of the training over time (to minimize any potential use of excessive force). • Develop and implement waste management plan. The plan should set out procedures for appropriately managing and disposing of hazardous materials and other forms of waste. • Develop and implement a Road Safety Awareness Campaign. MUPA will implement a road safety awareness campaign in the Project SAoI to improve community knowledge of the dangers of industrial road traffic and safe behaviors in and around roads. This programme will be implemented with a suitable and experienced local partner or NGO and in partnership with the local government. Such a program may be targeted at schools to help disseminate road safety information to children who may be particularly vulnerable to vehicle traffic. • MUPA will establish a livestock compensation framework that defines the process and rates for compensation for livestock that are injured or killed in Road traffic accidents. The Project Stakeholder Engagement Programme will include engagement activities with potentially affected communities to discuss and agree this framework. • MUPA will implement a stakeholder engagement, consultation and information disclosure process prior to use of the proposed road connection during construction. This will allow stakeholders to understand the upcoming increases in vehicle traffic, the plans for vehicle movements and driving policies, and to provide feedback on construction / transportation plans. • MUPA will establish an Emergency Response Plan (ERP) for the Project SAoI that details the agreed protocols, process, engagement and investigation processes for various relevant potential emergencies (Road Traffic Accidents - RTAs, spillage etc.). The ERP will include management and monitoring requirements as well Key Performance Indicators (KPIs) related to emergencies and emergency response. • Develop and communicate to local community the Grievance				

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				mechanism to report grievance from local population and employee regarding the Project activities.				
11.2	Community Safety and Security	Construction activities	Impacts on local infrastructure	Provide appropriate amenities at the workforce accommodation camp – e.g. recreational opportunities. This will help reduce the need for workers to utilize local infrastructure and services. • MUPA will ensure that company medical services have sufficient capacity and capability to treat a reasonable number of workers at the same time. • Develop and implement a Worker Code of Conduct for all employees, contractors and visitors directly related to the Project. This will be a contractual and enforced requirement for all staff and subcontractors. • MUPA will communicate on its recruitment approach emphasizing that priority for unskilled position will be given to inhabitant from local villages. • MUPA will engage with local authorities and public service providers to discuss specific influx impact calming measures and to develop a Project in-migration plan. • MUPA will conduct a traffic survey on the Pyin Gyi to Kanbauk road and develop the design of the road to ensure other users can still benefit from the road. • Develop and implement a traffic management plan to minimize the impact experienced by road users as a result of the Project. The traffic management plan should be developed in consultation with local stakeholders. Stakeholders should be notified in advance of the Project commencing of traffic routes that will be utilised and, where known, periods of increased traffic volumes. Where possible, traffic movements will be coordinated so as to limit disruptions to local activities. • Develop and implement a social investment/ corporate social responsibility plan/ program in consultation with local stakeholders. As part of the plan, MUPA should explore opportunities to enhance community infrastructure and services. And	Appointed EPC Contractor	EHS Division of the Project Proponent and on-site Project Management team	Monthly report to the Project Proponent	EPC Contractor Cost

Sr. No.	Project Stage/ Affected Aspect	Project Activity and Affected area	Potential Impacts	Proposed Mitigation Measures (if applicable)	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements	Mitigation Cost Source
				• Develop and implement a community health management plan and an occupational health and safety plan in consultation with relevant stakeholders (e.g. local health practitioners). These plans will ensure that appropriate and adequate health care services are provided on site and at the accommodation camp to address/ manage worker illnesses and injuries.				
12.1	Employment and Economy	Construction, operation and decommissioning	Employment Opportunities and opportunities for local business	In order to maximize the benefits from this impact for the local population, wherever possible, the workforce will be sourced from areas close to the Project after a training and selection process and thereafter at a regional or national level. Given that levels of educational achievement and formal employment experience in relevant sectors is low within the SAoI, it is assumed that the majority of the available local labor may be unskilled or at most semi-skilled. The Project will develop a Sourcing, Procurement and Recruitment Management Plan which will be developed for this Project with the aim to promote benefits to locals from recruitment and procurement activities for the Project (including information, training, and engagement). A key element of this will be to promote equal opportunity and non-discrimination throughout the recruitment and procurement process.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent and monthly internal reporting during operation and decommissioning	EPC Contractor Cost during Construction; The Project Proponent (Operator) Cost during Operation
13.1	Cultural Heritage	Construction, operation and decommissioning	Impact on cultural heritage buildings and access to Monastery.	• The EPC contractor during construction and the Project proponent during operations will monitor the state of religious buildings near the Project sites, in particular the monastery closest to the Water Intake facility. If damages are done to the buildings, compensation (in kind or in cash) should be organized to restore the building to its state before the damage occur. • The EPC contractor will develop the construction planning for the water intake pipeline in discussion with the monastery in Pyin Gyi in order to make sure that the pipeline laying activities near the monastery do not take place during special religious activities. • The EPC contractor will maintain access to the monastery during the pipeline laying activities and limit the time at which the principal access is blocked by the trench digging and pipeline laying activities.	Appointed EPC Contractor/ Project proponent or LTSA	On site Project Management team	Monthly report to the Project Proponent and monthly internal reporting during operation and decommissioning	EPC Contractor Cost during Construction; The Project Proponent (Operator) Cost during Operation

According to the EIA procedure (2015), the project proponent shall submit the monitoring report to the relevant authorities **every six months** or as per the instructions of the Ministry of Natural Resources and Environmental Conservation during both the construction and operation phases. In that EMoP report, the following contents must be included;

- Parameters to be Monitored for each Environmental Quality
- Methodologies, Measured Equipment, and Sampling Methods for each Parameter
- Specific locations (Coordinates) for each environmental component
- Descriptions for Environmental Conditions of where measurements conduct
- Related Guidelines for each environmental component
- Comparison results of monitoring results for previous and present conditions with technical assessments and judgements
- Recorded photos for each measurement

Table 19. 2 Environmental and Social Monitoring Programme

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Site Preparation and Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas and construction workers camp	Visual inspection of all active work areas	Daily	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Air Quality	Ambient Air Pollution	1-hour and 24- hour averaged NO_2 and SO_2 24-hour averaged $PM_{2.5}$, PM_{10}	1. (AQM1: 14º 35' 39.20" N, 98º 01' 30.00" E, Hle Kon Ward, Kanbauk Village) (Baseline AQ Measurement) 2. (AQM2: 14 º 36' 15.43" N, 98 º 01' 40.05" E, Migyaung Aing Ward, Kanbauk Village) (Baseline AQ Measurement) 3. (AQM3, 14 º 37' 28.10" N, 98 º 02' 49.40" E, Shinpyan Village, Ye Pyu	24-hour measured by EPAS-Haz Scanner	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (6,000,000 MMK/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			Township) (Baseline AQ Measurement) 4. Construction Site of Proposed Project (14°36'40.25"N, 98° 1'51.41"E) 5. Construction Area of Water Intake Facility (14°38'18.15"N, 98° 1'14.27"E) 6. Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)				
Noise Level	Increase in ambient noise levels*	Noise levels in Leq, Leq day, Leq night and hourly Leq	1) (AQM1: 14º 35' 39.20" N, 98º 01' 30.00" E, Hle Kon Ward, Kanbauk Village) (Baseline AQ Measurement) 2) (AQM2: 14 º 36' 15.43" N, 98 º 01' 40.05" E, Migyaung Aing Ward, Kanbauk Village) (Baseline AQ Measurement) 3) (AQM3, 14 º 37' 28.10" N, 98 º 02' 49.40" E, Shinpyan Village, Ye Pyu Township) (Baseline AQ Measurement) 4) Construction Site of Proposed Project (14°36'40.25"N, 98° 1'51.41"E) 5) Construction Area of Water Intake Facility	24-hour measured by Digital Sound Level Meter	Quarterly	Third Party hired by the Project Proponent	EPC Contractor Cost (300,000 MMK / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			(14°38'18.15"N, 98° 1'14.27"E) 6) Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)				
	Workers Health*	Noise levels in Leq	Identified location within the construction area	24-hour measured by Digital Sound Level Meter	Monthly	EPC Contractor	EPC Contractor Cost (included in Capex cost)
Soil	Contamination of soil*	pH, salinity, NH_4, total P, heavy metals	1. Construction site or laydown area or spill area 2. Baseline Soil Condition Construction Site of Proposed Project S1: (14°36'45.00"N, 98° 1'51.65"E)	Standard analytical methods**	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	Third Party hired by the Project Proponent	EPC Contractor Cost (2,000,000 MMK / time)
Surface Water	Contamination of surface water*	pH, Electrical Conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg); Arsenic (As).	1. Heinze Chaung River (upstream of the pumping station, 14°38'24.10"N, 98° 1'14.86"E) 2. Heinze Chaung River (Downstream of the pumping station 14°38'23.62"N, 98° 1'4.14"E) 3. Mi Gyaung Aing Chaung (upstream, 14°36'23.61"N, 98° 1'51.47"E) 4. Mi Gyaung Aing Chaung (downstream, 14°36'25.90"N, 98° 1'47.80"E)	Standard analytical methods**	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (3,500,000/time)
Ground Water	Ground Water Pollution	pH, EC, Dissolved Oxygen, Turbidity, BOD, COD, Total Nitrogen, Total Phosphorus, Oil &	1. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N)	Standard analytical method**	Once a year	Third Party hired by the Project Proponent	EPC Contractor Cost (2,400,000 MMK/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb), Mercury (Hg), Arsenic (As).	2. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 3. One village house at Pyin Gyi (14°38'15.38"N, 98° 1'3.44"E) 4. One village house at Mee Kyaung Aing (14°36'33.91"N, 98° 1'43.50"E)				
Sedimentation	Sediment Contamination*	pH, salinity, NH_4^+, total P, heavy metals, TSS	1. Locations, to be defined on a case-by-case basis. 2. Construction Area of Water Intake Facility (14°38'18.15"N, 98° 1'14.27"E) 3. Construction Area of Temporary Jetty (14°38'23.05"N, 98° 0'51.34"E)	Standard analytical methods**	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals Frequency to be defined on a case-by-case basis.	Third Party hired by the Project Proponent	EPC Contractor Cost (3,600,000MMK/ time)
Occupational Health and Safety	Accidents or incidents due to construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by EPC contractor	As defined in H&S Plan	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Access Road connecting site	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Public concerns	Complaints from community	Neighboring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Project Company	EPC Contractor Cost (included in Capex cost)
Operation Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	Plant EHS Team	Included in operation and maintenance (O&M) cost

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Air Emissions	Stack emissions*	NOx, SOx	Main stack and by-pass stack	CEMS Annual stack emission test: following USEPA method or equivalent	Continuous and Annually	Plant EHS Team	Installation included in EPC Cost Monitoring and maintenance in O&M cost (10,000 USD / time)
Air Emissions	Ambient air quality*	1-hour and 24- hour averaged NO2 and SO2 24-hour averaged PM, PM10 and PM2.5	1. Project Site (14°36'40.25"N, 98° 1'51.41"E) 2. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N) 3. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 4. One village house at Pyin Gyi (14°38'15.38"N, 98° 1'3.44"E) 5. One village house at Mee Kyaung Aing (14°36'33.91"N, 98° 1'43.50"E)	Method published by International Organization for Standardization, or USEPA or European Committee for Standardization or equivalent	Twice a year	Third Party hired by the Project Proponent	6,000,000 MMK/time
GHG Emissions	Climate change	GHG generation	Plant control room	Natural gas consumption Pollutant release inventory	Annually	Plant EHS Team	Included in operation and maintenance (O&M) cost for disclosure
Noise	Increase in ambient noise levels*	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified NSRs within 500 m from the Project boundary	24-hour measured by Digital Sound Level Meter	Quarterly	Power Plant's EHS team	Included in operation and maintenance (O&M) cost
	Workers Health*	Noise levels in Leq	1. Identified location within the plant area 2. Water Intake Facility near Pyin Gyi Village (14°38'18.15"N, 98° 1'14.27"E)	24-hour measured by Digital Sound Level Meter	Monthly	Power Plant's EHS team	
Surface Water	Surface Water Quality*	Temperature	At wastewater discharge point	Standard analytical method**	Once a week	Power Plant's EHS team	Included in operation and maintenance

Project Stage/ Affected Component	**Potential Impact**	**Parameters to be Monitored**	**Location**	**Measurements**	**Frequency**	**Responsibility**	**Cost**
							(O&M) cost
	Surface Water Quality*	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, BOD, COD, Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB), Total Residual Chlorine, Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As).	1. At wastewater discharge point 2. Heinze Chaung River (upstream of the pumping station, 14°38'24.10"N, 98° 1'14.86"E) 3. Heinze Chaung River (Downstream of the pumping station 14°38'23.62"N, 98° 1'4.14"E) 4. Mi Gyaung Aing Chaung (upstream, 14°36'23.61"N, 98° 1'51.47"E) 5. Mi Gyaung Aing Chaung (downstream, 14°36'25.90"N, 98° 1'47.80"E)	Standard analytical method**	Twice a year	Third Party hired by the Project Proponent	EPC Contractor Cost (4,000,000 MMK/time)
	Surface Water Quantity	Intake Flow Rate Flow Rate of Heinze River	At water intake location	Continuous monitoring of water intake quantities and flow rates in the Heinze River.	Continuous	Plant EHS team	Included in operation and maintenance (O&M) cost
Ground Water	Ground Water Pollution	pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids (TSS), Total Coliform Bacteria (TCB),	1. One village house at Hle Gone (98° 1'32.31"E, 14°36'16.11"N) 2. One village house at Shin Byan (14°37'28.10"N, 98° 2'49.40"E) 3. One village house at Pyin Gyi (14°38'15.38"N, 98° 1'3.44"E) 4. One village house at Mee Kyaung Aing	Standard analytical method**	Once a year	Third Party hired by the Project Proponent	EPC Contractor Cost (2,400,000 MMK/time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		Total Residual Chlorine, Iron (Fe), Zinc (Zn), Lead (Pb), Mercury (Hg), Arsenic (As).	(14°36'33.91"N, 98° 1'43.50"E)				
Soil	Soil and Sediment Contamination*	pH, salinity, NH_4^+, total P, heavy metals, TSS	Accidental spillage area and waste storage area	Standard analytical methods**	On occurrence for accidental spill and Half Yearly	Third Party hired by the Project Proponent	O&M Cost (1,000,000 MMK/ time)
Waste	Soil and Groundwater contamination	Monitoring of waste segregation, transportation and disposal	Project activity areas, disposal site.	As to be defined in the Waste Management Plan to be prepared for the Project	As defined in Waste Management Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
	Inappropriate waste disposal by waste contractor	Monitoring of appointed waste contractors using chain-of custody documentation	Project site Waste contractor documentation	Chain of custody documentation	As defined in Waste Management Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
Occupational Health and Safety	Accidents or incidents due to operation and maintenance activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As to be defined in the H&S Plan to be prepared for the Project	As defined in H&S Plan	Plant EHS Team	Included in operation and maintenance (O&M) cost
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Access Road	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of the Project Proponent	Included in operation and maintenance (O&M) cost
	Discharge of effluent and cooling water	Accidents, incidents and complaints	Adjoining Channel	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of the Project Proponent	Included in operation and maintenance (O&M) cost
	Public concerns	Complaints from community	Neighboring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Community Liaison Officer of the Project Proponent and Plant Manager	Included in operation and maintenance (O&M) cost
CSR Activities	Community Development	Activities/ Programs and No. of beneficiaries	Local communities around the Project activity areas	No. of beneficiaries and outcome of the activities	Periodic and need based	Admin/ HR Manager and Plant Manager	CSR Budget (app 100,000 USD / year)

19.6 INSTITUTIONAL SETTING AND IMPLEMENTATION ARRANGEMENTS

19.6.1 Construction Phase

The ESMP will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Proponent's staff, specifically the EHS Officer and Site Engineer, will monitor the implementation of these mitigation measures by the contractors at the site. These officers will be responsible for the field level monitoring of the Project.

The roles and responsibilities of the Project Proponent and EPC Contractor for implementation and monitoring have been outlined in *Table 19.3*.

Table 19. 3 Roles and Responsibilities of Sponsor and EPC Contractor

Sponsor	EPC Contractor
Obtaining statutory clearances required during pre-construction stage of the Project	Obtaining permits required during the construction stage
Overall Project co-ordination and management through EPC Contractor and supported by the third-party environmental consultants	Joint verification with the Project Proponent and Third-Party Environmental Consultant for review of ESMP implementation
Interaction and reporting to the respective department of GOM	Interaction with the Project Proponent and appointed supervision consultant, if any
Interaction and reporting to lenders	Filling of reporting formats as per the reporting schedule and submission to the Project Proponent
Effective implementation of ESMP and monitoring of ESMP implementation	Environmental monitoring through Third Party Environmental Laboratory
Carryout verification/ supervision exercises during the construction phase of the Project for implementation of ESMP	Preparation of various plans for effective implementation of ESMP by the Sponsor
Keeping records of all permits obtained by EPC Contractor	Identification of site for labour camp, batch mix plant, laydown areas
Overall supervision of ESMP implementation	Management of labour camp and to provide drinking water, sanitation facility
Approval of plans prepared by EPC Contractor	
Addressing grievances of local community and information dissemination	
Environmental monitoring through laboratory	

While the EPC Contractor or a particular party is responsible for physical implementation of the mitigating measures, the whole implementation process requires supervision, checking, documentation and verification so that problems are identified and properly addressed before they get out of hand. In order to ensure proper execution of the ESMP, implementation reviews will be conducted by the Project engineer such as the weekly construction meetings, construction log book, monthly and other construction reports etc. Records of these minutes of the weekly meeting, monthly reports and special reports on implementation of the mitigating measures will also be maintained and available for review by the Project management. It is suggested to identify documents and records that require templates and accordingly suitable templates shall be developed, which shall include but not limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contract lists, action plans etc. Further, all these templates shall be communicated to all potential users. All these records will be archived at the Project office and will be maintained by the EHS officer. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved. The Sponsor will document the process for creating, allocating and approving unique identifiers and will communicate this to relevant staff.

19.6.2 Operation Phase

During Operation Phase, the Project Proponent, especially the EHS team and operation team will be fully responsible for implementation of the ESMP. The Project Proponent's staff, specifically the EHS Officer and Plant Engineer, will monitor the implementation of these mitigation measures.

19.7 Training

19.7.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in-house/ external expert will be appointed by the EPC contractor in consultation with the Sponsor to develop and deliver a training program on implementation of the ESMP, monitoring and reporting will be conducted in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the EPC contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- EHS management plans prepared by the EPC Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines;
- Internal reporting and response system;
- Hazardous chemicals and waste handling;

In addition, specific training will be provided to the team involved in environmental and social monitoring and reporting, which will include:

- Applicable environmental and social guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation and analysis procedures;
- Solid and hazardous waste management;
- Quality assurance and quality control;
- Environmental monitoring report preparation

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between the Project Proponent, the relevant authorities and the Lenders.

19.7.2 Operation Phase

Prior to the commencement of the Plant operation, a suitably qualified in-house/ external environmental expert will be engaged by the Sponsor to develop and deliver a training program on operation phase environmental and social monitoring and reporting. The topics will be mostly same as that during the construction phase. However, it will also include following modules, which are specific to the operation phase:

- Continuous emission monitoring;
- Hazardous chemicals and waste management;
- Occupational health and safety programs, including Emergency Response Plan for both employee and nearby communities;

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between the Sponsor, the relevant authorities and the Lenders.

The Project Proponent's overall Project organization chart, the Project Proponent's organization chart during construction, including EPC contractor and other contractors, are shown in *Figure 19.1* and *Figure 19.2* respectively.

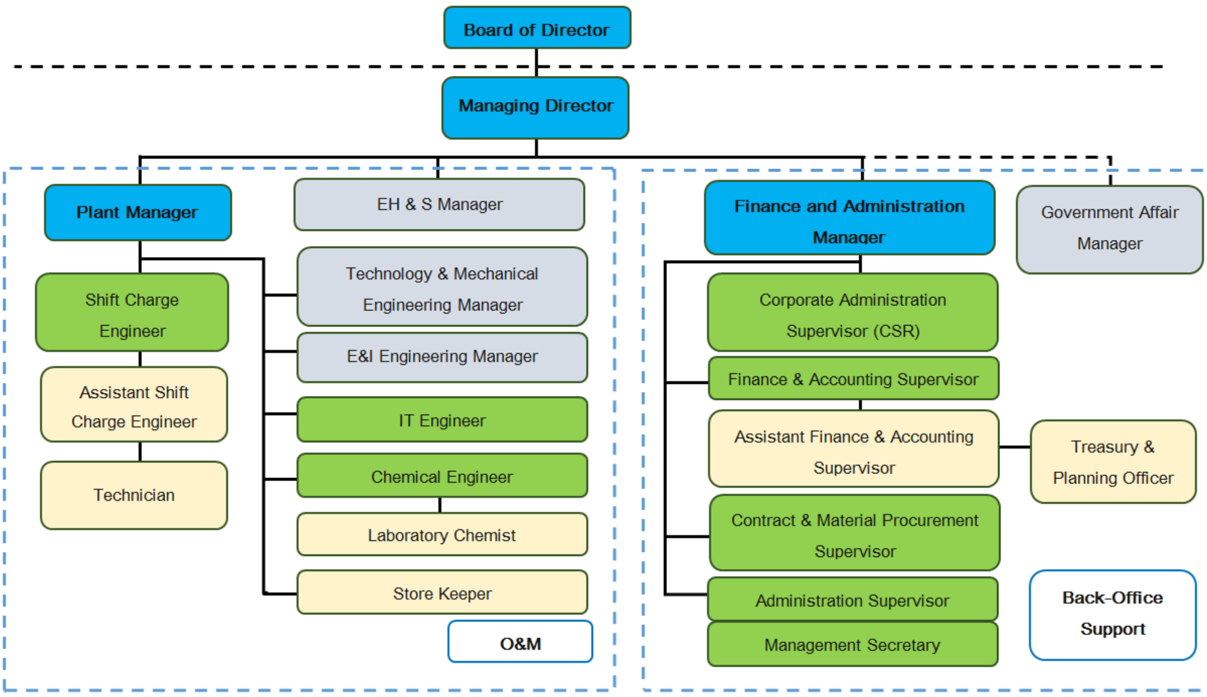

Figure 19. 1 MUPA's Overall Project Organization Chart

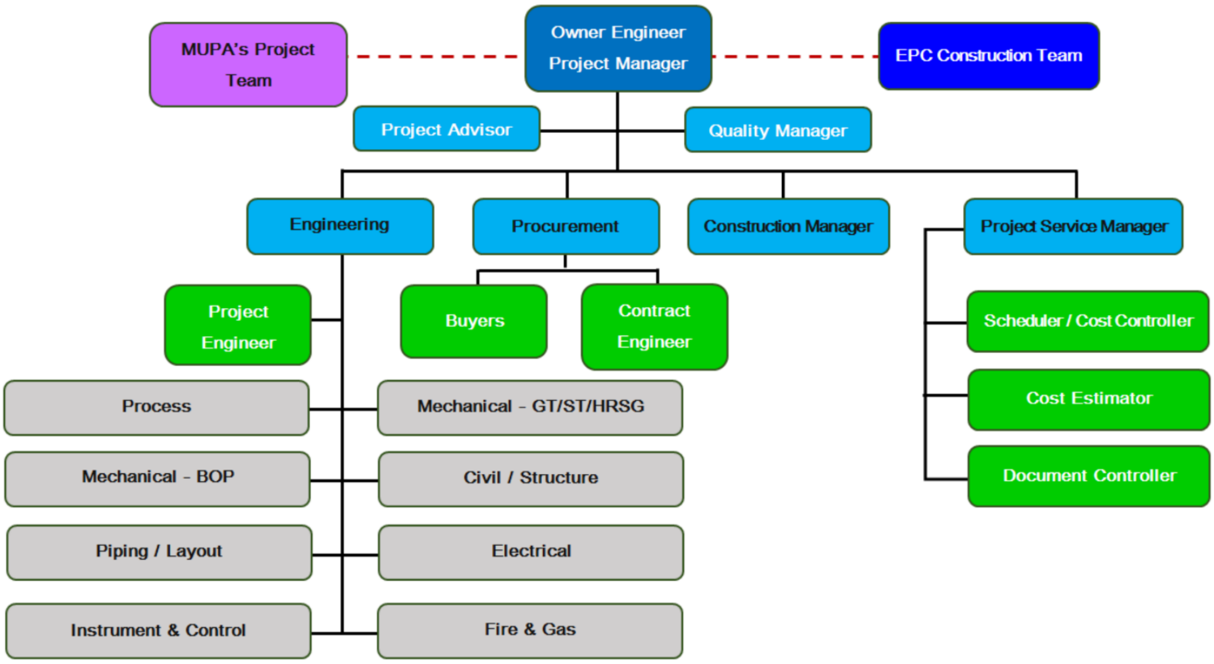

Figure 19. 2 MUPA's Organization Chart during Construction

19.8 Plans For Construction And Operation Phase Of The Project

19.8.1 Construction Phase

Prior to the beginning of major site works, the EPC contractor in cooperation with the Project Proponent will develop the following plans:

19.8.1.1 Emergency Response Plan

A site-specific emergency response plan will be prepared for soil clean-up, decontamination and any accidental spill management.

19.8.1.2 Health and Safety Plan

The EPC Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilization, construction sequence and safety arrangements. Measures will be implemented to reduce the likelihood and consequence of the following hazards:

- Falling from height;
- falling into water;
- entanglement with machinery;
- tripping over permanent obstacles or temporary obstructions;
- slipping on greasy or oily walkways;
- falling objects;
- asphyxiation;
- explosion;
- contact with dangerous substances;

- electric shock;
- variable weather conditions;
- lifting excessive weights; and
- traffic operations.

19.8.1.3 Construction Environmental and Social Management Plan (Site Specific Plan)

The EPC Contractor will prepare and implement a Construction Environmental and Social Management Plan prior to commencing work to manage the construction related environmental and social aspects.

19.8.1.4 Traffic Management Plan

The EPC Contractor will prepare and implement Traffic Management Plan prior to commencing work to manage the construction traffic. This will be required towards prevention of local traffic disruptions, avoid peak hours rush and prevent accidents. Movement of all heavy equipment and vehicles from Jetty to Project site needs to be coordinated with the logistics team of the Project Proponent and in discussion with relevant local authorities. Additionally, it is to be noted that the detailed management plans as specified in Section 19.4 will also be developed prior commencing activities in relation to such plans.

19.8.2 Operation Phase

During the operation phase of the Project, the Project Proponent will develop the following plan/ management systems for effective operation of the Plant:

19.8.2.1 HSE and Social Management System

The Project Proponent will develop and implement an HSE and Social Management System (HSE&SMS) to international guidelines for the entire Plant premises and its impact zones (project area of influence as defined under IFC PS) within two (2) years of commissioning the Plant.

19.8.2.2 Waste Management Plan

For effective segregation, handling, storage and disposal of solid and hazardous wastes generated from the Plant operations, a waste management plan will be developed by the Project Proponent.

19.8.2.3 Spill Response and Emergency Plan

The Project Proponent will prepare a spill response and emergency plan to address accidental spillages or release of hazardous wastes.

19.8.2.4 Emergency Response and Disaster Management Plan

Based on the outcome of the consequence analysis as well as detailed quantitative risk assessment of the Project after finalization of project design, an emergency response and disaster management plan will be developed by the Project Proponent. This will define protocols to be followed in the event of emergencies or disasters in order to limit the impact on the employees and the local community. The plan will address both on-site and off-site emergency situations due to the operation of the project. The plan will disclose potential disasters and potential risks from the plant to the local community as well as the plan of action on emergency protocol in the event of any such eventuality. This will also include awareness programs for the Plant personnel, local community and local administration.

Additionally, it is to be noted that the detailed management plans as specified in Section 19.4 will also be developed prior commencing activities in relation to such plans.

19.9 BUDGET

The EPC Contractor and the Project Proponent will allocate separate budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. It should be noted that costs for many in-built mitigation measures, such as, acoustic enclosures for noise control, water and wastewater treatment, CEM, etc., are already included in the EPC contract cost estimate and/or operating cost estimates. In addition, separate budget will be allocated for CSR activities, which will be conducted by the Sponsor for community development.

19.10 UPDATING OF ESMP

This ESMP will be updated, revised and reviewed internally on regular basis to ensure particularly that ESMP continuing suitability, adequacy and effectiveness regarding the Project commitment to continual improvement. The ESMP of the Project will be monitored and reviewed on half yearly basis.

Furthermore, in the event of an unanticipated impact and design change with respect to the Project Standards (including Myanmar Government and IFC requirements); the ESMP would be updated as necessary.

CHAPTER 20 STAKEHOLDER ENGAGEMENT

This Chapter describes the stakeholder engagement activities undertaken during development of the ESIA. This includes key issues raised by stakeholders and how each of these issues has been addressed in the ESIA.

The engagement process has been designed to meet both Myanmar legal requirements (per the Environmental Impact Assessment Procedure No. 616/2015) for public participation, and international requirements for engagement as outlined by the IFC Performance Standards.

20.1 Introduction

The Project team is committed to undertaking a process that delivers an inclusive and continuous dialogue with the Project stakeholders during the ESIA. The objectives of this engagement are to:

- **Identify** all those affected or interested in the Project to ensure they are included in the engagement process
- **Ensure Understanding** through an open, inclusive culturally appropriate and transparent engagement process. Information has been disclosed as early and as comprehensively as possible.
- **Involve Stakeholders** in the scoping of issues, the assessment of impacts, the generation of mitigation and management measures and the finalization of the ESIA report. Stakeholders also played an important role in providing local knowledge and information for the baseline to inform the impact assessment.
- **Build Relationships and Trust** through open dialogue and engagement. Establish transparency of MUPA activities to build trust with stakeholders.
- **Engage Vulnerable Peoples** by having an inclusive approach to consultation. Some stakeholders need special attention in such a process due to their vulnerability.
- **Manage Expectations** with respect to proposed Project benefits. The engagement process served as a mechanism for understanding and managing stakeholder and community expectations, where the latter will be achieved by disseminating accurate information in an accessible way.
- **Ensuring Compliance**. The process is designed to ensure compliance with both Myanmar regulatory requirements and international best practice.

20.2 Stakeholder Identification

The first step in establishing a dialogue is identifying the Project stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, and those who may have interests in and/ or the ability to influence a project’s outcomes (either positively or negatively).

A stakeholder mapping exercise was undertaken to identify the Project stakeholders as well as issues likely to be of concern to the stakeholders. A key part of this process was identifying individuals and groups who may find it difficult to participate as well as those who may be differentially or disproportionately affected by the Project because of their marginalized or vulnerable status.

The mapping exercise was developed based on a desktop review of maps detailing the Project site and surrounding land uses/ activities, data gathered during early site visits, discussion with some of the stakeholders and the scoping reporting that was prepared for the Project.

Stakeholders were prioritized based on their level of interest in the Project and power or ability to influence the Project. Level of interest for each stakeholder was confirmed during the subsequent visits to the site through formal engagement or ad hoc discussions.

By identifying the Project stakeholders early, the ESIA team was able to tailor the engagement approach to meet the needs and expectations of the stakeholders – e.g. address the issues of most concern to stakeholders during meetings.

A range of stakeholders were identified that may be impacted by the Project or have an interest in or ability to influence the outcome of the Project. **Table (20.1)** provides the list of Project stakeholders that were identified during the mapping exercise. This includes villages located in close proximity to the Project site and/ or its associated facilities.

Table 20. 1 List of Project Stakeholders

Stakeholder group	Stakeholder*
Union government	Ministry of Electricity and Energy Electric Power Generation Enterpise
Region government (Tanintharyi)	Ministry of Electricity and Industry Members of Parliament
Township government (Yebyu)	General Administration Department (GAD) Department of Livestock, Breeding and Veterinary Development Department of Irrigation and Agriculture Electricity Supply Enterprise Department of Immigration and National Registration Department of Planning and Statistics Department of Public Relations Department of Industry and Trade Department of Social Welfare, Relief and Resettlements Department of Labor Water Utilization Department Municipal Department Tax and Revenue Department Development Committee Environmental Conservation Department
Villages and potentially affected persons	Village Tract Leaders Local villagers – Mi Gyaung Auing, Hle Gone, Kanbauk, Pyin Gyi, Gan Gaw Taung, Ye Ngain Zeik, On Bin Kwin, Pet Taung, Shin Byan Farmers within local villages Fishermen within local villagers Women’s group representatives within local villages

	Youth representatives within local villages Healthcare workers within local villages and regional health care facilities Community based organisations Vulnerable groups (e.g. landless, poor) within the local villages
NGO, Media, Academic	Dawei Development Association Wildlife Conservation Society Dawei Research Association Dawei Watch Tanintharyi Natural Reserve

*Note: The stakeholder mapping exercise did not identify any Indigenous peoples in the Project area. This was confirmed during a site visit.

20.3 Summary Of Stakeholder Engagement Activities

Project stakeholders have been engaged at a number of points during development of the ESIA as presented in **Figure (20.1)**. The focus of the engagement activities has been to:

- Introduce the Project and provide ongoing updates as the design of the Project is further refined;
- Provide an overview of the likely impacts and proposed management measures and corresponding monitoring activities;
- Gather stakeholder insights and input, including feedback on the identified impacts, proposed management measures and monitoring activities; and
- Respond to key issues raised by stakeholders.

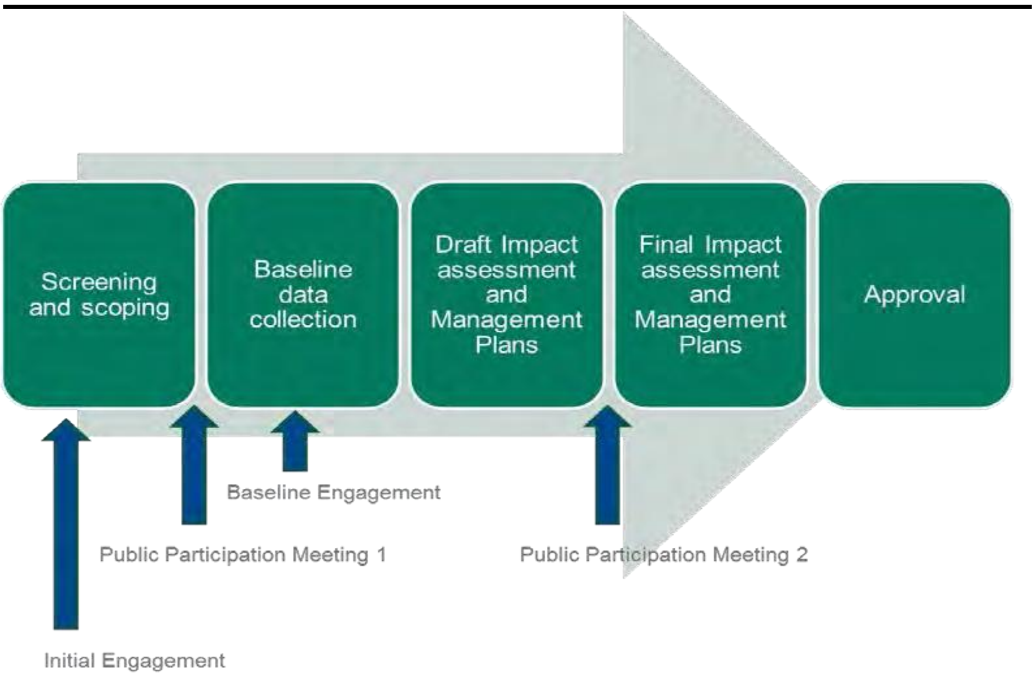

Figure 20. 1 Different Steps of The Stakeholder Engagement Process

Table (20.2) provides an overview the stakeholder engagement activities that have been undertaken as part of the ESIA, including face-to-face meetings with representatives from the Township GADs, public meetings with representatives of each of the nearby villages, focus group discussions with different interested groups in the villages and face-to0face meetings with local stakeholders with access to specific information (on health or education for example) in August, October, November and March 2017.

Table 20. 2 Summary of Engagement Activities

Method of engagement	Stakeholders
Face-to-face meeting	Tanintharyi Chief Minister
	Head of Yebyu Township
	Provincial Governor
	Village leader from: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing -Shin Byan -Ye Ngain Zeik -Gan Gaw Taung
	Ministry of Electricity and Industry
	Ministry of Electric Power
	Myingyan Township Development Committee
	Myingyan Township Water Utilization Department
	Myingyan Township Municipal Department
	Myingyan GAD
	Health practitioner from: -On Bin Kwin -Pyin Gyi -Kanbauk
	Cultural Heritage (Monk, elders) from: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing

Method of engagement	Stakeholders
	Ecosystem Services (user) from: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing
Public meeting	-On Bin Kwin Villagers
	-Pet Taung Villagers (at the meeting in Kanbauk)
	-Pyin Gyi Villagers
	-Kanbauk Villagers
	-Hle Gone Villagers (at the meeting in Kanbauk)
	-Mi Gyaung Auing Villagers (at the meeting in Kanbauk)
	-Shin Byan Villagers (at the meeting in Ein Da Rar Zar)
	-Ye Ngain Zeik Villagers
	-Gan Gaw Taung Villagers
	Ein Da Rar Zar Villagers
Focus Group Discussion	Women from: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing
	Youth from: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing
	Fishermen from: -On Bin Kwin -Pyn Gyi -Kanbauk

In addition to the activities described in **Table (20.2)** household surveys were undertaken to collect primary data for the social baseline (**Chapter 6**). As part of the data collection process, stakeholders were presented with Project information and asked about their views and concerns relating to the Project. This information has been analysed and fed into development of the ESIA. For Public Participation Meeting at scoping stage and at the draft ESIA stage, press releases have been issued in the local and national newspaper in Myanmar language. Copies of these press releases are in **Annex F**.

20.3.1 Engagement materials

To help guide the engagement process, and ensure a consistent message was being delivered, presentations were prepared in advance of each engagement. The presentations were initially prepared in English and then translated to Myanmar for the local audience. Copies of the presentations can be found in **Annex G**. Photos from the engagement meetings can be found in **Annex H**. In preparing for the engagement activities, consideration was given to the following:

- Local community sensitivities and structures to ensure that the engagement approach aligns with cultural norms;
- Community representation. When inviting village members to meetings, consideration was given to the cross section of members that might attend to ensure that women and vulnerable groups were represented. The participation of women and vulnerable community members has been encouraged, for example by organizing focus group discussions;
- Potential language barriers. Engagement activities were conducted in Myanmar (i.e. the local language); and
- Literacy rates. Literacy rates vary by village, as a result, where possible consultation was conducted using face-to-face communication and material were prepared considering different level of literacy.

20.4 Summary Of Key Stakeholder Feedback

Stakeholders were encouraged to ask questions and raise concerns throughout the engagement process. For those stakeholders not comfortable speaking up or who identified concerns after the stakeholder meetings, local contact details were provided to ensure the communication channel was still open. Minutes of the meetings are available in **Annex I**.

The summary timetable of stakeholder engagement meeting as part of ESIA study for Combined Cycle Power Plant in Kanbauk, Yebyu Township in Myanmar is in below table 20.3.

Table 20. 3 Summary Timetable of Stakeholder Engagement Meeting

No.	Date	Venue	Time	No. of Attendees	No. Question raised by Attendees
1.	15. November. 2016	Meeting Hall, General Administrative Department, Yebyu Township	3:00 – 4:35 pm	Total - 38	Total - 6
2.	16. November. 2016	Church Hall, Ein Da Rar Zar Village, Yebyu Township	9:00 – 10:05 pm	Total - 21	Total - 1

No.	Date	Venue	Time	No. of Attendees	No. Question raised by Attendees
3.	16. November. 2016	Village Tract Headman Office, Kanbauk Village, Yebyu Township	12:00 – 1:50 pm	Total - 32	Total - 2
4.	17. November. 2016	Monastery, Ye Ngain Zeik Village, Yebyu Township	8:00 – 8:30 pm	Total - 20	Total - 1
5.	17. November. 2016	Pre-school, Pyin Gyi Village, Yebyu Township	8:00 – 8:30 pm	Total - 21	Total - 1
6.	18. November. 2016	Buddhist Chapel, On Bin Kwin Village, Yebyu Township	1:00 – 1:40 pm	Total - 19	Total - 2
7.	18. November. 2016	Pre-school, Gan Gaw Taung, Yebyu Township	1:00 – 1:40 pm	Total - 21	Total - 3
8.	28. March. 2017	Church, Ein Da Rar Zar Village	15:00 to 16:20	Total - 27	Total - 4
9.	31. March. 2017	Preschool, Gangaw Taung Village	08:00 to 09:30 am	Total - 33	Total -3
10.	29. March. 2017	Kanbauk Administrative Office, Kanbauk Village	09:00 to 10:30 am	Total - 40	Total - 2
11.	30. March. 2017	Monastery, On Bin Kwin Village	14:30 to 16:00	Total - 20	Total - 11
12.	30. March. 2017	Villager's house, Pyin Gyi Village	09:30 to 10:45 am	Total - 27	Total - 3
13.	29. March. 2017	Monastery, Ye Ngan Village	14:30 to 16:00	Total - 25	Total -1
14.	28. March. 2017	Meeting Hall, General Administrative Department, Yebyu Township	09:00 to 11:00	Total - 61	Total - 7

A range of issues and concerns have been raised by stakeholders, which are summarized in **Table (20.4)**.

Table 20. 4 Summary of Stakeholder Feedback

Issues Raised	Stakeholders	Response Provided	Section of the report
Future of Electricity produce at the CCPP: There is a concern that the government will not be able to deliver its part of the project (overhead line) and that electricity will not be delivered in the Dawei area. There is strong expectation from the local population that the Project will reduce the number of black out period and lower the price of electricity.	Provincial Governor office	MUPA scope of work is limited to the generation of power. The new transmission line, connecting to Kanbuak Sub-station and beyond will be the responsibility of the local/ national authorities and therefore is classified as associated facility. Power should be used in Dawei district but this is government responsibility.	Ch 4 Project Description
Project Description: Is the land currently in use enough to accommodate the 200MW Power Plant? How is the plant operated?	Yebyu Township office	According to the projet design information available at this stage, the area is sufficient for the 200MW development Project. The team also explained the power generation process in a Combine Cycle Power Plant and confirmed this would be explained in more details in the final report.	Ch 4 Project Description
Waste Water: The water rejected from the plant must be in compliance with international standard and treatment must be systematic.	Prime Ministre office	Potential pollution and wastewater will be studied as part of the ESIA using both Myanmar and international standards as a reference.	Ch 10 an 11 Surface Water and Soil and Groundwater IAs
Engagement with local population: Local teachers could be used to communicate information to the local communities.	Prime Ministre office	Communication during the ESIA will be made in local language and using visual support allowing for everyone to understand the information provided. Local teachers are always invited to public meetings.	Ch 20 Stakeholder Engagement
Local Content: How many local people will have access to job?	Immigration and National Registration Department	Details for the workforce will be given in the final report. The main mitigation measure regarding employment is to ensure work is given to local population whenever possible.	Ch 4 Project Description and Ch 15 Social IA
Electricity shortage: Should electricity shortage be expected during the construction period?	Yebyu GAD	No power shortage is expected during the construction period.	Ch 4 Project Description
Waste Water: Streams in the Project area used by local fishermen. Pollution of the streams would have severe impacts on local population.	Yebyu GAD	Potential pollution and wastewater will be studied as part of the ESIA using both Myanmar and international standards as a reference. Impact and mitigation measures will be presented during PP2.	Ch 5 Baseline and Ch 10 and 11 Surface Water and Soil and Groundwater IAs
Noise Environment: How much impact is expected from the CCPP on the noise environment?	Yebyu GAD	The ESIA will consider impact from environmental discharge such as dust, vibration or noise and mitigation measures will be presented during PP2.	Ch 5 Baseline and Ch 9 Noise IA

Issues Raised	Stakeholders	Response Provided	Section of the report
Contractual matter: Has the project proponent signed a contract with MOEE?	Yebyu GAD	Power Purchase Agreement (PPA) between MUPA and the Ministry of Electric Power (MOEP) was signed on 28th March, 2016.	Ch 4 Project Description
Future of Electricity produce at the CCPP: Will the power produced be added to the national grid?	Tanintharyi parliament	The Power produced should be used in Dawei district and in the national grid but this is government responsibility as MUPA scope of work finishes at the sub-station within the project footprint.	Ch 4 Project Description
Project Proponent: Who are they, where are they coming from?	Tanintharyi parliament	History of MUPA	N/A
Fuel origin: Where is the gas coming from?	Dawei Development Association	Gas will be coming from Zawtika gas field and other MOGE gas field.	Ch 4 Project Description
ESIA study: How long is the ESIA going to last and can local people be involved?	Dawei Research Association	ESIA should be submitted end of March 2017. Local people will be involved in the public meeting, the focus group discussions and key informant interviews planned during the baseline.	Ch 4 Project Description and Ch 5 Baseline
Study area: Which villages are included in the study area?	ECD	The ESIA is an upgrade of a previous ESIA submitted in 2014. New scoping report is being prepared. Villages within the study area are: -On Bin Kwin -Pet Taung -Pyin Gyi -Kanbauk -Hle Gone -Mi Gyaung Auing -Shin Byan -Ye Ngain Zeik -Gan Gaw Taung	Ch 4 Project Description and Ch 5 Baseline
Futures of Electricity: Who is in charge of distributing the electricity? What villages will benefit from the Project?	Shin Byan villager	MUPA scope of work is limited to the generation of power. The new transmission line, connecting to Kanbuak Sub-station and beyond will be the responsibility of the local/ national authorities. The villages within 5 Km from the power plant have been considered in the study, but it does not mean that the benefits will be limited to these villages.	Ch 4 Project Description
Water: How will the water be used and where will it come from?	Ein Da Rar Zar Villager	The draft project design specify that the water will be pumped in the Heinze river and transported to the project site via a pipeline running along the road between Pyin Gyi and the Project site. Water will be used in a cooling system for the	Ch 4 Project Description

Issues Raised	Stakeholders	Response Provided	Section of the report
		power generation, but also for firefighting or for the project domestic uses.	
Environmental discharge: What will be the extent of vibration and noise impact and what mitigation measures exist?	Shin Byan Villager	The ESIA will consider impact from environmental discharge such as dust, vibration or noise and mitigation measures will be presented during PP2.	Ch 15 Social IA
Project description: Where will the 200MW power plant be located? What are the expected impacts?	Kanbauk Villager	The 200MW CCPP will be located at the same location as the existing 6MW power plant. ERM is undertaking an Environmental and Social Impact Assessment (ESIA) to determine what impacts may occur as a result of construction and operation of the Power Plant. The results of the ESIA will be presented during PP2.	Ch 4 Project Description and Ch 8 to 17 IAs
Emergency: Emergency response system should be developed in case of accident with the gas or the transmission line.	Hle Gone Villager	Project proponent scope is only to generate electric power and distribution of power (transmission line and electric posts) is the responsibility of MOEE. MUPA will develop an Emergency Response Plan considering the risk of an accident on the gas pipeline, at the CCPP or at the water intake station and should engage with local authorities and public services to develop this plan.	Ch 4 Project Description and Ch 17Unplanned Event
Compensation: How will people be compensated if there is an accident?	Ye Ngain Zeik Villager	MUPA should develop a grievance mechanism which is a channel for stakeholders to raise issues with MUPA. For each grievance, MUPA will study the source of the problem and potential compensation.	Ch 15 Social IA and Ch 20 Stakeholder Engagement
Benefits: Job opportunities and electricity must benefit people from the area.	Ye Ngain Zeik Villager	The ESIA will consider impact and benefit from the Project and will propose mitigation measures to enhance the positive impacts. These will be presented during PP2. Project proponent scope is limited to the generation of electricity. MOEE and MOEP are responsible for the prices and the distribution.	Ch 4 Project Description and Ch 15 Social IA
Handout should be shared with attendees	Ye Ngain Zeik Villager	The team took note of this comment.	Ch 20 Stakeholder Engagement
Impact on Livelihood: Many fishermen live in the area and pollution from waste water or chemical used in the treatment of the water could impact their livelihood.	Pyin Gyi secretary of village	The team will study pollution and wastewater quality as part of the ESIA using both Myanmar and international standards as a reference. Impact and mitigation measures will be presented during PP2.	Ch 4 Project Description and Ch 15 Social IA

Issues Raised	Stakeholders	Response Provided	Section of the report
Origin of the gas.	On Bin Kwin Villager	Gas will be coming from Zawtika gas field and other MOGE gas field.	Ch 4 Project Description
Project Proponent: Who is MUPA?	On Bin Kwin Villager	History of MUPA	Ch 2 Context and Ch 4 Project Description
Benefits: What will be the benefits for local people?	On Bin Kwin Villager	The ESIA will consider impact and benefit from the Project and will propose mitigation measures to enhance the positive impacts. These will be presented during PP2.	Ch 15 Social IA
Price: Electricity price should be reduced under 300 Kyats	On Bin Kwin Villager	MUPA scope is to produce electricity from natural gas. Once the electricity is produced, it is MOEE responsibility to distribute it and to set prices.	Ch2 Context and Ch 4 Project Description
Area: Will the land reserved for the project need to be expanded for the 200MW?	Gan Gaw Taung Villager	The area reserved for the CCPP next to the existing 6MW station is sufficient for the project and no additional land will be required at this site.	Ch 4 Project Description and Ch 15 Social IA
Schedule: When is the project going to start?	Gan Gaw Taung Villager	At the moment, based on ESIA submission in March/April 2017, the project proponent is planning for start of operation on the final quarter of 2020.	Ch 4 Project Description
Employment: Is the Project planning to employ local people?	Gan Gaw Taung Villager	Details for the workforce will be given in the final report. The main mitigation measure regarding environment is to ensure work is given to local population whenever possible.	Ch 4 Project Description and Ch 15 Social IA
Futures of Electricity: Will the electricity be used locally or added to the national grid?	Gan Gaw Taung Villager	It is MOEE responsibility to distribute and set the price for unit of power. MUPA responsibility is limited to the production of electricity according to the details of the PPA.	Ch 4 Project Description
Gender: Project should employ more women	Gan Gaw Taung Villager	Your feedback is noted and will be included in the final report.	N/A
Monitoring: What monitoring plan are in place and how long will the monitoring last?	Yebyu GAD	Monitoring plans have been developed for all the subject with substantial risks and MUPA will have internal monitoring all along the life cycle of the Project, but ECD will be responsible for the monitoring of the Project against the engagement in the EIA.	Ch 19 ESMP
Water treatment: Why MUPA has decided to use the expensive reverse osmosis system instead of the cheap system with chemical?	Yebyu community representative	MUPA has chosen the reverse osmosis system has it allow for a continuous water supplies all year long and present less impact to the environment.	Ch 4 Project Description

Issues Raised	Stakeholders	Response Provided	Section of the report
CSR: What percentage of the benefits will go to CSR and what programme will you provide?	Yebyu community representative	MUPA has 5 sectors in which it invests in SCR programme. The exact amount is not yet known but he is the vicinity of 100,000 USD per year.	N/A
Cimat: What will be the impact on Climate Change?	Yebyu community representative	Impact have been studied and described in Ch 13 of the study. Given the technology proposed for this Project, impact is considered limited.	Ch 13 GHG IA
Grievance Resolution: MUPA should set up a committee including representative of the local population and local authorities to review grievances received by the company.	Yebyu Township and other villages representatives	The comment is noted and proposition will be made to local stakeholders to include them in the grievance mechanism.	This chapter
Traffic safety: How do you plan to manage risk of traffic accident during the construction period?	Gan Gaw Taung Villager	Risk of accident and impact on community health and safety have been considered and are presented in this study. Mitigation measures include, but are not limited, to speed limit, engagement with stakeholders along the transport route, training of the drivers, etc.	Ch 15 Social IA

20.4.1 Incorporation in ESIA

The issues and concerns captured during the stakeholder engagement activities have been incorporated into development of the ESIA. The information has been used to inform the impact identification and assessment process as well as the identification of management measures and monitoring activities. **Table (20.4)** includes reference to the chapters within the ESIA where each of the issues or concerns has been addressed.

20.5 Future Stakeholder Engagement Activities

Engagement should continue to occur throughout construction and operation of the Project, in line with the IFC performance standards.

Engagement will be guided by a stakeholder engagement plan (SEP). The objectives of the SEP are to ensure:

- Stakeholders continue to be provided relevant Project information in a timely manner;
- Stakeholders continue to have an opportunity to share their views and concerns about the Project;
- Stakeholder expectations are managed. This includes expectations associated with benefits that are likely to be generated by the Project;
- Positive working relationships are built and maintained with stakeholders over time; and
- Engagement continues to be transparent, inclusive and appropriate. This includes being accessible to vulnerable groups. This involves considering issues such as language and illiteracy rates when engagement materials are developed – e.g. where possible include visual examples as well as text.

The SEP will include:

An engagement action plan;

Clear roles and responsibilities for implementation of the SEP. A community liaison officer (CLO) should be appointed and based at the Project site. The CLO will oversee implementation of the SEP, with support from other relevant Project representatives;

- Indicators against which the SEP can be monitored and evaluated over time;
- A stakeholder database to track engagement activities; and
- A grievance mechanism to receive and respond to concerns raised by stakeholders.

20.5.1 Action Plan

The SEP will include an action plan that sets out the engagement activities that will be undertaken during construction. The action plan will be revisited prior to the end of construction so that an action plan can be designed specific to the operation phase.

An initial action plan is provided in **Table (20.5)**. The focus is on:

- Ensuring stakeholders are kept up to date on progress of the Project;

- Gaining input during the development and implementation of key management plans, including the traffic management plan, the corporate social responsibility plan, the community health management plan, and the social management plan; and
- Managing stakeholder expectations, particularly regarding the benefits that will be generated by the Project. This includes direct benefits (e.g. employment) as well as benefits created through the corporate social responsibility plan.

As part of the action plan, engagement on key issues (e.g. air emissions, noise emissions, employment opportunities) will need to continue. In addition, the action plan should consider opportunities to engage interested stakeholders in monitoring activities (e.g. air and noise emissions), which may occur during construction and operation.

Table 20. 5 Stakeholder Action Plan for Construction

Stakeholder group	Actions	Timing
Union government	Progress updates via email or telephone	Bi-monthly*
	Progress updates via a face-to-face meeting	Twice a year
Region government	Progress updates via email or telephone	Monthly
	Progress updates via a face-to-face meeting	Quarterly
Township government	Progress updates via email or telephone or via the appropriate committee representative	Monthly
	Progress updates via a face-to-face meeting	Quarterly
	Seek input on relevant management plans	As required
	Notification in advance of undertaking noisy activities (e.g. pile driving)	As required
	Notification in advance of transportation of heavy machinery	As required
Villagers	Progress updates via information distributed to the village tract leaders and/ or the relevant committee representative	Monthly
	Progress updates via a face-to-face meeting	Quarterly
	Seek input on relevant management plans	As required
	Notification in advance of undertaking noisy activities (e.g. pile driving)	As required
	Notification in advance of transportation of heavy machinery	As required

* Bi-monthly means once every two months

In terms of government, this includes: The Ministry of Electric Power Enterprise, Yebyu GAD, and the township management and development committees.

In terms of villages, this includes:

- On Bin Kwin
- Pet Taung
- Pyin Gyi
- Kanbauk
- Hle Gone
- Mi Gyaung Auing
- Shin Byan
- Ye Ngain Zeik
- Gan Gaw Taung

The Project's SEP and CDP are regarded as living documents which shall require updating with new additional stakeholder information as the Project progresses.

20.5.2 Stakeholder Committee

In addition to the activities set out in the action plan, a stakeholder committee should be established. Key stakeholder groups will be represented on the committee, including, at a minimum, representatives from each of the surrounding villages, the Yebyu GADs, and the Project team.

The committee will provide an avenue to:

- Build on the relationships already established between local stakeholders and the Project;
- Gain a better understanding of village priorities and concerns as they relate to the Project;
- Receive ongoing input regarding management and monitoring of impacts; and
- Provide regular Project updates to key stakeholders.

It will be the responsibility of the committee members to disseminate the information provided at the committee meetings to their villages. This will be one of a number of ways in which information will be relayed to local villages.

Stakeholders will have the opportunity to raise Project related issues and concerns with committee members. It will be the responsibility of committee members to relay the issues and concerns to MUPA and to raise them during the committee meetings for discussion.

The committee will meet monthly during construction. At the end of the construction period, the frequency at which the committee meets will be reviewed.

20.5.3 Stakeholder Database

Implementation of the SEP will be supported by a stakeholder database. The stakeholder database will track the following information:

- The stakeholder – i.e. an organization or individual;
- A contact person's name and position or title;
- Contact details (address, telephone, email, website);
- The main interests/issues/ concerns of the organization as they may relate to the Project; and
- Details of engagement activities – i.e. date, location, attendees and key issues raised – and responses/actions agreed.

The database will help ensure that issues and concerns are captured and can be fed into decision-making process and that commitments that are made are met.

20.5.4 Grievance Mechanism

A grievance mechanism will be established as part of the SEP to ensure that grievances are promptly heard, analyzed and, to the extent possible, resolved.

The aim is to resolve disagreements or stakeholder concerns before they evolve into grievances through ongoing engagement. This includes informal negotiations and discussions; any agreements reached through informal channels will be voluntarily signed by all parties involved in the negotiation.

If, despite engagement efforts, grievances still arise, they will be processed via the grievance mechanism if the stakeholder wishes to do so. A variety of methods will be available through which stakeholders can lodge grievances. This will include:

- Face-to-face meetings with the member of the committee, the CLO or other relevant Project representative;
- Written communication (e.g. email, letter) directed to a committee member, a CLO or other relevant Project representative. Villagers may choose to speak to their village tract leader or committee representative to help facilitate a written complaint; and
- Telephone call placed to a committee member, the CLO or other relevant Project representative.

It is anticipated that the committee will be the first point of contact for villagers to raise grievances (and other issues and concerns). However, the CLO will also be available to receive grievances.

In all instances, grievances will be logged using the same template. This will ensure a consistent approach is taken to collecting data (associated with the grievance). If a written grievance is received, a follow-up phone call or meeting may be required to ensure that the grievance is understood and sufficient information has been obtained from the complainant.

Grievances will be forwarded and reviewed in the first instance by the CLO. The CLO will determine if:

- The grievance is not valid (e.g. does not relate to the Project). If it is decided that a grievance is not valid, the grievance will be dismissed and advice of the decision and the reasons for dismissal will be provided to the complainant in writing (and in person if required);
- The grievance is a minor issue (e.g. a request for information or clarification). A response will be provided in writing (and in person if required); and
- The grievance is a major issue (e.g. repetitive or sensitive issue, related to compensation, group complaints). Major issues will involve investigation prior to a response being developed. The Project CEO will need to sign-off on responses for all grievances considered to be major (**Figure (20.2)**)

All grievances will be reported to the committee, including those that have been deemed to be invalid. This will include an overview of the grievance and the response provided by the Project.

The grievance mechanism will address all grievances raised by stakeholders impacted or affected by the Project. This includes grievances associated with land acquisition, compensation, livelihood restoration, and environmental and social matters. A separate grievance mechanism will be developed to address internal grievances relating to employment matters.

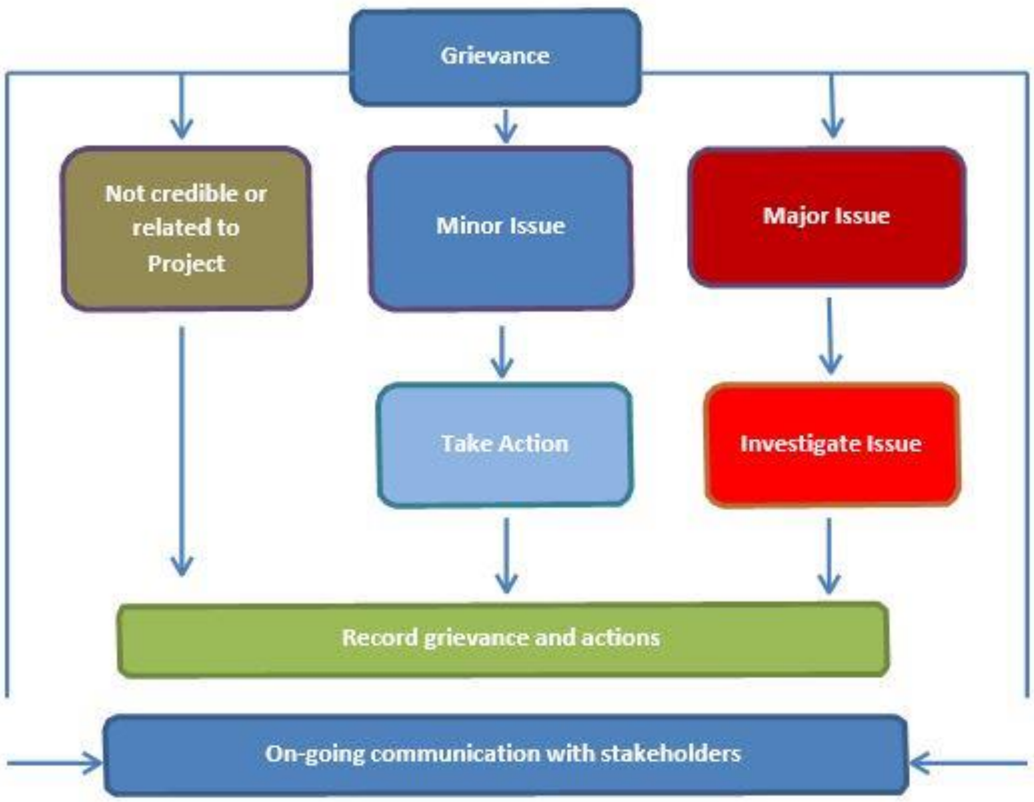

Figure 20. 2 Overview of The Grievance Management Process

All grievances will be recorded in the stakeholder database. This will include a summary of the grievance, the resolution or agreement on proposed actions (between the Project and the complainant), and monitoring of actions taken in response to the grievance. In addition, the grievance log will be stored in the database.

A grievance management procedure will be developed that sets out the grievance management process and provides further detail on the steps involved.

20.5.5 Monitoring and Evaluation

A key part of the SEP will be establishing indicators against which performance can be monitored and evaluated over time. At a minimum the SEP will be reviewed every 6 months during construction and annually during operation. The outcomes will be used to update and refine the SEP. **Table (20.6)** provides a list of indicators for assessing performance.

Table 20. 6 Draft Stakeholder Action Plan

Objective	Performance Indicators
Stakeholders are provided information about the Project in a timely manner	Frequency in which timely and accurate Project information is distributed to stakeholders Stakeholder feedback received regarding information dissemination Number and type of grievances lodged by stakeholder members

Stakeholders have an opportunity to share their views and concerns	Number and type of engagement opportunities provided Percentage of stakeholders taking part in engagement opportunities (throughout the year) Frequency in which stakeholders receive feedback on how their input is used Number and type of grievances lodged by stakeholders
Positive working relationships are built and maintained over time	Number and type of grievances lodged by stakeholders Number of satisfactorily closed out grievances Stakeholder willingness to engage with the Project Percentage of stakeholders taking part in engagement efforts Frequency in which stakeholders receive feedback on how their input has been used
Engagement continues to be transparent, inclusive and appropriate	Frequency in which timely and accurate Project information is distributed to stakeholders Stakeholder feedback received about the engagement activities Representation of vulnerable groups in engagement activities Number and type of grievances lodged by community members Timely resolution of grievances lodged by community members Number of satisfactorily closed out grievances

CHAPTER 21 CONCLUSION AND RECOMMENDATION

This Environmental Impact Assessment report has been prepared based on the technical information provided by the Project Proponent, existing studies and reports relevant to the Project, site visit, baseline environmental monitoring and the stakeholder engagement.

Through this process an assessment has been conducted of the potential environmental and social impacts attributable to the construction and operation phases of the Project. Qualitative and quantitative (where possible) assessments of impacts have been presented, significance of each potential impact has been identified, and mitigation measures to minimize and reduce the impacts have been recommended.

Cumulative environmental impacts particularly on-air quality and community health and safety have also been assessed taking into consideration the existing industrial facilities present in the Study Area. The environmental and social assessment of the Project ascertains that the Project is unlikely to cause any significant environmental and social impacts. Many of the impacts are localized and short-term or temporary in nature (linked to the construction phase) and can be readily addressed by some embedded control measures in the engineering design of the Project as well as additional mitigation measures as suggested in the Environmental and Social Management Plan (ESMP).

The built-in dry low NOx burners will be installed in order to reduce NOx emission at stack to below 25ppm at all times. The subsequent impacts from stack emissions at identified air sensitive receivers (ASRs) during normal combined cycle operation are considered negligible. Monitoring will be used by the project proponent to ensure emissions are kept below this concentration and do not impact the non-degraded airshed for NO_2.

With regards to impacts to surface water, groundwater, and soil, it is noted that the assessment of such impacts for this Project is highly important due to the Project's vicinity to the Heinze River, as well as the reliance of the local population on surface water, groundwater, and soil resources within the Project area and surroundings for their health and livelihood.

Although a number of potential environmental, social and health impacts were identified, the assessments found that impacts are typically short term in duration have minor residual significance after implementation of mitigation measures. The potential for impacts is well understood with little or no evidence of adverse consequences on the majority of environmental, social or health receptors provided that adequate in-place controls and/or mitigation measures are implemented. The suggested mitigation measures in the ESMP are well established amongst international practice, and proven to be effective in managing any impacts that might occur to acceptable levels.

In terms of social aspect, the results from initial stakeholder engagement indicate that the Project has received favorable support from local people and other stakeholders. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region, potential employment (direct and indirect) and that the negative impacts can be easily mitigated.

In addition, the ESMP has been prepared as part of this report to manage and mitigate such impacts, a range of measures have been developed to reduce the overall impacts to acceptable levels and as low as reasonably practicable.

The effective implementation of the ESMP and adherence with the Myanmar NEQ, and IFC guidelines will assist in minimizing the environmental impacts to acceptable levels.

CHAPTER 22 STATEMENT OF COMMITMENTS

MUPA will at all times comply fully with the commitments, mitigation measures, and plans that have been presented in this EIA Report.

MUPA shall fully implement the ESMP, all Project commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the Project comply fully with all applicable Laws, including the Environmental Conservation Law (2012), Environmental Conservation Rules and Environmental Impact Assessment Procedure (2015), as well as the ESMP, Project commitments and conditions.

MUPA and E Guard hereby confirm that:

1) The EIA Report is accurate, consolidated and complete to the best of our knowledge, at the time of preparing this Report;
2) The EIA has been conducted in accordance with relevant laws, including the EIA Procedure (2015).
3) The Project Proponent will fully follow the commitments, mitigation measures and plans set out in this EIA Report.

ANNEXES