Environmental Impact Assessment (EIA) for
Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign
PTTEP South Asia Limited

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REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL CONSERVATION
ENVIRONMENTAL CONSERVATION DEPARTMENT

SUBMISSION FORM OF ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PLAN

This is the official submission form of an Environmental Impact Assessment (EIA) Report together with an Environmental Management Plan (EMP) under *Environmental Impact Assessment Procedure Notification No.616/2015*. This form shall be completed in its entirety and submitted to the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, along with all required EIA and EMP Report.

Project Proponent Information

Proponent Name:	**PTTEP South Asia Limited**	Company Registration Number by DICA (if any):	**84 FC**
Contact name of Proponent:	**Zar Chi Saint**		
Proponent's address for correspondence:	**Vantage Tower, 623 Pyay Road, Kamayut Township, Yangon, Republic of the Union of Myanamar**		
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Project Information

Project Title	**Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign**
Project Location (Address)	**Thayet Township, Thayet District, Magway Region**

Report type

☒ New report	☐ Revised report	Date of submission (dd/mm/yyyy)

Check list of necessary contents for EIA report

The EIA Report shall contain the following information (see also Article 63 of EIA Procedure)

- ☒ a) Executive Summary
- ☒ b) Introduction
- ☒ c) Policy, Legal and Institutional Framework
- ☒ d) Description of the Project and Alternatives Selection
- ☒ e) Description of the Surrounding Environment
- ☒ f) Impact and Risk Assessment and Mitigation Measures
- ☒ g) Cumulative Impact Assessment (If applicable)
- ☒ h) Environmental Management Plan
- ☒ i) Public Consultation and Disclosure
- ☒ j) Conclusion and recommendations

Check list of necessary contents for EMP

The EMP, prepared as anall-inclusive or a standalone document, shall contain the following information (see also Article 2s) to t), and Article 63 – 8.0 of EIA Procedure No.616/2015)

- ☐ a) Executive Summary (if separate volume)
- ☐ b) Project Description (if separate volume)
- ☐ c) Health Policies and Commitments, legal requirements and institutional arrangements(if separate volume)
- ☐ d) Summary of impacts and mitigation measures (if separate volume)
- ☐ e) Overall budget for implementation on the EMP
- ☐ f) Management and Monitoring Sub-Plans for each identified impact
- ☐ g) Contents of each sub-plan

Proposed measure for information disclosure of the report

The EIA report shall be disclosed to civil society not later than 15 days after submission (in accordance with Article 65 of EIA Procedure Notification No.616/2015)

Duration/date of disclosure	Methodology (Public meeting, WEB, newspaper and so on)	Accessible place (Address, URL of web site, and so on)	Type of documents to be disclosed
5.2.2018 - 8.2.2018	1st Public meeting	Township and village level Public Consultation	Scoping Report
19.3.2018	PTTEP SA Website	https://www.pttep.com/en/Sustainabledevelopment/Business/Capital project management.aspx	Scoping Report
19.3.2018	Newspaper	The Mirror / Global New Light of Myanmar	Scoping Report
24.4.2018 - 26.4.2018	2nd Public meeting	Township and village level Public Consultation	EIA Report
25.6.2018	PTTEP SA Website	https://www.pttep.com/en/Sustainabledevelopment/Business/Capital project management.aspx	EIA Report
25.6.2018	Newspaper	The Mirror / Global New Light of Myanmar	EIA Report

Signature (Representative of the project proponent)

I, the undersigned Proponent (or representative, there of), hereby state that the information provided in/with the application and the report ensure;

a) the accuracy and completeness of the EIA and the EMP report;

b) that the EIA and the EMP report have been prepared in strict compliance with applicable laws including EIA Procedure Notification No. 616/2015 and with the TOR for the EIA; and

c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EIA and EMP Report.

Signature: [signature]

Date of submission: (dd/mm/yyyy) ____________

Name: Zar Chi Saint

FOR OFFICE USE ONLY

Date received:

Project Identification Number:

The proponent submitted the reports with the forms of; ☐ Paper copy ☐ Digital copy

Recorded by:

Additional comments, notes or recommendations (attached if necessary):

စီမံကိန်း အစီရင်ခံစာအကျဉ်းချုပ်

မာတိကာ

၁။ စီမံကိန်း အကျဉ်းချုပ် ....

၁.၁။ စီမံကိန်းအကြောင်းအရာ ....

၁.၂။ စီမံကိန်းအဆိုပြုသူ ....

၁.၃။ ဥပဒေ၊ မူဝါဒနှင့် ဖွဲ့စည်းပုံမူဘောင် ....

၁.၄။ စီမံကိန်းအကြောင်းအရာ နှင့် ဖြစ်နိုင်ခြေရှိမှုများ ....

၁.၅။ ပတ်ဝန်းကျင်အခြေအနေ ....

၁.၆။ သက်ရောက်မှုနှင့် ဘေးအန္တရာယ် ဆန်းစစ်ခြင်း နှင့် လျော့ချရေးနည်းလမ်းများ ....

၁.၇။ ဆင့်ကဲသက်ရောက်မှုများ ....

၁.၈။ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ် (EMP) ....

၁.၉။ လူထုတွေ့ဆုံဆွေးခြင်းနှင့် ထုတ်ဖော်ပြောကြားခြင်း..

၁.၁၀။ နိဂုံး ....

ဇယားများ

ဇယား (၁-၁) လုပ်ကွက် MOGE-3 ၏ အနားသတ်ကိုသြဒိနိတ်များ..

ဇယား (၁-၂) အလားအလာရှိသော တွင်းတည်နေရာများ..

ဇယား (၁-၃) ဆောက်လုပ်ခြင်းနှင့်တပ်ဆင်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ ....

ဇယား (၁-၄) တွင်းတူးဖော်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ..

ဇယား (၁-၅) တွင်းစမ်းသပ်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ ....

ဇယား (၁-၆) တွင်းပိတ်သိမ်းခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ..

ဇယား (၁-၇) ကြိုတင်စီစဉ်ခြင်းမပြုနိုင်သောဖြစ်ရပ်များအတွက်အရေးပါသောအချက်များ..

ဇယား (၁-၈) အဓိကလျော့ချရေးနည်းလမ်းများနှင့် ကတိကဝတ်ဇယား..

ဇယား (၁-၉) စီစဉ်မထားသော အဖြစ်အပျက်များအတွက် လျော့ချရေးနည်းလမ်းများနှင့် ကတိကဝတ်ဇယား.........

ဇယား (၁-၁၀) ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ စောင့်ကြည့်စစ်ဆေးခြင်း..

ဇယား (၁-၁၁) ပထမအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးခြင်း အချိန်ဇယားနှင့် ပါဝင်ပတ်သက်သူများ........................

ဇယား (၁-၁၂) ပထမအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲမှ အဓိကတွေ့ရှိချက်များ ....

ဇယား (၁-၁၃) ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲ အချိန်ဇယားနှင့် သက်ဆိုင်သူများ................................

ဇယား (၁-၁၄) ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲမှ အဓိကအချက်အလက်များ ....

၁။ စီမံကိန်း အကျဉ်းချုပ်

၁.၁။ စီမံကိန်းအကြောင်းအရာ

ဤပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာကို ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်အစိုးရ၏ ထုတ်ပြန်ချက်အမှတ် ၉/၂၀၁၂ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ အပိုဒ်(၄၂)(ခ) တွင်ပါရှိသော ဆောင်ရွက်ရန် အချက်များ၊ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသော ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ ပတ်ဝန်းကျင်ဆိုင်ရာ နည်းဥပဒေများနှင့်အညီ ပြင်ဆင်ရေးဆွဲ ထားပါသည်။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လေ့လာမှုတွင် အနည်းဆုံး လိုက်နာရန် လိုအပ်သည့် မြန်မာနိုင်ငံရှိ ဥပဒေများ၊ နိုင်ငံတကာ လမ်းညွှန်ချက်များနှင့် စံချိန်စံညွှန်းများ ကိုလည်း အကျဉ်းချုပ် ထည့်သွင်း ဖော်ပြထားပါသည်။

PTTEP South Asia Limited (PTTEP SA) သည် မြန်မာ့ရေနံနှင့်သဘာဝဓါတ်ငွေ့လုပ်ငန်း (MOGE) ၏ ကုန်းတွင်း ရေနံလုပ်ကွက်အမှတ် MOGE-3 တွင် ရေနံရှာဖွေတူးဖော်ခွင့်ရရှိထားပြီးဖြစ်ပါသည်။ လုပ်ကွက် MOGE-3 သည် ၁၂၁၇ စတုန်းရန်း ကီလိုမီတာ ကျယ်ဝန်းပြီး ပုံ (၁- ၁) တွင် ဖော်ပြထားသည့်အတိုင်း မြန်မာနိုင်ငံအလယ်ပိုင်းဒေသ မကွေးတိုင်းဒေသကြီး တောင်ဘက်အပိုင်း ကုန်းမြေနိမ့်၍ ပူပြင်းခြောက်သွေ့သောဒေသတွင် တည်ရှိပါသည်။ လုပ်ကွက် MOGE-3 ၏ ကိုဩဒီနိတ် အမှတ်များကို **ဇယား (၁- ၁)** တွင် အသေးစိတ် ဖော်ပြထားပါသည်။

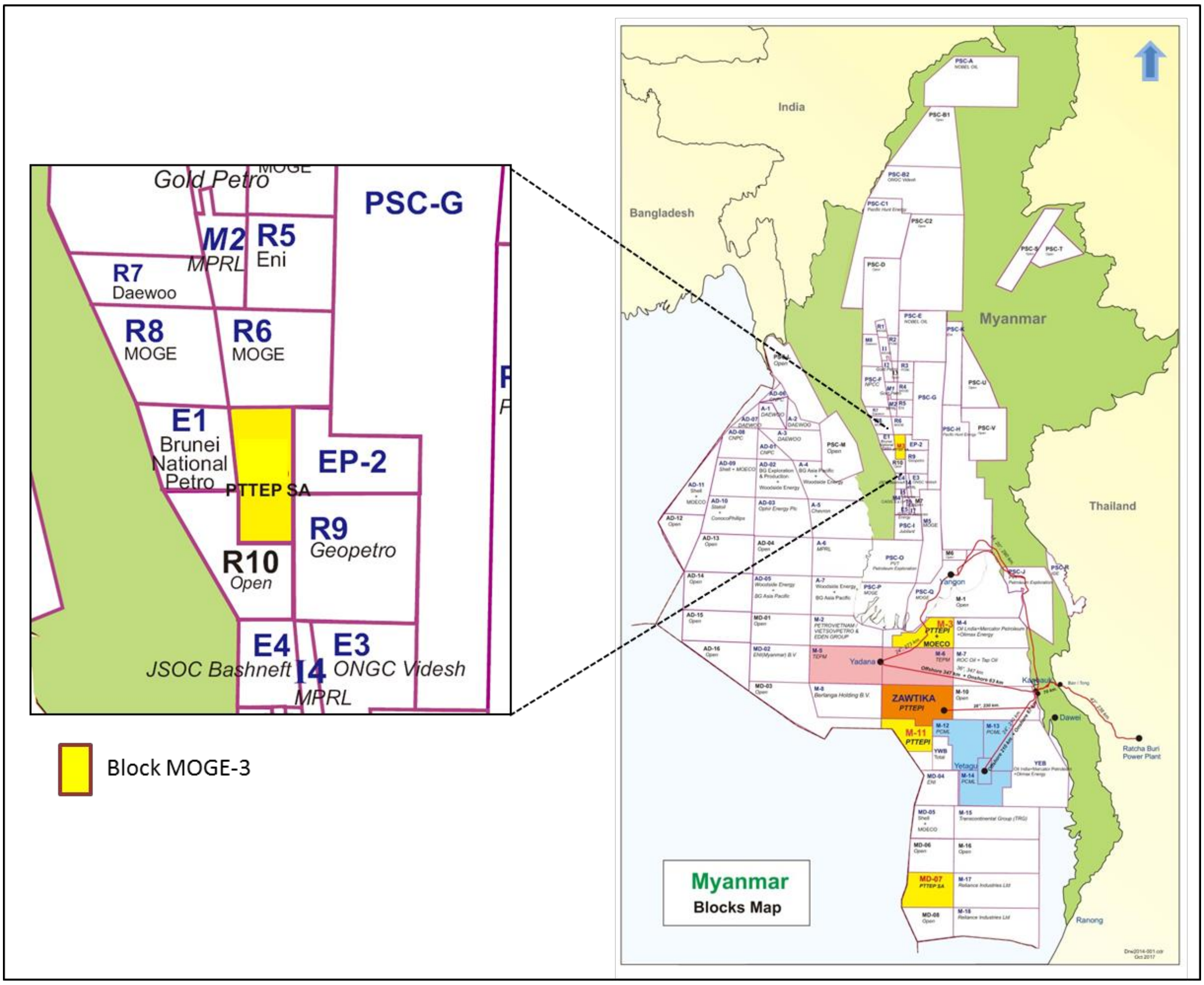
၂၀၁၆-၂၀၁၇ ခုနှစ်တွင် PTTEP SA သည် နှစ်ဖက်မြင်နှင့်သုံးဖက်မြင် ဆိုက်စမစ်တိုင်းတာခြင်းလုပ်ငန်းများကို ရေနံ လုပ်ကွက်အမှတ် MOGE-3 နှင့် အနီးအနားရှိဒေသများတွင် ဆောင်ရွက်ခဲ့ပြီးဖြစ်ပါသည်။ ထုတ်လုပ်မှုအပေါ် ခွဲဝေခံစားခြင်းစာချုပ်ပါ အတိုင်း PTTEP SA သည် ရေနံလုပ်ကွက်အမှတ် MOGE-3 တွင် ရေနံအစမ်းတွင်းများအား တူးဖော်သွားပါမည်။ ၂၀၁၈ ခုနှစ် စတုတ္ထသုံးလပတ်အတွင်းတွင် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ဆောင်ထားသော နေရာ (၈) နေရာအနက်မှ ရေနံတွင်း (၄) တွင်းအား ရွေးချယ်တူးဖော်သွားရန် ဆောင်ရွက်လျက်ရှိပါသည်။ ရေနံတွင်း (၄) တွင်း တူးဖော်ခြင်း အတွက် (၁တွင်းချင်းခန့်မှန်းကြာချိန်သည် လေးလခန့်ဖြစ်ပြီး တွင်းစမ်းသပ်ခြင်းမှာ ၅ လကျော်ခန့် ကြာမြင့်မည် ဖြစ်ပါသည်။ ကုန်းတွင်း လုပ်ကွက်အမှတ် MOGE-3 ရှိ ရေနံရှာဖွေတူးဖော်ခြင်း စီမံကိန်း၏ အဓိက ရည်ရွယ်ချက်များမှာ -

(က) ရေနံလုပ်ကွက်အမှတ် MOGE-3 တွင် ဟိုက်ဒရိုကာဗွန်တည်ရှိနေမှုကို အတည်ပြုနိုင်ရန်နှင့်

(ခ) ထုတ်လုပ်မှုအပေါ်ခွဲဝေခြင်းစာချုပ်ပါ ကတိကဝတ်များကို ပြည့်မီစေရန် ဖြစ်ပါသည်။

ဇယား (၁- ၁) လုပ်ကွက် MOGE-3 ၏ အနားသတ်ကိုဩဒီနိတ်များ

	အမှတ်	X	Y
MOGE-3	A	၃၉၀၇၃၆.၄၄	၂၁၆၃၈၆၂.၅၀
	B	၄၁၄၃၃၈.၈၁	၂၁၆၃၇၃၄.၂၅
	C	၄၁၅၈၃၉.၉၄	၂၁၁၀၂၄၀.၂၅
	D	၃၉၄၇၉၈.၃၈	၂၁၁၀၃၄၈.၂၅
	E	၃၉၄၀၃၈.၉၁	၂၁၃၀၆၄၁.၇၅
	A	၃၉၀၇၃၆.၄၄	၂၁၆၃၈၆၂.၅၀



ပုံ (၁-၁) လုပ်ကွက် MOGE-3၏ တည်နေရာ

၁.၂။ စီမံကိန်းအဆိုပြုသူ

PTTEP ၏ ကုမ္ပဏီခွဲတစ်ခုဖြစ်သော PTTEP South Asia Limited (PTTEP SA) သည် မြန်မာနိုင်ငံအတွက် ယုံကြည်အားထားရသော အဖွဲ့ဝင်ဖြစ်သည်နှင့် အညီ ရေရှည်တည်တံ့သော စီးပွားရေး၊ လူမှုရေး၊ ပတ်ဝန်းကျင် နှင့် လူသားအရင်းအမြစ်ဖွံ့ဖြိုးမှုတွင် တစိတ်တပိုင်းအဖြစ် ပါဝင်လျက်ရှိပါသည်။

ကုမ္ပဏီအမည်	PTTEP South Asia Limited
လိပ်စာ	(၃) လွှာ၊ Vantage တာဝါ၊ အမှတ် (၆၂၃)၊ ပြည်လမ်း၊ ကမာရွတ်မြို့နယ်၁၁၀၄၁၊ ရန်ကုန်၊ မြန်မာ
အဓိကဆက်သွယ်ရန်ပုဂ္ဂိုလ်	ဦးဘုန်းသက်ခိုင် ဒေါ်သီရိအောင်
ဖုန်းနံပါတ်	၉၅ (၁) ၆၅၂၇၀၀ ~၀၄
Email လိပ်စာ	PhoneThetK@pttep.com, ThiriAung@pttep.com

၁.၃။ ဥပဒေ၊ မူဝါဒနှင့် ဖွဲ့စည်းပုံမူဘောင်

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေပုဒ်မ ၅၂ နှင့် ၅၃၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ အပိုဒ် ၇ အရ PTTEP SA သည် အဆိုပါစီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှု သက်သေခံလက်မှတ် (ECC) ရရှိရန် ပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း အစီရင်ခံစာကို ရေးဆွဲရန် လိုအပ်ပါသည်။

စီမံကိန်းအား နိုင်ငံတကာနှင့် ဒေသတွင်းရှိ စံချိန်စံညွှန်းများ၊ ဥပဒေများနှင့်အညီ အကောင်အထည် ဖော်သွားပါမည်။

မြန်မာနိုင်ငံတွင် ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးအတွက် လိုအပ်သော ဥပဒေများမှာ-

- မြန်မာနိုင်ငံရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) (ပုဒ်မ ၇ (ဏ)၊ ၁၄၊ ၁၅၊၂၉)
- ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ (၂၀၁၅) (နည်းဥပဒေ ၆၉)
- ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်း (၂၀၁၅) (အပိုဒ် ၈၇၊ ၁၀၂ မှ ၁၁၀၊ ၁၁၃၊၁၁၅)
- အမျိုးသားအဆင့် ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် (၂၀၁၅)

အသေးစိတ် မူဝါဒများ၊ နည်းဥပဒေများကို နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်း အစီရင်ခံစာ၏ **အခန်း (၃)** တွင် ထပ်မံ၍ ဖော်ပြထားပါသည်။

၁.၄။ စီမံကိန်းအကြောင်းအရာ နှင့် ဖြစ်နိုင်ခြေရှိမှုများ

၁.၄.၁။ ရည်ရွယ်ချက်

အဆိုပါအစီရင်ခံစာ၏ ရည်ရွယ်ချက်မှာ PTTEP SA မှ လုပ်ကွက်အမှတ် MOGE-3 တွင် နေရာ (၈) နေရာအနက်မှ အစမ်းတွင်း (၄) တွင်း စမ်းသပ်ရှာဖွေတူးဖော်ခြင်းကို အကောင်အထည် ဖော်ဆောင်ရွက်ရာတွင် ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် လုံခြုံရေး အစီအစဉ်များ ဆောင်ရွက်ကိုထည့်သွင်းဆောင်ရွက်ရန် ရည်ရွယ်ပါသည်။ စီမံကိန်းအကြောင်းအရာ အပြည့်အစုံကို အဆိုပါပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ **အခန်း (၄)** တွင်အသေးစိတ် ဖော်ပြထားပါသည်။

၁.၄.၂။ စီမံကိန်းအား ထိန်းညှိခြင်း

PTTEP SA သည် မြန်မာနိုင်ငံအလယ်ပိုင်း မကွေးတိုင်းဒေသကြီး အတွင်းရှိ သရက်နှင့် ကံမ မြို့နယ်တို့တွင် နှစ်ဖက်မြင် (2D) နှင့် သုံးဖက်မြင် (3D) ဆိုက်စမစ်တိုင်းတာခြင်းလုပ်ငန်းများကို ၂၀၁၇ ခုနှစ်တွင် အောင်မြင်စွာ ဆောင်ရွက်ခဲ့ပြီး ဖြစ်ပါသည်။

PTTEP SA သည် ထုတ်လုပ်မှုအပေါ်ခွဲဝေခြင်းစာချုပ်ပါ ကတိကတိကဝတ်များ ပြည့်မီရန် နှင့်လုပ်ကွက်အမှတ် MOGE-3 တွင် ရေနံစမ်းသပ်ရှာဖွေတွေ့ရှိနိုင်ရန်အလို့ငှာ ၂၀၁၈-၂၀၁၉ ခုနှစ်တို့တွင် ရှာဖွေရေးတွင်းများကို တူးဖော်သွားရန် စီစဉ်ဆောင်ရွက်နေပါသည်။

၁.၄.၃။ စီမံကိန်း ဆိုင်ရာ ရွေးချယ်မှုများ

၁.၄.၃.၁။ စီမံကိန်းမလုပ်ဆောင်ခြင်း

အဆိုပြု စမ်းသပ်တူးဖော်ခြင်းစီမံကိန်းကို အကောင်အထည်မဖော်ပါက စီမံကိန်းကြောင့်ဖြစ်ထွန်းလာမည့် စီးပွားရေး အကျိုးမြတ်များ ရရှိနိုင်တော့မည်မဟုတ်ပါ။ ဆုံးရှုံးသွားနိုင်သော အကျိုးအမြတ်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

၁. စမ်းသပ်တူးဖော်ခြင်းအတွက် အလုပ်သမားခန့်ထားမှု ကုန်ကျစရိတ်နှင့် စီမံကိန်းကုန်ကျစရိတ်များ။

၂. စီမံကိန်းနေရာမှ ရေနံထုတ်လုပ်နိုင်မှုဆုံးရှုံးခြင်း/နှောင့်နှေးကြန့်ကြာစေခြင်း။

၃. ထုတ်လုပ်မှုအပေါ်ခွဲဝေခံစားခြင်းစာချုပ်မှရရှိလာမည့် မြန်မာနိုင်ငံတော်နှင့် ဒေသဆိုင်ရာအစိုးရများအတွက် နိုင်ငံတော်ဝင်ငွေ ဆုံးရှုံးခြင်း။

၄. ဤဒေသမှရေနံစိမ်းထုတ်လုပ်ဖြန့်ဝေနိုင်မှုအစား အခြားနိုင်ငံများမှ ရေနံများကို အစားထိုးအသုံးပြုရမည် ဖြစ်ပါသည်။ ပြင်ပမှ ရေနံစိမ်းတင်သွင်းမှုကြောင့် ကုန်ကျစရိတ် များပြားလာမှု အပါအဝင် သယ်ယူပို့ဆောင်ရေးကဏ္ဍမှတဆင့် မြန်မာနိုင်ငံအပေါ် သက်ရောက်မှုများ ရှိလာနိုင်ပါသည်။

၁.၄.၄။ တွင်းတည်နေရာ

၂၀၁၈-၂၀၁၉ ခုနှစ်တွင် တွင်းတူးဖော်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရန်အတွက် **ဇယား(၁-၂)** တွင် ပြသထားသော ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းပြုလုပ်ထားသည့်နေရာ (၈) ခုအပေါ်အခြေခံ၍ (၄) နေရာကို ရွေးချယ်သတ်မှတ်သွားမည် ဖြစ်ပါသည်။

ဇယား (၁-၂) အလားအလာရှိသော တွင်းတည်နေရာများ

တည်နေရာ	လတ္တီကျူ	လောင်ဂျီကျူ	X	Y
တံစည်းခေါက်	၁၉° ၃၃' ၃၈.၆၀"	၉၅° ၀' ၂၈.၃၁"	၃၉၅၉၂၈.၄၆	၂၁၆၃၁၇၃.၇၂
မိုးနတ်ကုန်း	၁၉° ၃၀' ၄၁.၁၂"	၉၄° ၅၉' ၃၈.၉၀"	၃၉၄၄၅၆.၆၁	၂၁၅၇၇၂၆.၂၁
ငါးဘတ်ကျ	၁၉° ၂၅' ၅၈.၀၉"	၉၄° ၅၉' ၁၄.၉၅"	၃၉၃၇၀၇.၂၃	၂၁၄၉၀၂၉.၇၄
ဗန်းပြင်	၁၉° ၂၄' ၅၅.၉၈"	၉၅° ၀၁' ၁၇.၄၈"	၃၉၇၂၆၉.၇၄	၂၁၄၇၀၉၉.၈၀
ပိတောက်ပင်	၁၉° ၂၂' ၂၆.၃၄"	၉၅° ၀၄' ၄၀.၀၂"	၄၀၃၁၅၂.၄၁	၂၁၄၂၄၆၇.၃၀
စခန်းကြီး	၁၉° ၂၂' ၂၀.၅၁"	၉၅° ၀၆' ၁၆.၉၆"	၄၀၅၉၇၉.၅၂	၂၁၄၂၂၇၃.၂၀
တလဘာ	၁၉° ၂၁' ၄၇.၀၅"	၉၅° ၀၀' ၃၀.၂၉"	၃၉၅၈၆၀.၀၂	၂၁၄၁၂၉၉.၈၈
နတ်မီး	၁၉° ၁၃' ၀၇.၁၂"	၉၅° ၀၁' ၁၁.၈၃"	၃၉၆၉၈၁.၆၅	၂၁၂၅၃၁၀.၃၁

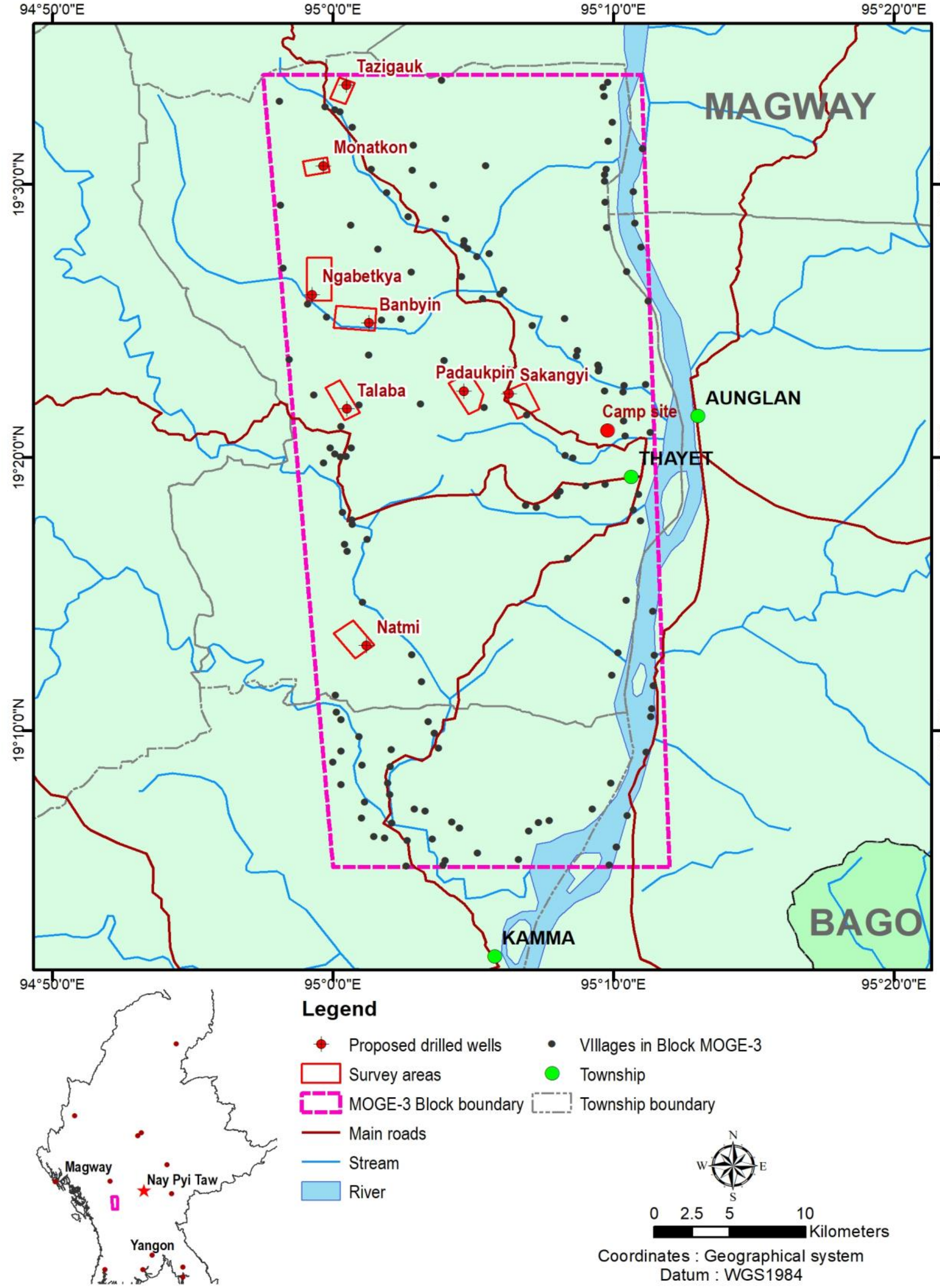
Note: Datum: UTM WGS84 Zone 46N

ပုံ (၁-၂) တွင် ဖော်ပြထားသော အဆိုပြုပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းစစ်တမ်းကောက်ယူထားသည့် တည်နေရာများ၏ ကိုဩဒိနိတ်များကိုဇယား (၁-၃) တွင် ဖော်ပြထားပါသည်။

ရေနံအစမ်းတွင်းများကို သဲကျောက်/နံးကျောက်များ တည်ရှိရာ ကျောက်လွှာအလယ်ပိုင်းနှင့် အနက်ပိုင်းတို့အထိ တူးဖော် သွားရန် လျာထားပါသည်။ PTTEP SA သည် ကုန်းတွင်းသုံးတွင်းတူးစက်ကိုသုံး၍ ရေနံတွင်းများ တူးဖော်သွားပါမည်။ အဆိုပါ တူးဖော်သွားမည့်နေရာများ အနီးတဝိုက်တွင် သင့်တော်သောဟိုတယ်များ (သို့မဟုတ်) ဧည့်ဂေဟာ များစသောနေရာများ မရှိသောကြောင့် ယာယီစခန်းချရန်နေရာကို ရေနံတွင်းအနီးတဝိုက်တွင် တည်ဆောက် သွားပါမည်။ ယာယီစခန်းချမည့်နေရာကို သရက်မြို့အပြင်ဘက် ၃ ကီလိုမီတာ အကွာရှိ လမ်းမကြီးဘေးတွင် တည်ဆောက်သွားပါမည်။ ဧရိယာအားဖြင့် (၁၀၀ x ၁၀၀) မီတာခန့် ရှိပါမည်။

ဇယား (၁-၃) အဆိုပြုတွင်းလေ့လာသည့် နေရာများ

NO.	Name	Point	Site locations	
			X	Y
1	Monatkon (1.5x1.0)	A	394709.19	2158286.50
		B	393203.56	2158036.25
		C	393366.63	2157041.50
		D	394858.75	2157310.50
		A	394709.19	2158286.50
2	Ngabetkya (1.5x2.9)	A	393414.31	2151523.25
		B	393388.00	2148628.00
		C	394924.53	2148614.25
		D	394941.78	2151524.50
		A	393414.31	2151523.25
3	Padaukpin (1.5x2.4)	A	402207.16	2142989.00
		B	403472.00	2143755.25
		C	404363.38	2142242.25
		D	404061.78	2141230.50
		E	403427.91	2140887.00
		A	402207.16	2142989.00
4	Sakangyi (1.5x2.0)	A	405637.53	2142382.00
		B	406476.13	2140568.00
		C	407846.34	2141208.50
		D	406979.91	2143009.50
		A	405637.53	2142382.00
5	Banbyin (2.5x1.5)	A	395217.00	2148262.00
		B	395059.88	2146797.50
		C	397584.28	2146552.50
		D	397705.88	2148044.25
		A	395217.00	2148262.00
6	Tazigauk (1.0x1.5)	A	395505.84	2163660.25
		B	396457.84	2163292.00
		C	395874.16	2161881.00
		D	394910.84	2162277.50
		A	395505.84	2163660.25
7	Natmi-North (1.5x2.0)	A	394925.84	2126137.50
		B	396166.38	2127034.00
		C	397445.50	2125354.00
		D	396269.91	2124437.50
		A	394925.84	2126137.50
8	Talaba (1.0x2.5)	A	394504.31	2142758.50
		B	395402.31	2143255.25
		C	396643.63	2141031.75
		D	395685.53	2140537.50
		A	394504.31	2142758.50



ပုံ (၁-၂) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းစစ်တမ်းကောက်ယူထားသည့် တည်နေရာများ

၁.၄.၅။ စီမံကိန်းအချိန်ဇယား

PTTEP SA သည် ၂၀၁၈ ခုနှစ် ဒီဇင်ဘာလတွင် ပထမအစမ်းတွင်းကို စတင်တူးဖော်သွားရန် စီစဉ်ဆောင်ရွက်လျက်ရှိပါသည်။ ရေနံအစမ်းတွင်း တစ်တွင်းစီ၏ အလားတူ တူးဖော်မည့် အချိန်ဇယားကို အဆင့် (၃) ဆင့်ဖြင့် ခွဲခြားဖော်ပြထားပါသည်။

- တည်ဆောက်ခြင်းအဆင့် - ± ရက်ပေါင်း ၁၅၀ (လမ်းခင်းရန်ကြာချိန် ရက် ၆၀နှင့် ရေနံတွင်းတူးဖော်ရန်ကြာချိန် ရက် ၉၀)
- တွင်းတူးခြင်းနှင့် တွင်းစမ်းသပ်ခြင်း အဆင့် - ± ရက်ပေါင်း ၆၀(တွင်းတူးရန်ကြာချိန် ရက် ၃၀ နှင့် တွင်းစမ်းသပ်ရန် အများဆုံးကြာချိန် ၂၂ရက်)
- ရေနံတွင်း ရပ်ဆိုင်းခြင်း၊ အပြီးသတ်ပိတ်သိမ်းခြင်းနှင့် မြေနေရာ ပြန်လည်ပြင်ဆင်ခြင်း - ± ရက်၃၀

စီမံကိန်းတစ်ခုလုံးအတွက် အချိန်ဇယားကို ဇယား (၁-၄) တွင် ဖော်ပြထားပါသည်။

၁.၄.၆။ အစမ်းတွင်းတူးဖော်ခြင်းအဆင့်

စီမံကိန်း၏အဓိကလုပ်ငန်းများမှာ တည်ဆောက်ခြင်း၊ တွင်းတူးခြင်း၊ တွင်းစမ်းသပ်ခြင်း နှင့် တွင်းပြီးဆုံးခြင်း၊ တွင်းရပ်ဆိုင်းခြင်း၊ တွင်းအပြီးသတ်ပိတ်သိမ်းခြင်း တို့ဖြစ်ပါသည်။

- **တွင်းနေရာအား ပြင်ဆင်ခြင်း**
  - PTTEP SA သည် ရေနံတွင်းတည်ဆောက်မည့်နေရာကို ဝယ်ယူပါမည်။
  - တွင်းနေရာကို ၂၂၀ x ၂၆၀ မီတာပတ်လည်အတွင်း တည်ဆောက်ပါမည်။
  - တွင်းနေရာသို့ဝင်မည့်လမ်းခင်းခြင်းကို လိုအပ်သောအဆင့်မြှင့်တင်ခြင်း ပြုလုပ်မည်။ လိုအပ်ပါက ၈ မီတာ အကျယ်ရှိသော လမ်းသစ်ကို ဖောက်လုပ်သွားပါမည်။
- **တွင်းတူးခြင်း**
  - ကုန်းတွင်း တွင်းတူးစက်ကိုသုံး၍ ရေနံတွင်းများတူးဖော်သွားပါမည်။
  - တွင်းတူးစက်ကို သယ်ယူပို့ဆောင်သည့်ယာဉ်ကြီးများဖြင့် တွင်းတူးမည့်နေရာသို့ သယ်ယူသွားပါမည်။
  - ပစ္စည်းကိရိယာများ၊ ဓါတုပစ္စည်းများနှင့် စွန့်ပစ်ပစ္စည်းများအပါအဝင် တွင်းတူးဖော်စဉ်ကာလတလျှောက်လုံး၌ လိုအပ်သည့်အရာများကို သယ်ယူပို့ဆောင်ရေးယာဉ်များဖြင့် ထောက်ပံ့ပို့ဆောင်ပါမည်။
- **တွင်းစမ်းသပ်ခြင်း**
  - တွင်းတူးပြီးနောက် ဟိုက်ဒရိုကာဗွန်ပါဝင်မှုကို သိရှိရန်အတွက် တွင်းအား စမ်းသပ်သွားပါမည်။
  - တွင်းစမ်းသပ်ခြင်းသည် ၄င်းနေရာတွင် အနာဂတ်ထုတ်လုပ်မှုအဆင့်အတွက် အထောက်အပံ့တစ်ခုအနေဖြင့် လိုအပ်ပါသည်။
  - တွင်းစမ်းသပ်ခြင်း လုပ်ငန်းစဉ်တွင် မီးရှို့ခြင်းနှင့် ဖိအားမြင့်ဓါတ်ငွေ့ လောင်ကျွမ်းခြင်းများ ပါဝင်သည်။
- **တွင်းပြီးဆုံးခြင်းနှင့် ပလပ်ချ၍ တွင်းကို အပြီးသတ်ပိတ်သိမ်းခြင်း**
  - တွင်းတူးဖော်ခြင်းနှင့် စမ်းသပ်ခြင်းများ ပြီးဆုံးသောအခါ အဆိုပါတွင်းကို အမြဲတမ်း သီးသန့်ဖြစ်နေစေရန် ပလပ်ချခြင်းဖြင့် အပြီးသတ်တွင်းပိတ် သိမ်းခြင်းကို ဆောင်ရွက် ရပါသည်။

  - မတူကွဲပြားသော မြေလွှာများမှ အရည်များ မြေပေါ်သို့ တက်မလာစေရန် ကာကွယ်ခြင်း အလို့ဌာတူးဖော် ထားသော တွင်းထဲသို့ ဘိလပ်မြေ ပလပ်များနှင့် စက်သုံး ပလပ်များဖြင့် ပိတ်ဆို့ထားရပါသည်။
  - တွင်းကာ ပိုက်များနှင့် အခြားသော တွင်းတူး ပစ္စည်း များကို တွင်းထဲမှ ထုတ်ယူရပါသည်။
  - ရေနံတွင်းတူးစက်ကို တွင်းနေရာမှ ပြန်လည် ဖယ်ရှားရပါသည်။

- **မြေနေရာပြန်လည်ပြုပြင်ခြင်း**

စီမံကိန်းလုပ်ငန်းများပြီးဆုံးပြီးနောက် MOGE၊ ဒေသခံအာဏာပိုင်များ (သို့) ဒေသခံပြည်သူလူထု ထံသို့ စီမံကိန်းနေရာကို ပြန်လည်လွှဲပြောင်းရန် အဆင့်သင့်ဖြစ်အောင် ပြန်လည်ပြုပြင်မွမ်းမံပါမည်။

ဇယား (၁-၄) MOGE-3 အစမ်းတွင်းတူးဖော်ခြင်းအချိန်ဇယား

Well	Duration																														
	2018							2019												2020											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Well#1 PDP	Construction	Construction	Construction	Construction	Construction	Drilling	Drilling											Well Testing										Site Restoration			
Well#2 MNK	Construction	Construction	Construction	Construction	Construction	Construction		Drilling	Drilling										Well Testing										Site Restoration		
Well#3 NBK			Construction	Construction	Construction	Construction	Construction			Drilling	Drilling									Well Testing										Site Restoration	
Well#4 SKG				Construction	Construction	Construction	Construction	Construction				Drilling	Drilling								Well Testing										Site Restoration

Remark: Construction Phase; Drilling Phase; Well Testing Phase; Site Restoration Phase

၁.၅။ ပတ်ဝန်းကျင်အခြေအနေ

ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ အချက်အလက်ကောက်ယူခြင်းကို စီမံကိန်း အနီးဝန်းကျင်တွင် ကောက်ယူခဲ့ပြီး စီမံကိန်းလုပ်ငန်းစဉ်များမှ ပတ်ဝန်းကျင်အပေါ် သက်ရောက်နိုင်မှုများကို screening အဆင့်တွင် ဖော်ပြသွားပါမည်။ ကနဦးလေ့လာမည့်ဧရိယာသည် တွင်းတူးဖော်မည့်နေရာမှ အချင်းဝက် ၅ ကီလိုမီတာ အတွင်း ဖြစ်ပါသည်။ စီမံကိန်းပတ်ဝန်းကျင်အကြောင်းအရာ အပြည့်အစုံကို အဆိုပါ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ အခန်း (၅) တွင် ဖော်ပြထားပါသည်။

၁.၅.၁။ လေ့လာမှုနယ်ပယ်နှင့် အသုံးချနည်းပညာ

နိုင်ငံတကာ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု ကုမ္ပဏီ (IEM) နှင့် ပတ်ဝန်းကျင်အရည်အသွေးစီမံခန့်ခွဲမှု ကုမ္ပဏီ (EQM) တို့သည် မြန်မာနိုင်ငံ မကွေးတိုင်းဒေသကြီး သရက်ခရိုင် သရက်မြို့နယ်ရှိ လုပ်ကွက် MOGE-3 တွင် ကုန်းတွင်းပတ်ဝန်းကျင်ဆိုင်ရာအခြေခံနမူနာ ကောက်ယူခြင်း၊ သဘောထားအမြင် စစ်တမ်းကောက်ယူခြင်း နှင့် အုပ်စုဖွဲ့အစည်းအဝေးများ ကျင်းပခြင်းများကို ပြုလုပ်ခဲ့ပါသည်။ စစ်တမ်းကောက်ယူမှု ရလဒ်များကို PTTEP SA မှ လုပ်ငန်းဆောင်ရွက်လျက်ရှိသော MOGE-3 ရေနံစမ်းသပ်တူးဖော်ရေးစီမံကိန်း ၏ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာတွင် ထည့်သွင်းရေးဆွဲပါမည်။

နိုင်ငံတကာ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု ကုမ္ပဏီ(IEM) သည် အောက်ပါလေ့လာဆန်းစစ်ခြင်းများကို ပြုလုပ်ပြီး ဖြစ်ပါသည်။

၁။ သရက်မြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန၊ သစ်တောဦးစီးဌာန နှင့် မြို့နယ်စည်ပင်သာယာရေး ကော်မတီမှ အရာရှိများ နှင့် တွေ့ဆုံ၍ ပတ်ဝန်းကျင်၊ လူမှုရေး နှင့်ရှေးဟောင်းသမိုင်းဝင် ဗိသုကာလက်ရာများနှင့် ပတ်သက်သည့် သတင်းအချက်အလက်များ စုံစမ်းမေးမြန်းခဲ့ပါသည်။
၂။ ရွာ ၃၄ ရွာမှ သဘောထားအမြင်စစ်တမ်း နမူနာ ၄၁၂ ခု
၃။ လုပ်ကွက်အတွင်းရှိ မြေပေါ်ရေနမူနာ ၁၆ခု
၄။ လုပ်ကွက်အတွင်းရှိ မြေအောက်ရေနမူနာ ၁၆ခု
၅။ လုပ်ကွက်အတွင်းရှိ မြေနမူနာ ၁၆ခု
၆။ လုပ်ကွက်အတွင်းရှိ လေနမူနာ ၄ခု နှင့် ဆူညံသံနမူနာ ၄ခု
၇။ ရှေးဟောင်းယဉ်ကျေးမှု ဗိသုကာလက်ရာ စစ်တမ်းကောက်ယူမှု
၈။ မြေအသုံးပြုမှု၊ ဇီဝမျိုးစုံမျိုးကွဲ နှင့် ဂေဟဗေဒဆိုင်ရာ စစ်တမ်းကောက်ယူမှု
၉။ ရိုးရာဂေဟဗေဒဆိုင်ရာအသိပညာဗဟုသုတစစ်တမ်းကောက်ယူမှု

၁.၅.၂။ ရုပ်ပိုင်းဆိုင်ရာ ပတ်ဝန်းကျင် အခြေအနေ

၁.၅.၂.၁။ မြေမျက်နှာသွင်ပြင်

ရေနံအစမ်းတွင်း တူးဖော်ခြင်းစီမံကိန်းများသည် အလယ်ပိုင်းမြေနိမ့်ရုပ်သွင်ရပ်ဝန်းဇုန်၏ အနောက်ဘက်ပိုင်းတွင် တည်ရှိပါသည်။ မြေမျက်နှာသွင်ပြင်အားဖြင့် တောင်ကုန်းတောင်တန်းနှင့် ချိုင့်ဝှမ်းများ ဖြစ်ပါသည်။

၁.၅.၂.၂။ ရာသီဥတုနှင့် လေအရည်အသွေး

လုပ်ကွက် MOGE-3 သည် မကွေးတိုင်းထက် ပိုမိုမိုးများသော အလယ်ပိုင်းခြောက်သွေ့ဇုန်၏ တောင်ဘက်အပိုင်းတွင် တည်ရှိပါသည်။ နှစ်၃၀အတွင်း (၁၉၈၁-၂၀၁၀ ခုနှစ်) နှစ်စဉ် ပျမ်းမျှ မိုးရေချိန်မှာ၁၂၂၇ မီလီမီတာ ရွာသွန်းခဲ့ပါသည်။ တနှစ်ပတ်လုံး အနိမ့်ဆုံး အပူချိန်မှာ ၁၆.၂-၂၄.၈ ဒီဂရီစင်တီဂရိတ်ကြားတွင် တည်ရှိပြီး အမြင့်ဆုံးအပူချိန်မှာစင်တီဂရိတ်မှာ ၃၁-၃၈.၇ ဒီဂရီစင်တီဂရိတ်ကြားတွင် တည်ရှိပါသည်။

ပူပြင်းခြောက်သွေ့ဖုန်ဖြစ်ခြင်းကြောင့်သော်လည်းကောင်း၊ စိုက်ပျိုးရေးလုပ်ငန်းများကြောင့် သော်လည်းကောင်း သေးငယ်သော အမှုန်အမွှားများ (PM2.5 and PM10) လေထုအတွင်း ပါဝင်မှု မြင့်မားနေကြောင်းတွေ့ရှိရပါသည်။

၁.၅.၂.၃။ ဆူညံမှု အရည်အသွေး

တစည်းကောက်ရွာ၏ ညအချိန်ဆူညံမှုနှုန်း (46dB) မှာ မြန်မာ့အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် နှင့် WHO လမ်းညွှန်ချက် စံချိန်စံညွှန်းများထက် ကျော်လွန်နေသည်မှလွဲ၍ နေ့အချိန်နှင့်ညအချိန်နှစ်ခုလုံး (Leq 24hr and Ldn) ၏ ဆူညံသံအခြေအနေမှာ သာမန်မျှသာ ဖြစ်ပါသည်။

၁.၅.၂.၄။ မြေထုနှင့် နုန်းအနည်အနှစ်

စားကျက်မြေနေရာတစ်ခုတွင် ဟိုက်ဒရိုကာဗွန်ပါဝင်မှု မြင့်မားနေသည်မှလွဲ၍ မြေဆီလွှာနမူနာအများစုသည် ကောင်းမွန်သော အခြေအနေ၌ရှိပြီး ဟိုက်ဒရိုကာဗွန်ပါဝင်မှုမရှိကြောင်း တွေ့ရပါသည်။

မြေဩဇာ၊ ပိုးသတ်ဆေးနှင့် စွန့်ပစ်အရည်များကြောင့် အချို့မြေဆီလွှာနမူနာများတွင် ခရိုမီယမ် (Cr) နှင့် နီကယ်လ်(Ni) ပါဝင်နေကြောင်း တွေ့ရှိရပါသည်။

၁.၅.၂.၅။ မြေပေါ်ရေ

မြေပေါ်ရေနမူနာအများစုသည် ကောင်းမွန်သောအခြေအနေ၌ ရှိကြပါသည်။ အချို့မြစ်နှင့် မြောင်းများ၌ ဆိုင်းကြွအနယ် (TSS) များနေကြောင်း တွေ့ရှိရပါသည်။
ဘူမိဗေဒအနေအထားအရ သဘာဝအလျောက်သံသတ္တုဓါတ်မြင့်မားမှုကို နေရာတိုင်း၌ တွေ့ရပါသည်။

၁.၅.၂.၆။ မြေအောက်ရေ

မြေအောက်ရေအများစုသည် ကောင်းမွန်သော အနေအထား၌ ရှိကြသော်လည်း သောက်သုံးရန်မသင့်လျော်သော လျှပ်စီးကိန်း (EC)မြင့်မားနေမှု နှင့် ပျော်ဝင်အနည်များ (TDS) ပါဝင်နေကြောင်းတွေ့ရှိရပါသည်။
ဘူမိဗေဒအနေအထားအရ သဘာဝအလျောက်သံသတ္တုဓါတ်မြင့်မားမှုကို နေရာအချို့၌ တွေ့ရှိရပါသည်။

၁.၅.၃။ ဇီဝဗေဒ ပတ်ဝန်းကျင် အခြေအနေ

၁.၅.၃.၁။ ဝန်းကျင်ဒေသနှင့် ကာကွယ်ထားသည့် မျိုးစိတ်များ

ရေနံစမ်းသပ်တူးဖော်ခြင်း စီမံကိန်းများသည် အလယ်ပိုင်း မြေနိမ့်ရပ်သွင်ရပ်ဝန်းဖုန်၏ အနောက်ဘက်ပိုင်းတွင် တည်ရှိပါသည်။ WWF မှ ၂၀၁၅ ခုနှစ်တွင် လေ့လာထားမှုများအရ မြေမျက်နှာ သွင်ပြင်သည် ရောဝတီ ရွက်ပြတ်ရောနှော တောစိုဖြစ်ပြီး တောင်ကုန်းတောင်တန်းနှင့် ချိုင့်ဝှမ်းများ ဖြစ်ပါသည်။ ဒေသဆိုင်ရာ မြေအသုံးချမှုနှင့် အပင်ဖုန်းလွှမ်းမှု မြေပုံအနေအထားအရ ရေနံလုပ်ကွက်အမှတ် MOGE-3 ရှိ မြေအမျိုးအစားကို ချုံပုတ်နှင့် အပင်ငယ်များသာ ရှိသည့်မြေဟု သတ်မှတ်ထားပါသည်။ သို့သော်လည်း စိုက်ပျိုးမြေ အဖြစ်ပြောင်းလဲအသုံးပြုလာကြပါသည်။ ဇီဝမျိုးစုံမျိုးကွဲ လေ့လာဆန်းစစ်မှုနှင့် မေးမြန်းချက်များအရ မျိုးတုန်းပျောက်ကွယ်လုနီးပါးဖြစ်သော မျိုးစိတ်များဖြစ်သည့် dhole (*Muntiacus feae* - EN)၊ fishing cat (*Prionailurus viverrinus* – EN)၊ Flat-headed Cat (*Prionailurus planiceps - EN*) နှင့် the Green Peafowl (*Pavo muticus* – EN) တို့ကိုတွေ့ရှိရပါသည်။

၁.၅.၃.၂။ ကာကွယ်ထားသည့် နေရာများ

ရေနံလုပ်ကွက် MOGE -3 တွင် တရားဝင် ကာကွယ်ထားသော သစ်တောကြိုးဝိုင်းများ မရှိပါ။ စီမံကိန်းဧရိယာအနီး ဇီဝမျိုးစုံမျိုးကွဲများ၏ အရေးပါမှု နေရာသည်ရောဝတီ မြစ်ကမ်း တစ်လျှောက်ဖြစ်ပါသည်။ အဆိုပါ ရေနံတွင်းနေရာ(၈)နေရာအနီးတဝိုက်၌ သဲဖြူကြိုးဝိုင်း တောနှင့် ကတို့တောင်ကြိုးဝိုင်းတောများသာရှိပါသည်။ ရေနံတွင်းတူးဖော်မည့် ဧရိယာအား လုံးသည် ကြိုးဝိုင်းတောအပြင်ဘက်တွင် ရှိပြီး သရက်သစ်တောဦးစီးဌာနမှ အတည်ပြု ထားပြီး ဖြစ်ပါသည်။

၁.၅.၄။ လူမှုစီးပွားရေးအခြေအနေ

၁.၅.၄.၁။ စီမံခန့်ခွဲရေး နှင့် အုပ်ချုပ်ရေး

စီမံကိန်းသည် မကွေးတိုင်းဒေသကြီး၊ သရက်ခရိုင်၊ သရက်မြို့နယ်တွင် တည်ရှိပါသည်။ ပြည်ထဲရေးဝန်ကြီးဌာနလက်အောက်ရှိ အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနသည် ဒေသအုပ်ချုပ်ရေး၏ ပင်မကျောရိုးတစ်ခု ဖြစ်ပါသည်။

၁.၅.၅။ လူဦးရေ

၂၀၁၄ခုနှစ်တွင် လူဦးရေနှင့် သန်းခေါင်စာရင်းအရ သရက်ခရိုင်၏ လူဦးရေ စုစုပေါင်းမှာ ၇၃၈,၀၄၇ ယောက် ဖြစ်ပါသည်။ လုပ်ကွက်၏ စုစုပေါင်းဧရိယာသည် ၁,၁၃၄.၄ စတုရန်းကီလိုမီတာ (၄၃၈ စတုရန်းမိုင်) ဖြစ်ပါသည်။ မကွေးတိုင်းဒေသကြီးသည် ဧရိယာအားဖြင့် ၁၇,၃၀၆ စတုရန်းမိုင် (၄၄,၈၂၀ စတုရန်းကီလိုမီတာ) ရှိပြီး မြန်မာနိုင်ငံ၏ တိုင်းဒေသကြီး (၇) ခု တွင် အကြီးဆုံး ဖြစ်ပါသည်။ မကွေးတိုင်းဒေသကြီးတွင် ခရိုင် (၅) ခုရှိပြီး သရက်ခရိုင်မှာ ဧရိယာအားဖြင့် ၄,၇၅၀ စတုရန်းကီလိုမီတာ ရှိပါသည်။ အနောက်ဘက်တွင်ရခိုင်ရိုးမရှိပြီး အရှေ့ဘက်တွင် ပဲခူးရိုးမရှိပါသည်။ အဓိကမြစ်မှာ ဧရာဝတီမြစ်ဖြစ်ပြီး သရက်ကို ဖြတ်၍ မြောက်မှ တောင်သို့စီးဆင်းလျက်ရှိပါသည်။ သရက်ခရိုင်တွင် အဓိက ထွက်ကုန်များမှာ ဆန်၊ ဝါ၊ ဆီအုန်း၊ ဆေးရွက်ကြီး တို့ဖြစ်ပါသည်။ ဆိုးဆေးထုတ်ကုန် အဖြစ် အသုံးပြုသော ရှားပင်များမှာ အလွန်ပေါများလှပါသည်။

ထိခိုက်လွယ်သော နေရာများ၏ အကွာဝေးကို ဇယား(၁-၅)တွင် ဖော်ပြထားပါသည်။

ဇယား (၁-၅) ထိခိုက်လွယ်သော နေရာများနှင့် အဆိုပြု တွင်းတစ်ခုစီမှ အကွာအဝေးများ

တွင်း ၀၁- မိုးနတ်ကုန်း		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ဘော် (တောင်)	၂.၄	အရှေ့
	ဘော် (မြောက်)	၂.၆	အရှေ့မြောက်
	အင်းလယ်	၃.၀	အရှေ့
	မိုးနတ်ကုန်း	၃.၃	အရှေ့မြောက်
မြစ်/ ချောင်း	တန်ဇီတူးမြောင်း	၂.၀	အရှေ့
	ဧရာဝတီမြစ်	၁၈.၃	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၂၅.၀	တောင်

တွင်း ၀၂- ငါးဘတ်ကျ		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ငါးဘတ်ကျ	၀.၇	အနောက်တောင်
	အုန်းမွန်တော	၁.၇	အရှေ့တောင်
	စန်းလယ်	၂.၆	အနောက်
မြစ်/ ချောင်း	ပန်တူးမြောင်း	၀.၆	အနောက်တောင်
	ဧရာဝတီမြစ်	၂၀.၀	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၁၇.၀	တောင်

တွင်း ၀၃- ပိတောက်ပင်		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ပိတောက်ပင်	၁.၈	အရှေ့တောင်
	ငါးသိုင်းခြုံ	၂.၃	အနောက်တောင်
	ကျောက်အိုး	၃.၀	အနောက်တောင်
မြစ်/ ချောင်း	ပန်တူးမြောင်း	၅.၄	အရှေ့မြောက်
	ဧရာဝတီမြစ်	၁၃	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၉.၀	အနောက်တောင်

တွင်း ၀၄- စခန်းကြီး		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ဘော် (တောင်)	၁.၆	မြောက်
	စခန်းကြီး	၁.၆၅	အရှေ့တောင်
	ပိတောက်ပင်	၂.၀၈	အနောက်တောင်
မြစ်/ ချောင်း	ပန်တူးမြောင်း	၃.၇	အရှေ့မြောက်
	ဧရာဝတီမြစ်	၉.၈	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၉.၈	အနောက်တောင်

တွင်း ၀၅- ဘန်းပြင်		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ဘန်းပြင်	၀.၈	အရှေ့
	ရွာသစ်	၂.၀	အရှေ့
	ပေကုတင်	၂.၁	အနောက်တောင်
မြစ်/ ချောင်း	ပန်တူးမြောင်း	၀.၁	မြောက်
	ဧရာဝတီမြစ်	၁၈.၂	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၁၃.၈	အရှေ့တောင်

တွင်း ၀၆- တံဇီးကောက်		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	တန်ဇီးကောက် (ရှေ့)	၁.၈	အနောက်တောင်
	တန်ဇီးကောက် (နောက်)	၁.၉	အနောက်တောင်
	တလုတ်ပင်	၂.၀	အနောက်တောင်
	မိုးနတ်ကုန်း	၂.၉	တောင်
မြစ်/ ချောင်း	တန်ဇီတူးမြောင်း	၂.၉	တောင်
	ဧရာဝတီမြစ်	၁၇.၀	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၃၀.၀	တောင်

တွင်း ၁၇- နတ်မီး		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ပေါက်ဦးကား	၃.၁	အရှေ့မြောက်
	တုံ	၃.၂	အရှေ့တောင်
	မန်ကျည်းပင်	၃.၅	အနောက်တောင်
	ပန်းနား	၃.၆	အနောက်မြောက်
မြစ်/	ပါးနီတူးမြောင်း	၂.၂	အရှေ့
ချောင်း	မင်းတုန်းတူးမြောင်း	၃.၉	အနောက်တောင်
	ရောဝတီ	၁၇.၀	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၂.၆	အရှေ့မြောက်

တွင်း ၁၈- တလက်ဘ		အကွာအဝေး (ကီလိုမီတာ)	လားရာ
ကျေးရွာ	ရှမ်းကျော	၀.၈	အရှေ့
	ရေမြင့်	၁.၃	အနောက်တောင်
	တောင်မြင့်	၂.၂	အနောက်မြောက်
မြစ်/	ပါးနီတူးမြောင်း	၃.၅	အနောက်တောင်
ချောင်း	ရောဝတီမြစ်	၂၀.၀	အရှေ့
သစ်တော	သဲဖြူကြိုးဝိုင်း	၉.၀	တောင်

၁.၅.၆။ လူမျိုးစု

မကွေးတိုင်းဒေသကြီး၏ ဒေသခံအများစုမှာ ဗုဒ္ဓဘာသာဝင် ဗမာလူမျိုးများ ဖြစ်ပါသည်။ ချင်း၊ ရခိုင်၊ ကရင်၊ ရှမ်း နှင့် အခြားတိုင်းရင်းသားလူနည်းစုအချို့လည်း နေထိုင်ကြပါသည်။ ဒေသခံအများစုမှာ ဗုဒ္ဓဘာသာဝင်များဖြစ်ကြပါသည်။

၁.၅.၇။ စိုက်ပျိုးရေးနှင့် စက်မှုလုပ်ငန်း

ရေနံလုပ်ကွက်အမှတ် MOGE-3 ရှိ မြေအသုံးချမှုမှာ စိုက်ပျိုးရေးလုပ်ငန်းများဖြင့် လွှမ်းမိုးထားပြီး အထူးသဖြင့် ခြောက်သွေ့သော မြေတွင် စိုက်ပျိုးခြင်း ဖြစ်ပါသည်။ သရက်မြို့နယ်အတွင်းတွင် အစိုးရပိုင်လုပ်ငန်း ၈၅ခု ရှိပါသည်။ အစိုးရပိုင်လုပ်ငန်းသည် ရေနံနှင့်သဘာဝဓာတ်ငွေ့ လက်ယက်ကုမ္ပဏီ ၆ခုကို လုပ်ငန်းလုပ်ကိုင်ခွင့်ပြုပြီး ဖြစ်ပါသည်။ လက်ယက်လုပ်ငန်းများသည် ပေ၁၀၀၀ အောက်အနက်ထိ တူးဖော်လေ့ရှိပါသည်။

အမှိုက်စီမံခန့်ခွဲမှု

သရက်မြို့နယ်၏အမှိုက်စီမံခန့်ခွဲမှုစနစ်မှာ လဟာပြင်မီးရှို့ခြင်းနှင့် လဟာပြင်အမှိုက်စုပုံခြင်းတို့ ဖြစ်ပါသည်။ အမှိုက်ပုံသည် ၄.၅ ဧက ကျယ်ဝန်းပြီး မြို့နယ်မှ ၃မိုင်ခန့်အကွာတွင် တည်ရှိပါသည်။ တနေ့လျှင်အမှိုက်တန်ချိန်ပေါင်း ၄တန်ခန့် ထွက်လေ့ရှိပြီး အများစုမှာ အိမ်သုံးစွန့်ပစ်ပစ္စည်းများ ဖြစ်ကြပါသည်။

၁.၅.၇.၁။ ဒေသဆိုင်ရာလူမှုစီးပွားရေး

သက်ဆိုင်ရာရွာများ၏ အိမ်ထောင်စု ၄၁၁ စုတွင် လူမှုစီးပွားသဘောထားအမြင်စစ်တမ်းကောက်ယူခြင်းကို ပြုလုပ်ခဲ့ပါသည်။
စိုးရိမ်ပူပန်မှုများနှင့် အကြံပြုချက်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်-

၁.၁။ ဆုံးဖြတ်ချက်ချရာတွင် ၈၉%သည် ရပ်ရွာခေါင်းဆောင်၏ဆုံးဖြတ်ချက်ပေါ်တွင် မူတည်ပါသည်။

၁.၂။ စစ်တမ်းကောက်ယူခဲ့သည့် ၉၈% သောအိမ်ထောင်စုအများစုမှာ ၄င်းတို့နေထိုင်သောမြေအပေါ် ပိုင်ဆိုင်မှုရှိကြပါသည်။ ၅၄% သော ရွာသားများမှာ စာရွက်စာတမ်း အထောက်အထားရှိပြီး ၄၃% မှာ ခွင့်ပြုချက်ရှိသော်လည်း စာရွက်စာတမ်း အထောက်အထားမရှိပါ။ ၄% မှာ ခွင့်ပြုချက်မရှိသလို စာရွက်စာတမ်း အထောက်အထားလည်း မရှိပါ။

၁.၃။ ၃၅% ၏ နှစ်စဉ်ဝင်ငွေမှာ ၁,၀၀၀,၀၀၁ မှ ၂,၀၀၀,၀၀၀ ကျပ် အတွင်းဖြစ်ပြီး ၃၁% ၏ နှစ်စဉ်ဝင်ငွေမှာ ၂,၀၀၀,၀၀၁ မှ ၃,၀၀၀,၀၀၀ ကျပ်အတွင်း ဖြစ်ပါသည်။

၁.၄။ စစ်တမ်းဖြေဆိုခဲ့သူတို့၏ ၆၂% မှာ အတန်း ပညာ ၄-၉ တန်းထိ ပညာသင်ကြားခဲ့ကြပါသည်။

၁.၅။ ၄၃%သော စစ်တမ်းဖြေဆိုသူတို့သည် သောက်သုံးရေအဓိက အရင်းအမြစ်အဖြစ် ထိန်းသိမ်းကာကွယ်ထားသော ရေတွင်း၊ ရေကန်၊ ချောင်း၊ မိုးရေများကို အသုံးပြုကြပြီး ၃၆%သည် အဝီစိတွင်းရေကိုလည်းကောင်း၊ ၁၆% သည် ထိန်းသိမ်းကာကွယ်မှုမရှိသော ရေတွင်း နှင့် မြစ်/ချောင်းများကို လည်းကောင်း အသုံးပြုကြပါသည်။

၁.၅.၈။ ယဉ်ကျေးမှု

IEMသည် စီမံကိန်းဧရိယာ၌ ရှေးဟောင်းယဉ်ကျေးမှုဆိုင်ရာ သတင်းအချက်အလက်များ ကောက်ယူခဲ့ပါသည်။ စီမံကိန်း ဧရိယာတွင် စိုက်ပျိုးမြေ၊ စားကျက်မြေ၊ သစ်တောမြေ၊ မြေရိုင်း နှင့် မစိုက်ပျိုးသောမြေနေရာများ ပါဝင်ပါသည်။

သရက်မြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ အတည်ပြုထားသည့်အတိုင်း စီမံကိန်းဧရိယာတွင် သမိုင်းဝင်ရှေးဟောင်း ယဉ်ကျေးမှုအမွေအနှစ် နေရာများ မရှိပါ။

၁.၅.၉။ အမြင်အာရုံ

မကွေးတိုင်းဒေသကြီး၏ နာမည်ကြီးကျော်ကြားသည့်နေရာများမှာ မကွေးမြသလွန်စေတီတော် နှင့် မင်းဘူးရွှေစက်တော် စေတီတော်တို့ ဖြစ်ပါသည်။ သရက်မြို့နယ်တွင် ၁၈၈၇ ခုနှစ်၌ ဗြိတိသျှတို့ ဆောက်လုပ်ခဲ့သော ဂေါက်ကွင်းတစ်ခု တည်ရှိ၍ ရှေးဟောင်း စစ်တပ်ခံတပ်တစ်ခု လည်းရှိပါသည်။

လုပ်ကွက် MOGE-3 အတွင်းရှိ စီမံကိန်းဧရိယာတွင် ကမ္ဘာလှည့်ခရီးသွားများကို ဆွဲဆောင်နိုင်သည့် အရာများ မတွေ့ရှိရပါ။

၁.၆။ ဖြစ်နိုင်ချေရှိသောထိခိုက်နိုင်မှုများနှင့် လျော့ချရေးနည်းလမ်းများ

ဖြစ်နိုင်ချေရှိသော ထိခိုက်နိုင်မှုများ အရေးပါခြင်းရှိမရှိကို ဆုံးဖြတ်နိုင်ရန် စီမံကိန်း အဆင့်လိုက် ဆောင်ရွက်ချက်များကို သိရှိနားလည်နိုင်သော ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင်နှင့် ကျန်းမာရေးကဏ္ဍများပါဝင်သော အကျဉ်းချုပ်ဇယား ကိုရေးဆွဲ၍ ကနဦးအကဲဖြတ်ခြင်းအဆင့်တွင် ထည့်သွင်းသွားပါမည်။ အကယ်၍ အရေးပါသော အကြောင်းအရာ အချက်အလက်များ ရှိပါက အသေးစိတ်အကဲဖြတ်ခြင်းများကို ဆက်လက်ဆောင်ရွက်သွားပါမည်။ အဆိုပြုစီမံကိန်းမှ ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင်နှင့် ကျန်းမာရေးကဏ္ဍ များအပေါ်ထိခိုက်နိုင်မှုများကို အရေအသွေးနှင့် အရေအတွက် ဆန်းစစ်ခြင်းနှစ်မျိုးလုံးကို ဆောင်ရွက်ခဲ့ပါသည်။ ထိခိုက်နိုင်မှုများ အတွက် အသေးစိတ်လေ့လာမှုစံနှုန်းများကို အခန်း ၆ တွင် အကျဉ်းချုပ်ဖော်ပြထားပါသည်။

ထိခိုက်မှုများလေ့လာခြင်းတွင် မျှော်လင့်မထားသော (သို့မဟုတ်) ကြိုတင်စီစဉ်ထားခြင်းမပြုနိုင်သော ဖြစ်ရပ်များကိုလဲ ထည့်သွင်း စဉ်းစားထားပါသည်။ ထိုသို့လေ့လာအကဲဖြတ်ခြင်းတွင် ကြီးမား၍အန္တရာယ်ရှိသော ဥပမာ မီးလောင်ခြင်းပေါက်ကွဲခြင်း၊ ဆီယိုဖိတ်ခြင်းအပါအဝင်အခြားသော သဘာဝဘေးအန္တရာယ်များဖြစ်သော မြေငလျှင်လှုပ်ခြင်းတို့ကိုပါထည့်သွင်း ဆန်းစစ်ထားပါသည်။ ဤလေ့လာဆန်းစစ်မှုတွင် ကြီးမား၍အန္တရာယ်ရှိသော ဖြစ်ရပ်များမှ ထိခိုက်နိုင်သော ဖြစ်နိုင်ချေနှင့် သက်ရောက် နိုင်မှုများအပြင် ၎င်းတို့၏အရေးပါမှုနှင့် ထိခိုက်နိုင်သော ဧရိယာများ၏ အရည်အသွေးနှင့် အရေအတွက်တို့ကိုပါ ထည့်သွင်း ဆုံးဖြတ်ရပါသည်။ ထို့နောက် တိကျသေချာသော လိုက်နာဆောင်ရွက်ရမည့် စီမံခန့်ခွဲမှုအစီအစဉ်များကို အဆိုပြုထားပါသည်။ နောက်ဆုံးအနေဖြင့် လိုက်နာဆောင်ရွက်ရမည့် စီမံခန့်ခွဲမှုအစီအစဉ်များ လေ့လာသတ်မှတ်ပြီးသောအခါ ကြွင်းကျန် သက်ရောက်မှုများကို လေ့လာအကဲဖြတ်ထားပါသည်။

အစမ်းတွင်းတူးဖော်ခြင်းမှ ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင်၊ ကျန်းမာရေးကဏ္ဍ နှင့် ကြိုတင်မစီစဉ်ထားသော အဖြစ်အပျက်များ၏ ကြွင်းကျန်သက်ရောက်မှုများကို အောက်ပါ **ဇယား (၁-၃) မှ ဇယား (၁-၇)** တွင် ဖော်ပြထားပါသည်။

ဇယား (၁-၆) ဆောက်လုပ်ခြင်းနှင့်တပ်ဆင်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
ရုပ်ဝန်းကျင်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
1. မြေမျက်နှာသွင်ပြင် နေအထား	1.1 ရေနံတွင်းနေရာ နှင့် စခန်းနေရာ တည်ဆောက်ခြင်း	1.1.1 ဒေသန္တရမြေပြင် အနေထား ပျက်ယွင်းခြင်း	နိမ့်သော
2. လေထု အရည်အသွေး	2.1 ရေနံတွင်းနေရာ နှင့် စခန်းနေရာ တည်ဆောက်ခြင်း	2.1.1 ဖုန်မှုန့်များကြောင့် လေထုအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	2.2 အဆောက်အအုံနှင့် လမ်းဆောက်လုပ်နေစဉ် စက်ယန္တရားများ အသုံးပြုခြင်း	2.2.1 စက်ယန္တရားများကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	2.3 အဆောက်အအုံ နှင့်လမ်းဆောက်လုပ်နေစဉ် စက်ယန္တရားများ အသုံးပြုခြင်း	2.3.1 GHGထုတ်လွှတ်ခြင်းကြောင့် ရာသီဥတုအပြောင်းအလဲ ဖြစ်ပေါ်စေခြင်း	နိမ့်သော
3. အသံဆူညံမှု	3.1 တည်ဆောက်ခြင်းနှင့် သယ်ယူပို့ဆောင်ခြင်း လုပ်ငန်းစဉ်အတွင်း စက်ယန္တရားများ အသုံးပြုခြင်း	3.1.1 စက်ယန္တရားများကြောင့်အသံဆူညံမှု မြင့်တက်လာခြင်း	နိမ့်သော
4. မြေပေါ်ရေ ဇလဗေဒ	4.1 အဆောက်အအုံ နှင့် လမ်းတည်ဆောက်ခြင်း	4.1.1 မြေပေါ်ရေ ဇလဗေဒ ပြောင်းလဲမှု	နိမ့်သော
5. မြေပေါ်ရေ အရည်အသွေး	5.1 အဆောက်အအုံ၊လမ်းနှင့် ရေနုတ်မြောင်းဆောက်လုပ်ခြင်း	5.1.1 မြေပေါ်ရေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
6. မြေအောက်ရေ အရည်အသွေး	6.1 အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်း၊ အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်းနှင့် ဓါတုပစ္စည်းများကိုင်တွယ် အသုံးပြုခြင်း	6.1.1 အမှိုက်များ၊ ဓါတုပစ္စည်းများနှင့် စွန့်ပစ်ရေတို့ကြောင့် မြေအောက်ရေညစ်ညမ်းမှုများ ဖြစ်ပေါ်နိုင်ခြင်း	နိမ့်သော
7. မြေဆီလွှာ အရည်အသွေး	7.1 ရေနံတွင်းနေရာ တည်ဆောက်ခြင်း နှင့် လမ်းဖောက်ခြင်း	7.1.1 ဆောက်လုပ်ရေးလုပ်ငန်းများကြောင့် မြေအရည်အသွေးကျဆင်းခြင်း	နိမ့်သော
ဂေဟစနစ်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
8. အပင်နှင့်သတ္တဝါများ	8.1 ရေနံတွင်းနေရာနှင့်စခန်းနေရာ တည်ဆောက်ခြင်းအတွက် ရှင်းလင်းခြင်း	8.1.1 သဘာဝအနေအထားများ ပျက်စီးယိုယွင်းသွားခြင်း	နိမ့်သော
	8.2 ရေနံတွင်းနေရာနှင့်စခန်းနေရာ တည်ဆောက်ခြင်း	8.2.1 နေထိုင်ကျက်စားရာအနေအထား ပျက်ယွင်းခြင်း	နိမ့်သော
	8.3 လုပ်ငန်းခွင်မှ စီးထွက်လာသောရေများနှင့် ရေနုတ်မြောင်းများ	8.3.1 ရေနေသတ္တဝါနေထိုင်ကျက်စားရာအ နေအထားပျက်ယွင်းခြင်း	နိမ့်သော
လူမှုဝန်းကျင်အတွက်ထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
9. မြေအသုံးပြုမှု ပြောင်းလဲခြင်း	9.1 လမ်းဖောက်လုပ်ရန်၊ တူးဖော်ရန်နေရာနှင့် စခန်းနေရာ	9.1.1 မူလအသုံးချသည့်ပုံစံ ပြောင်းလဲသွားခြင်း	ကောင်းသော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
	တို့အတွက် မြေနေရာ ဂယ်ယူခြင်း		
10. သယ်ယူပို့ဆောင်ခြင်း	10.1 တွင်းတူးစက်ရွှေပြောင်းခြင်း၊ယာဉ်နှင့်စက်ယန္တရားများသုံးစွဲခြင်း	10.1.1 ယာဉ်အသွားအလာ အနှောင့်အယှက် ဖြစ်စေခြင်း	နိမ့်သော
		10.1.2 လမ်းပျက်စီးစေခြင်း	
11. ရေအသုံးချခြင်း	11.1 ဆောက်လုပ်ခြင်းနှင့် နေ့စဉ်သုံးစွဲသည့်ရေတို့ကို ဒေသရှိရေအရင်းအမြစ်မှ အသုံးပြုခြင်း	11.1.1 ရေကိုပြိုင်တူ အသုံးပြုနေရခြင်း	နိမ့်သော
12. မြောင်းများမှရေဖြတ်သန်းစီးဆင်းခြင်း နှင့် ရေကြီးရေလျှံခြင်း	12.1 လမ်းများနှင့် စခန်းနေရာများမှ မိုးရေများ ဖြတ်သန်းစီးဆင်းခြင်း	12.2 ရေဖြတ်သန်းစီးဆင်းမှု ပိုမို များပြားလာခြင်းကြောင့် လမ်းများနှင့် အခြေခံအဆောက်အဦများကို ထိခိုက်နိုင်ခြင်း	လျစ်လျူရှုနိုင်သော
13. စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	13.1 အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	13.1.1 လေတိုက်ခြင်းကြောင့် အမှိုက်များပျံ့နှံ့ခြင်း၊ ပိုးမွှားတိရိစ္ဆာန်များရောက်ရှိလာခြင်းကြောင့် ရောဂါများဖြစ်ပွားလာနိုင်ခြင်း	နိမ့်သော
14. လူမှုစီးပွါးဖွံ့ဖြိုးတိုးတက်ခြင်း	14.1 ဆောက်လုပ်ရေးလုပ်ငန်းများ အတွက် ထောက်ပံ့မှုများ ပေးနိုင်ခြင်း	14.1.1 အနီးနားရှိဒေသခံများ အလုပ်အကိုင်နှင့် ဝင်ငွေရရှိနိုင်ခြင်း	ကောင်းသော
	14.2 အလုပ်သမားများရွှေ့ပြောင်းဝင်ရောက်လာခြင်းနှင့် လူ့အဖွဲ့အစည်းအတွင်း ထိတွေ့ဆက်ဆံခြင်း	14.2.1 အခြားဒေသမှအလုပ်သမားများနှင့် နယ်ခံများအကြား ပဋိပက္ခများ ဖြစ်ပေါ်လာနိုင်ခြင်း	နိမ့်သော
ယဉ်ကျေးမှုဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
15. သမိုင်းဝင် ရှေးဟောင်း သုတေသန ဆိုင်ရာ နှင့် ယဉ်ကျေးမှုဆိုင်ရာ အရင်းအမြစ်များ	15.1 လမ်းဖောက်လုပ်ရန်၊ တူးဖော်ရန်နေရာ နှင့် စခန်းနေရာတို့တည်ဆောက်ခြင်း	15.1.1 သမိုင်းဝင်ရှေးဟောင်း သုတေသနဆိုင်ရာ ကျောက်ဖြစ်ရုပ်ကြွင်းများ စီမံကိန်းဧရိယာတွင် တွေ့ရှိခြင်း	လျစ်လျူရှုနိုင်သော
အမြင်/မြင်ကွင်းဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
16. ခရီးသွားလုပ်ငန်းနှင့် ဖျော်ဖြေရေး	16.1 လမ်းဖောက်လုပ်ရန်၊ တူးဖော်ရန်နေရာ နှင့် စခန်းနေရာတို့တည်ဆောက်ခြင်း	16.1.1 စီမံကိန်းဆောက်လုပ်ရေး လုပ်ငန်းများနှင့်စီမံချက် လုပ်ဆောင်ခြင်းတို့ကြောင့် ခရီးသွားလုပ်ငန်းနှင့် ဖျော်ဖြေရေးအပေါ် အနှောင့်အယှက်ဖြစ်နိုင်ခြင်း	လျစ်လျူရှုနိုင်သော
ကျန်းမာရေးဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
17. ပြည်သူလူထုနှင့် လုပ်ငန်းခွင်ကျန်းမာရေး	17.1 လမ်းဖောက်လုပ်ရန်၊ တူးဖော်ရန်နေရာနှင့် စခန်းနေရာတို့တည်ဆောက်ခြင်း	17.1.1 ဖုန်မှုန့်များကြောင့်အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါများ ဖြစ်ပွါးနိုင်ခြင်း	အသင့်အတင့်ရှိသော
	17.2 ယာဉ်နှင့်စက်ယန္တရားများ သုံးစွဲခြင်း	17.2.1 အလုပ်သမားများအကြားအာရုံချို့ယွင်းခြင်းနှင့်ပြည်သူလူထုကို အနှောင့်အယှက်ဖြစ်စေခြင်း	လျစ်လျူရှုနိုင်သော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
	17.3 ဆောက်လုပ်ရေးလုပ်ငန်းများနှင့် သယ်ယူပို့ဆောင်ရေး	17.3.1 ယာဉ်မတော်တဆဖြစ်မှု	အသင့်အတင့် ရှိသော
	17.4 အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း	17.4.1 အစားအသောက်ကျန်းမာရေး၊ ဝမ်းပျက်ဝမ်းလျှော၊အူရောင ငန်းဖျားနှင့်ငှက်ဖျားရောဂါများ ဖြစ်ပွါးနိုင်ခြင်း	လျစ်လျူရှု နိုင်သော

ဇယား (၁-၇)တွင်းတူးဖော်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
ရုပ်ဝန်းကျင်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
1. လေထု အရည်အသွေး	1.1. စက်ယန္တရားများ အသုံးပြုခြင်း	1.1.1. ဖုန်မှုန့်များကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	1.2. စက်ယန္တရားများ အသုံးပြုခြင်း	1.2.1. စက်ယန္တရားများ၏ ထုတ်လွှတ်ခြင်းများကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	1.3. တွင်းတူးဖော်ခြင်း	1.3.1. ဟိုက်ဒြိုဂျင်ဆာလဖိုက် ဓာတ်ငွေ့ကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	1.4. စက်ယန္တရားများ အသုံးပြုခြင်း	1.4.1. GHG ထုတ်လွှတ်ခြင်းကြောင့် ရာသီဥတု အပြောင်းအလဲ ဖြစ်ပေါ်စေခြင်း	နိမ့်သော
2. အသံဆူညံမှု	2.1. တွင်းတူးဖော်ခြင်းနှင့် စက်ယန္တရားများ အသုံးပြုခြင်း	2.1.1. ရေနံတူးဖော်ရေးလုပ်ငန်းများကြောင့် အသံဆူညံမှုမြင့်တက်လာခြင်း	နိမ့်သော
3. အပူ နှင့် အလင်း	3.1. ယာဉ်များ၊တွင်းတူးစင်၊ စခန်းနေရာနှင့် တွင်းတူးဖော် သည့် နေရာတို့တွင် လုပ်ငန်း ဆောင်ရွက်ရန် မီးထွန်းခြင်း	3.1.1. ညအချိန် လုပ်ငန်းဆောင်ရွက်စဉ် မီးထွန်းခြင်း	လျစ်လျူရှု နိုင်သော
4. မြေပေါ်ရေ အရည်အသွေး	4.1. လုပ်ငန်းခွင်မှစီးထွက်လာသော ရေများ နှင့် ရေနုတ်မြောင်းများ	4.1.1. ရေအရည်အသွေးပြောင်းလဲခြင်း သို့မဟုတ် ညစ်ညမ်းခြင်း	နိမ့်သော
	4.2. တွင်းတူးဖော်ရေး လုပ်ငန်းများမှ ဘေးအန္တရာယ် ရှိသောစွန့်ပစ်ပစ္စည်းများ စွန့်ထုတ်ခြင်း	4.2.1. တွင်းတူးရာမှထွက်ရှိသောစွန့်ပစ်ရေဆိုး များကြောင့် မြေပေါ်ရေ အရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
5. မြေ အရည်အသွေး	5.1. လုပ်ငန်းခွင်မှစီးထွက်လာသော ရေများ နှင့် ရေနုတ်မြောင်းများ	5.1.1. တွင်းတူးရာမှထွက်ရှိသောရေဆိုးများ ကြောင့် မြေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
6. မြေအောက်ရေ အရည်အသွေး	6.1. ရေလည်ပတ်စီးဆင်းမှု ဆုံးရှုံးခြင်း	6.1.1. တွင်းတူးဖော်ရေးလုပ်ငန်းများကြောင့် မြေအောက်ရေအရည်အသွေး ယိုယွင်းခြင်း	နိမ့်သော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
	6.2. အမှိုက်စွန့်ပစ်ကန်များမှမြေကြီးနှင့် ဆည်မြောင်းများ ထဲသို့ စိမ့်ဝင်ခြင်း	6.2.1. မြေအောက်ရေအရည်အသွေး ပျက်စီးယိုယွင်းခြင်း	နိမ့်သော
ဂေဟာစနစ်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
7. ဒေသန္တရ အပင်များနှင့် တိရစ္ဆာန်များ	7.1. တွင်းတူးလုပ်ငန်းစဉ်များ၊ အလုပ်သမားများနှင့်လူနေ အဆောက်အအုံများ	7.1.1. လုပ်သားများ၏လုပ်ငန်းဆောင်ရွက်မှု ကြောင့်ရေနေသတ္တဝါနေထိုင် ကျက်စားရာအနေအထား ပျက်ယွင်းခြင်း	နိမ့်သော
လူမှုဝန်းကျင်အတွက်ထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
8. သယ်ယူပို့ဆောင်ခြင်း	8.1. လမ်းပေါ်တွင်ယာဉ်နှင့် စက်ယန္တရား ကြီးများ သွားလာခြင်း	8.1.1. လမ်းများပျက်စီးခြင်း	နိမ့်သော
9. ရေအသုံးချခြင်း	9.1. နေ့စဉ်သုံးစွဲရန်လိုအပ်သည့်ရေကို ဒေသရှိရေအရင်းအမြစ်မှ အသုံးပြုခြင်း	9.1.1. စီမံကိန်းမှရေထုတ်ယူသုံးဆွဲခြင်းကြောင့် ဒေသခံများ၏ရေရရှိမှုကိုသက်ရောက်မှု ဖြစ်စေနိုင်ခြင်း	နိမ့်သော
10. စွမ်းအင်အသုံးပြုခြင်း	10.1. တွင်းတူးဖော်ခြင်းနှင့် လုပ်ငန်းခွင်အတွက်စွမ်းအင်သုံးစွဲမှု	10.1.1.ဒေသခံများစွမ်းအင်ရရှိမှုကို တိုးလာစေခြင်း(သို့မဟုတ်) လျော့ကျသွားစေခြင်း	လျစ်လျူရှု နိုင်သော
11. စွန့်ပစ်ပစ္စည်းစီမံ ခန့်ခွဲခြင်း	11.1. အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း	11.1.1. အမှိုက်များကြောင့် မီးလောင်မှုအန္တရာယ်ရှိခြင်း၊ လေတိုက်ခြင်းကြောင့် အမှိုက်များပျံ့လွင့်ခြင်း၊ ပိုးမွှားတိရိစ္ဆာန်များရောက်ရှိလာနိုင်ခြင်း ၊မြေပေါ်နှင့်မြေအောက်ရေ ညစ်ညမ်းမှုများကြောင့် ရောဂါများဖြစ်ပွားလာနိုင်ခြင်း	နိမ့်သော
	11.2. အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း	11.2.1.အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းများ ကြောင့် ပတ်ဝန်းကျင်ကိုထိခိုက်မှု ဖြစ်စေခြင်း	နိမ့်သော
	11.3. တွင်းတူးကျစ်စာများနှင့် ဓါတုပစ္စည်းများကိုင်တွယ်ခြင်းနှင့် စွန့်ပစ်ခြင်း	11.3.1.တွင်းတူးရွှံ့တွင် ပါဝင်သော ဓါတုပစ္စည်း များကြောင့် ဒေသတွင်းရှိ မြေဆီလွှာနှင့် ရေအရင်းအမြစ် အရည်အသွေးများ ပြောင်းလဲ သွားခြင်း	အသင့်အတင့် ရှိသော
12. လူမှုစီးပွါးဖွံ့ဖြိုးတိုးတက် ခြင်း	12.1. အလုပ်အကိုင်အခွင့်အလမ်းများ ရှိခြင်းနှင့်ဒေသအတွင်းရှိ ပစ္စည်းများဝန်ဆောင်မှုများ သုံးစွဲခြင်း	12.1.1.အလုပ်အကိုင်နှင့် ဝင်ငွေရရှိနိုင်ခြင်း	ကောင်းမွန် သော
ကျန်းမာရေးဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
13. ပြည်သူလူထုနှင့် လုပ်ငန်းခွင် ကျန်းမာရေး	13.1. တွင်းတူးစက်၊မီးစက်နှင့် အခြား စက်ယန္တရားကြီးများ	13.1.1.ဆူညံသံများမှ ကျန်းမာရေးထိခိုက်နိုင်မှု	လျစ်လျူရှု နိုင်သော
	13.2. တွင်းတူးခြင်း ထောက်ပံ့မှုလုပ်ငန်းများနှင့်	13.2.1. ယာဉ်မတော်တဆဖြစ်မှု	အသင့်အတင့် ရှိသော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
	သယ်ယူပို့ဆောင်ခြင်း		
	13.3. အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း	13.3.1.အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်းမှ ကျန်းမာရေးအပေါ် သက်ရောက်နိုင်မှုများ	နိမ့်သော
	13.4. အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းများ ကိုင်တွယ်ခြင်းနှင့်စွန့်ပစ်ခြင်း	13.4.1.အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းမှ ကျန်းမာရေးအပေါ် သက်ရောက်နိုင်ခြင်း	နိမ့်သော
	13.5. အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း နှင့် ဓါတုပစ္စည်းများ ကိုင်တွယ်အသုံးပြုခြင်း	13.5.1.တွင်းတူးရှိ ဓါတုပစ္စည်းများနှင့် တွင်းတူးအမှိုက်များကြောင့် ကျန်းမာရေးထိခိုက်နိုင်မှုများ	နိမ့်သော
	13.6. ဝန်ထမ်းများနှင့် လူနေဆောင်များ	13.6.1.ကူးစက်ရောဂါများကြောင့် ကျန်းမာရေးအပေါ် သက်ရောက်နိုင်မှုများ	နိမ့်သော

ဇယား (၁-၈) တွင်းစမ်းသပ်ခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
ရုပ်ဝန်းကျင်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
1 လေထု အရည်အသွေး	1.1 စက်ယန္တရားများ အသုံးပြုခြင်း	1.1.1 ဖုန်မှုန့်များကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
		1.1.2 ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း နှင့် ဓာတ်ငွေ့များ ထုတ်လွှတ်မှုကြောင့် လေအရည်အသွေး ကျဆင်းနိုင်ခြင်း	နိမ့်သော
	1.2 တွင်းစမ်းသပ်ခြင်း (ဟိုက်ဒြိုဂျင်ဆာလဖိုက် ဓာတ်ငွေ့ ထုတ်လွှတ်ခြင်း)	1.2.1 ဟိုက်ဒြိုဂျင်ဆာလဖိုက်ဓာတ်ငွေ့ ကြောင့်လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
	1.3 ထွက်ရှိလာသောဓာတ်ငွေ့ကိုမီးရှို့ခြင်း	1.3.1 GHGထုတ်လွှတ်ခြင်းကြောင့် ရာသီဥတုပြောင်းလဲမှု ဖြစ်ပေါ်ခြင်း	နိမ့်သော
2 အသံဆူညံမှု	2.1 တွင်း စမ်းသပ်နေစဉ် အတွင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	2.1.1 တွင်းစမ်းသပ်ခြင်းကြောင့် အသံဆူညံမှု မြင့်တက်လာခြင်း	နိမ့်သော
3 အလင်း နှင့် အပူ	3.1 တွင်း စမ်းသပ်နေစဉ် အတွင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	3.1.1 ထွက်ရှိလာသောဓာတ်ငွေ့ကို မီးရှို့ခြင်းကြောင့် ညအချိန်အလင်းရောင် မြင့်တက်လာခြင်း	နိမ့်သော
4 မြေပေါ်ရေ အရည်အသွေး	4.1 ဘေးအန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှု	4.1.1 တွင်းတူးရာမှ ထွက်ရှိသော စွန့်ပစ်ရေဆိုးများကြောင့် မြေပေါ်ရေ အရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
5 မြေအရည် အသွေး	5.1 ဘေးအန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှု	5.1.1 တွင်းတူးရာမှထွက်ရှိသောစွန့်ပစ်ရေဆိုးများကြောင့်မြေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
ဂေဟစနစ်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
6 ဒေသန္တရ အပင်များနှင့် တိရစ္ဆာန်များ	6.1 အလုပ်သမားများနှင့် လူနေအဆောက်အအုံများ	6.1.1 အပူ နှင့် အလင်း ကြောင့် ဒေသန္တရ အပင်များနှင့် တိရစ္ဆာန်များ နေထိုင်ကျက်စားမှု ပျက်ယွင်းခြင်း	နိမ့်သော
	6.2 တွင်းစမ်းသပ်နေစဉ်အတွင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	6.2.1 အပူနှင့်အလင်းကြောင့် ဒေသန္တရ အပင်များနှင့် တိရစ္ဆာန်များ နေထိုင်ကျက်စားမှု ပျက်ယွင်းခြင်း	နိမ့်သော
လူမှုဝန်းကျင်အတွက်ထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
7 သယ်ယူပို့ဆောင်ခြင်း	7.1 လမ်းပေါ်တွင်ယာဉ်နှင့်စက်ယန္တရားကြီးများ သွားလာခြင်း	7.1.1 ယာဉ်အသွားအလာ အနှောင့်အယှက်ဖြစ်စေခြင်း	နိမ့်သော
		7.1.2 လမ်းများပျက်စီးခြင်း	
8 စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်း	8.1 အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းနှင့်အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်းများစီမံခန့်ခွဲခြင်း	8.1.1 အမှိုက်များကြောင့် မီးလောင်မှုအန္တရာယ်ရှိခြင်း၊ လေတိုက်ခြင်းကြောင့် အမှိုက်များပျံ့လွင့်ခြင်း၊ ပိုးမွှားတိရိစ္ဆာန်များရောက်ရှိလာနိုင်ခြင်း၊မြေပေါ်နှင့်မြေအောက်ရေညစ်ညမ်းမှုများကြောင့် ရောဂါများဖြစ်ပွားလာနိုင်ခြင်း	နိမ့်သော
		8.1.2 အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းများ	နိမ့်သော
9 လူမှုစီးပွါးဖွံ့ဖြိုးတိုးတက်ခြင်း	9.1 ဝန်ထမ်းများနှင့် လူနေဆောင်များ	9.1.1 အလုပ်အကိုင်အခွင့်အလမ်းနှင့် ဝင်ငွေရရှိနိုင်ခြင်းမှု	ကောင်းမွန်သော
ကျန်းမာရေးဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
10 ပြည်သူလူထုနှင့် လုပ်ငန်းခွင်ကျန်းမာရေး	10.1 မီးရှို့၍ ဓါတ်ငွေ့စမ်းသပ်ခြင်း	10.1.1 အနှောင့်အယှက်ဖြစ်နိုင်သောအလင်းရောင်နှင့် အပူတို့နှင့်ထိတွေ့ခြင်း	နိမ့်သော
	10.2 မီးရှို့၍ ဓါတ်ငွေ့စမ်းသပ်ခြင်း	10.2.1 အသက်ရှူလမ်းကြောင်းဆိုင်ရာ ပန်းနာရင်ကြပ်ကဲ့သို့ရောဂါများဖြစ်ပွါးခြင်းနှင့် မီးရှို့၍ ဓါတ်ငွေ့စမ်းသပ်ခြင်းကြောင့် စိတ်ရောဂါများဖြစ်ပွါးနိုင်ခြင်း	နိမ့်သော
	10.3 တွင်းတူးခြင်း ထောက်ပံ့မှုလုပ်ငန်းများနှင့် သယ်ယူပို့ဆောင်ခြင်း	10.3.1 ယာဉ်မတော်တဆဖြစ်မှု	အသင့်အတင့်ရှိသော
	10.4 အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	10.4.1 အမှိုက်များကြောင့်မြေပေါ်နှင့် မြေအောက်ရေညစ်ညမ်းပြီး ရောဂါများဖြစ်ပွားလာနိုင်ခြင်း	နိမ့်သော
	10.5 အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	10.5.1 အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းမှ ကျန်းမာရေးအပေါ် သက်ရောက်နိုင်ခြင်း	နိမ့်သော

ဇယား (၁-၉) တွင်းပိတ်သိမ်းခြင်းအဆင့်အတွက်အရေးပါသောအချက်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
ရုပ်ဝန်းကျင်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
1. မြေမျက်နှာသွင်ပြင် အနေအထား	1.1 စီမံကိန်းနေရာနှင့် လမ်းတံတား အသုံးပြုမှု ရပ်ဆိုင်းခြင်း နှင့် မြေနေရာ ပြန်လည်ပြင်ဆင်ခြင်း	1.1.1 ဒေသန္တရ မြေမျက်နှာသွင်ပြင် အနေအထား ပျက်ယွင်းခြင်း	နိမ့်သော
2. လေထု အရည်အသွေး	2.1 စက်ယန္တရားများ အသုံးပြုခြင်း	2.1.1 ဖုန်မှုန့်များကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
		2.1.2 ထွက်ရှိလာသော လောင်စာများကို မီးရှို့ခြင်းကြောင့် လေအရည်အသွေး ကျဆင်းနိုင်ခြင်း	
		2.1.3 GHG ထုတ်လွှတ်ခြင်းကြောင့် ရာသီဥတုအပြောင်းအလဲ ဖြစ်ပေါ်စေခြင်း	
3. အသံဆူညံမှု	3.1 စက်ယန္တရားများ အသုံးပြုခြင်း	3.1.1 စက်ယန္တရားများဖြင့် ပြန်လည်ဖြုတ်သိမ်းခြင်း ၊သယ်ယူပို့ဆောင်ခြင်း တို့ကြောင့် အသံဆူညံမှု မြင့်တက်လာခြင်း	နိမ့်သော
4. မြေပေါ်ရေ ဇလဗေဒ	4.1 ဘေးအန္တရာယ်မရှိသော / ရှိသော စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှု	4.1.1 စက်ယန္တရားများဖြင့် ပြန်လည်ဖြုတ်သိမ်းခြင်းကြောင့် နီးစပ်သောနေရာများတွင် ယာယီရေအရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
5. မြေပေါ်ရေ အရည်အသွေး	*5.1* မြေနေရာပြန်လည်ပြုပြင်ခြင်း	5.1.1 မြေပေါ်ရေ ဇလဗေဒပြောင်းလဲသွားခြင်း	နိမ့်သော
6. မြေ အရည်အသွေး	6.1 မြေနေရာပြန်လည်ပြုပြင်ခြင်း အတွက် မြေတူးခြင်း	6.1.1 စက်ယန္တရားများဖြင့် ပြန်လည်ဖြုတ်သိမ်းခြင်းကြောင့်	နိမ့်သော
7. မြေအောက်ရေ အရည်အသွေး	7.1 ဘေးအန္တရာယ် မရှိသော / ရှိသော စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှု နှင့် ဓာတု ပစ္စည်း ကိုင်တွယ်မှု	7.1.1 စွန့်ပစ် ပစ္စည်းများ ၊ ရေဆိုးများ ၊၊ ဓာတုပစ္စည်းများကြောင့် မြေအောက်ရေ အရည်အသွေး ကျဆင်းခြင်း	နိမ့်သော
ဂေဟစနစ်ဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
8. ဒေသန္တရအပင်များနှင့် တိရစ္ဆာန်များ	8.1 အလုပ်သမားများ နှင့် လူနေ အဆောက်အအုံများ	8.1.1 နယ်မြေဒေသတွင်း နေထိုင်ကျက်စားသော သတ္တဝါများအပြုအမူ ပျက်ယွင်းခြင်း	နိမ့်သော
	8.2 လုပ်ငန်းခွင် စီးထွက်လာသော ရေများ နှင့် ရေနုတ်မြောင်းများ	8.2.2 ရေနေသတ္တဝါနေထိုင် ကျက်စားရာအနေအထား ယာယီပျက်ယွင်းခြင်း	နိမ့်သော
လူမှုဝန်းကျင်အတွက်ထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
9. မြေအသုံးပြုမှု ပြောင်းလဲခြင်း	9.1 မြေနေရာပြန်လည်ပေးအပ်ခြင်း	*9.1.1* မူလအသုံးချသည့်ပုံစံ ပြောင်းလဲသွားခြင်း	ကောင်းမွန်သော
10. သယ်ယူပို့ဆောင်ခြင်း	10.1 လမ်းပေါ်တွင်ယာဉ်နှင့် စက်ယန္တရားကြီးများ အသုံးပြုခြင်း	10.1.1 ယာဉ်အသွားအလာ အနှောင့်အယှက်ဖြစ်စေခြင်း	နိမ့်သော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
	10.2 မြေနေရာပြန်လည်ပြုပြင်ခြင်း	10.2.1 လမ်းများပျက်စီးခြင်း	
11. စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	*11.1* အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်း နှင့်အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများစီမံခန့်ခွဲခြင်း	*11.1.1* အမှိုက်များကြောင့်မြေပေါ် နှင့် မြေအောက်ရေညစ်ညမ်းပြီး ရောဂါများဖြစ်ပွားလာနိုင်ခြင်း	နိမ့်သော
ကျန်းမာရေးဆိုင်ရာထိခိုက်နိုင်မှုများဆန်းစစ်ခြင်း			
12. ပြည်သူလူထုနှင့် လုပ်ငန်းခွင်ကျန်းမာရေး	*12.1* အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်း	*12.1.1* အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများနှင့် ထိတွေ့မှုကြောင့် ညစ်ညမ်းမှုများ ဖြစ်ပေါ်နိုင်ခြင်း	လျစ်လျူရှုနိုင်သော
	၁၂.၁ အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု	၁၂.၂.၁ အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများမှ ညစ်ညမ်းခြင်း။	လျစ်လျူရှုနိုင်သော

ဇယား (၁-၁၀) ကြိုတင်စီစဉ်ခြင်းမပြုနိုင်သောဖြစ်ရပ်များအတွက်အရေးပါသောအချက်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
1. တွင်းကန်ခြင်း/ တွင်းပေါက်ကွဲထွက်ခြင်း	1.1 တွင်းတူးဖော်ခြင်း	1.1.1 ဟိုက်ဒရိုကာဗွန်များ ထိန်းချုပ်နိုင်မှု မရှိဘဲ ပန်းထွက်ခြင်း၊ မီးလောင်ခြင်း၊ ပေါက်ကွဲခြင်းတို့ကြောင့် ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု ဖြစ်နိုင်ပြီး လူများ ထိခိုက်ဒဏ်ရာရရှိခြင်း (သို့မဟုတ်) သေဆုံးနိုင်ခြင်း	အသင့်အတင့်ရှိသော
2. မီးလောင်ခြင်း သို့မဟုတ် ပေါက်ကွဲခြင်း (ပေါက်ထွက်ခြင်းနှင့် မသက်ဆိုင်)	2.1 လောင်စာဆီသိုလှောင်ခြင်းနှင့် စတင်လောင်ကျွမ်းသည့် အရင်းအမြစ်	2.1.1 တွင်းတူးစက် သို့မဟုတ် စခန်းနေရာ သို့မဟုတ် စက်သုံးဆီသိုလှောင်သည့် နေရာတွင် ပေါက်ကွဲနိုင်ခြင်း သို့မဟုတ် မီးလောင်နိုင်ခြင်း	အသင့်အတင့်ရှိသော
3. လောင်စာဆီ၊ ဓါတုပစ္စည်း၊အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်း များ ယိုဖိတ်မှုဖြစ်ခြင်း	3.1 လောင်စာဆီ၊ ဓါတုပစ္စည်း၊အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းများ သိုလှောင်ထားရှိခြင်း	3.1.1မတော်တဆယိုဖိတ်မှုများကြောင့် လေအရည်အသွေး၊ မြေလွှာ အရည်အသွေး၊ မြစ်ချောင်းအင်းအိုင်များ အတွင်းရှိရေ၊ မြေအောက်ရေ၊ ဒေသတစ်ခု အတွင်း ပေါက်ရောက်ကျက်စားသော အပင်နှင့် သတ္တဝါ အစုနှင့်လူသားများကို ထိခိုက်ပြီး သဘာဝပတ်ဝန်းကျင်ကို အန္တရာယ်ဖြစ်နိုင်ခြေ ရှိခြင်း	အသင့်အတင့်ရှိသော
4. သယ်ယူပို့ဆောင်စဉ် မတော်တဆဖြစ်ခြင်း များ	4.1 ယာဉ်နှင့် စက်ယန္တရား ကြီးများ အသုံးပြုခြင်း	4.1.1 ဒဏ်ထိမ်းများ ထိခိုက်ဒဏ်ရာ ရရှိခြင်း သို့မဟုတ် အသက်ဆုံးရှုံးနိုင်ခြေရှိခြင်း၊	အသင့်အတင့်ရှိသော

အပိုင်းကဏ္ဍ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု	ကြွင်းကျန် သက်ရောက်မှု
		နေရာကွက်၍ သဘာဝပတ်ဝန်းကျင် ညစ်ညမ်းမှုဖြစ်ခြင်း	
5. မြေလျောင်လှုပ်ခတ်ခြင်း	5.1 မြေမျက်နှာပြင် ပြောင်းလဲသွားခြင်း/ ရွေ့လျားမှုများဖြစ်ပေါ်ခြင်း	5.1.1 ရုပ်ပိုင်းအနေအထား ပျက်ယွင်းပြောင်းလဲသွားခြင်း ကြောင့် အဆောက်အဦများ ပြိုကျခြင်း၊ တွင်းမှ ရေနံပန်းထွက်ခြင်း၊ မီးလောင်ခြင်း၊ ရေနံများ မတော်တဆ စီးထွက်၍ ယိုဖိတ်မှုများဖြစ်ပွါးနိုင်ခြင်း	နိမ့်သော

၁.၇ ဆင့်ကဲသက်ရောက်မှုများ

ဆင့်ကဲသက်ရောက်မှုများ ဆန်းစစ်ရခြင်း၏ ရည်ရွယ်ချက်မှာ ၄င်းတို့သီးသန့်တစ်ခုတည်းရှိရုံဖြင့် သိသာထင်ရှားသော သက်ရောက်မှုများကို မဖြစ်စေပဲ ယင်းစီမံကိန်း နှင့်/သို့ တခြားစီမံကိန်းများ၏အတိတ်၊ ပစ္စုပ္ပန် (သို့) အနာဂတ်ရှိ လုပ်ငန်း ဆောင်ရွက်မှုများမှ သက်ရောက်မှုအချင်းချင်း ပေါင်းစပ်သွားသည့်အခါ ပိုမိုကျယ်ပြန့်ပိုမို သိသာထင်ရှားသော သက်ရောက်မှု (များ) ကို ဖြစ်စေနိုင်သည့် ပတ်ဝန်းကျင်၊ လူမှုရေး သို့ ကျန်းမာရေးဆိုင်ရာ ရှုထောင့်များကို သတ်မှတ်ပေးရန် ဖြစ်ပါသည်။

စီစဉ်ထားသော၊ မစီစဉ်ထားသောစီမံကိန်းဆိုင်ရာလုပ်ငန်းဆောင်ရွက်မှုများကို ဆန်းစစ်ခြင်း/တိုင်းတာသတ်မှတ်ခြင်း သည် ဆင့်ကဲသက်ရောက်မှုများကို ဖြစ်ပေါ်နိုင်ခြေရှိသည့် ပတ်ဝန်းကျင်၊ လူမှုရေး သို့ ကျန်းမာရေးဆိုင်ရာ ရှုထောင့်များကို သတ်မှတ်ပေးရန် အထောက်အကူပေးပါသည်။ ၄င်းတို့တွင် အောက်ပါတို့ ပါဝင်ပါသည်- လူထုနှင့် လုပ်ငန်းခွင် ကျန်းမာရေး၊ လူမှုစီးပွားရေး၊ အမှိုက်စီမံခန့်ခွဲမှု၊ သယ်ယူပို့ဆောင်ရေး၊ အပင်နှင့် သတ္တဝါ (ရေနေအပါအဝင်)၊ မြေအောက်ရေအရည်အသွေး၊ မြေပေါ်ရေအရည်အသွေး၊ မြေဆီလွှာ၊ ဆူညံသံနှင့် လေအရည်အသွေး။ ဆင့်ကဲသက်ရောက်မှုများကို ဖြစ်ပေါ်စေနိုင်သည့် အဓိက လုပ်ငန်းဆောင်တာများမှာ - ဘေးအန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်း နှင့် ဘေးအန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်း၊ ရေနုတ်မြောင်း၊ ပစ္စည်းများနှင့် ဓာတုပစ္စည်းများ ကိုင်တွယ်ခြင်း၊ လမ်းနှင့် စီမံကိန်းနေရာ တည်ဆောက်ခြင်း၊ ယာဉ်နှင့် ပစ္စည်းကိရိယာ အသုံးပြုမှု၊ အလုပ်သမားများနှင့် နေရာချထားခြင်း နှင့် ကြိုတင်မစီစဉ်ထားသော ဖြစ်ရပ်များ (ပွင့်ထွက်မှု၊ မီးလောင်မှုနှင့် ပေါက်ကွဲမှု၊ ဓာတုပစ္စည်းနှင့်ဘေးအန္တရာယ်ရှိ ပစ္စည်းများ ယိုဖိတ်ခြင်းတို့ ဖြစ်ပါသည်။

ဆင့်ကဲသက်ရောက်မှုများဆန်းစစ်ရခြင်းသည် ဆင့်ကဲသက်ရောက်မှုများ မဖြစ်ပေါ်လာအောင် အဆုံးအဖြတ်ပေးပါသည်။ ထို့အပြင် အဆိုပါအစမ်းတွင်း(၄)တွင်းတူးဖော်ခြင်းစီမံကိန်းအတွက်လက်ရှိသတ်မှတ်ထားသော လျော့ချရေးနှင့် စောင့်ကြည့်လေ့လာရေး နည်းလမ်းများသည် **အခန်း(၇)** တွင်အသေးစိတ်ဖော်ပြထားသော ဆင့်ကဲသက်ရောက်မှုများကို ထပ်မံ၍ ကာကွယ် တားဆီး ပေးလိမ့်မည်ဟု ဆုံးဖြတ်ပေးပါသည်။

၁.၈။ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ် (EMP)

၁.၈.၁။ နိဒါန်း

ထိခိုက်သက်ရောက်နိုင်မှုဆန်းစစ်ရာတွင် အလားအလာရှိသော သိသာထင်ရှားသည့် သက်ရောက်မှုများကို စီစစ်သတ်မှတ် ခဲ့ပါသည်။ သက်ရောက်မှုတစ်ခု ဖြစ်ပေါ်လာပါက ၎င်း၏သက်ရောက်မှုဖြစ်နိုင်ခြေနှင့် သက်ရောက်မှု ပမာဏကို ကာကွယ်တားဆီးရန် နှင့်/သို့ လျော့ချရန် နှင့်/သို့ သက်ရောက်နိုင်မှုနယ်ပယ်ကို ကန့်သတ်ရန် အလို့ငှာ စီမံကိန်း၏ လုပ်ငန်းဆောင်တာ တစ်ခုစီအတွက် စီမံခန့်ခွဲမှုနည်းလမ်းများကို ရေးဆွဲသတ်မှတ်ခဲ့ကြပါသည်။ လိုက်နာကျင့်သုံးရမည့် လမ်းညွှန်ချက်များ၊ စက်ရုံသုံးအလေ့အကျင့်များ၊ ပညာရှင်အဆုံးအဖြတ်များ၊ ဒီဇိုင်းနည်းပညာများ နှင့် လုပ်ငန်းစဉ် ထိန်းချုပ်မှုများကို အဆိုပြုထားသော စီမံခန့်ခွဲမှု အစီအစဉ်များတွင် ထည့်သွင်းစဉ်းစားရပါမည်။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်ကို **အခန်း(၈)** တွင် အသေးစိတ်ဖော်ပြထားပါသည်။

ထို့အပြင် ပတ်ဝန်းကျင်နှင့် စီမံကိန်းလုပ်ငန်းဆောင်တာများကို စောင့်ကြည့်လေ့လာဖို့ရန် ပတ်ဝန်းကျင် စောင့်ကြည့်စစ်ဆေးရေး နည်းလမ်းများကို ဒီဇိုင်းရေးဆွဲထားပါသည်။ စောင့်ကြည့်လေ့လာရေးအစီအစဉ်များ၏ ရည်ရွယ်ချက်မှာ - စီမံခန့်ခွဲမှု အစီအစဉ်များ၏ အကျိုးထိရောက်မှုကို လေ့လာတွက်ချက်ရန်၊ မြန်မာ့ဥပဒေများ လမ်းညွှန်ချက်များ စံချိန်စံညွှန်းများကို လိုက်နာမှုအပေါ် ဆန်းစစ်ရန်နှင့် ဖြစ်နိုင်ချေရှိသော ပြောင်းလဲမှု နှင့်/သို့ သက်ရောက်မှုများကို မှတ်တမ်းတင်ဖို့ရန် စီမံကိန်း အကောင်အထည်ဖော်ပြီးနောက်ပိုင်းရှိ ပတ်ဝန်းကျင်အခြေအနေများကို ကနဦးပတ်ဝန်းကျင်အခြေအနေများ နှင့် နှိုင်းယှဉ်ရန် တို့ဖြစ်ပါသည်။

၁.၈.၂။ ပတ်ဝန်းကျင် လူမှုရေး ကျန်းမာရေး လျော့ချရေးနှင့် စောင့်ကြည့်စစ်ဆေးခရေးနည်းလမ်းများ

တည်ဆောက်ခြင်းနှင့်တပ်ဆင်ခြင်း၊ တွင်းတူးဖော်ခြင်း၊ တွင်းစမ်းသပ်ခြင်း၊ အပြီးသတ်ပိတ်သိမ်းခြင်းနှင့် ကြိုတင်မစီစဉ်ထားသော အဖြစ်အပျက်များအတွက် လျော့ချရေးနည်းလမ်းများနှင့် ကတိကဝတ်ပြုမှုများကို **ဇယား(၁-၈)** နှင့် **ဇယား (၁-၉)** တွင် အကျဉ်းချုပ်ဖော်ပြထားပါသည်။ စောင့်ကြည့်စစ်ဆေးရေး နည်းလမ်းများကို **ဇယား(၁-၁၀)**တွင်ဖော်ပြထားပါသည်။

ဇယား (၁-၁၁) အဓိကလျော့ချရေးနည်းလမ်းများနှင့် ကတိကဝတ်ဇယား

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
ရုပ်ပိုင်းဆိုင်ရာ ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်း								
၁။ မြေမျက်နှာသွင်ပြင်	၁.၁ တွင်းနှင့် ယာယီစခန်း တည်ဆောက်မှု	၁.၁.၁ ဒေသမြေမျက်နှာ သွင်ပြင် အပေါ် သက်ရောက်မှု	၁.၁.၁.၁ တွင်းနေရာများနှင့် လမ်းဖောက်လုပ်မှုကိုသာ ကန့်သတ်ရန်။	နိမ့်သော	တွင်းနေရာများနှင့် လမ်းဖောက်လုပ်မှုကိုသာ ကန့်သတ်ခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလတလျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
၂။ လေအရည်အသွေး	၂.၁ တွင်းနှင့် ယာယီစခန်း တည်ဆောက်မှု	၂.၃.၂ ဖုန်မှုန့်များကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း	၂.၃.၂.၁ အထူးသဖြင့် ခြောက်သွေ့ရာသီအတွင်း မြေယာရှင်းလင်းခြင်းကို လျော့ချရန်	နိမ့်သော	ခြောက်သွေ့ရာသီအတွင်း မြေယာရှင်းလင်းခြင်းကို လျော့ချခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလတလျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
			၂.၃.၂.၂ လမ်းနှင့် လုပ်ငန်းခွင်တွင် ယာဉ်မောင်းနှင်သည့်အရှိန်ကို ကန့်သတ်ရန်နှင့် ဖုန်ထမှုကို လျော့ချရန်		လမ်းနှင့်လုပ်ငန်းခွင်တွင် ယာဉ်မောင်းနှင် သည့် အရှိန်ကို ကန့်သတ်ခြင်းနှင့် ဖုန်ထမှုကို လျော့ချခြင်း။			
			၂.၃.၂.၃ ဖုန်မှုန့်ပျံ့လွင့်မှုကို ကာကွယ်ရန် ပစ္စည်းများ သယ်ယူရာတွင် မိုးကာ (သို့) ပလပ်စတစ်ဖြင့် အုပ်၍ သယ်ယူရန်။		ပစ္စည်းများ သယ်ယူရာတွင် မိုးကာ (သို့) ပလပ်စတစ်ဖြင့် အုပ်၍ သယ်ယူခြင်း။			
			၂.၃.၂.၄ ဖုန်ထခြင်းကို လျော့ချရန် လမ်းများအား ရေဖြန်းရန်။ အနည်းဆုံး တစ်ရက်လျှင် တစ်ကြိမ်၊ အထူးသဖြင့် နွေရာသီတွင် ရေဖြန်းရန်။		ဖုန်ထခြင်းကို လျော့ချရန် လမ်းများအား ရေဖြန်းခြင်း။			
			၂.၃.၂.၅ လိုအပ်လျှင် လုပ်ငန်းခွင်မှမထွက်ခွာမီယာဉ်များ၏ တာယာများကို ဆေးကြောရန်။		လိုအပ်လျှင် လုပ်ငန်းခွင်မှမထွက်ခွာမီ ယာဉ်များ၏တာယာများကို			

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
					ဆေးကြောခြင်း။			
			၂.၃.၂.၆ အလုပ်သမားများအတွက် တစ်ကိုယ်ရေ ကာကွယ်ရေး ပစ္စည်းများ (PPE) ထားရှိပေးရန်။		လိုအပ်သော တစ်ကိုယ်ရေ ကာကွယ်ရေး ပစ္စည်းများ (PPE) ထားရှိပေးခြင်း။			
			၂.၃.၂.၇ ယာဉ်မောင်းနေစဉ်တွင် ဖုန်မထွက်စေရန် ယာဉ်များတွင် ဖုန်ကာများ အသုံးပြုရန်။		ယာဉ်များတွင် ဖုန်ကာများအသုံးပြုခြင်း			
	၃.၁ တွင်းစမ်းသပ်ရာမှ ဟိုက်ဒရိုဂျင် ဆာလဖိုက်ထုတ်လွှတ်ခြင်း။	၂.၃.၃ ဟိုက်ဒရိုဂျင်ဆာလဖိုက်ကြောင့် လေထုအရည်အသွေးကျဆင်းခြင်း။	၂.၃.၃.၁ အရေးပေါ် အခြေအနေတွင် တုန့်ပြန်နိုင်ရန် ဓါတ်ငွေ့စမ်းသပ်ကိရိယာအား တပ်ဆင်ရန်။	နိမ့်သော	H_2Sစမ်းသပ်ခြင်းနှင့် လုံခြုံရေးကိရိယာများ သည် အဓိကဖြစ်ပြီး PTTEP SA ၏ အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်(ERP) တွင် H_2S အရေးပေါ် အစီအစဉ် ပါဝင်ပါသည်။	PTTEP SA	တွင်းစမ်းသပ်ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
			၁.၁.၁.၁ ဓါတ်ငွေ့လိုင်း တစ်လျောက် H_2S သည် 10 ppm ထက်ကျော်လျှင် သင့်တော်သော လုံခြုံရေးဖုံများ ထားရှိရန် (8 hr TWA)					
			၁.၁.၁.၂အလုပ်သမားအားလုံးသည် H_2S တုန့်ပြန်ရေးလုပ်ငန်းစဉ်များကို လေ့ကျင့်ထားရန်။ H_2S အသိပညာပေးခြင်းအတွက် တွင်းတူးခြင်းနှင့် လုပ်ငန်းဆိုင်ရာ သင်တန်းများ ဖွင့်ပေးရန်။					
			၁.၁.၁.၃ ဖြစ်နိုင်ပါက တွင်းစမ်းသပ်ကာလ ကို သတ်မှတ်ထားရန်					
၃။ ဆူညံသံ	၃.၁	၃.၁.၁ စက် /	၃.၁.၁.၁ ပတ်ဝန်းကျင်ဆိုင်ရာ	နိမ့်သော	ပတ်ဝန်းကျင်ဆိုင်ရာ	PTTEP SA	ဆောက်လုပ်ရေး	PTTEP SA

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
	စက်/အင်ဂျင်နှင့် ကိရိယာများ အသုံးပြုခြင်း။	အင်ဂျင်များမှ အသံဆူညံမှုများ	ထိခိုက်လွယ်သော နေရာများတွင် တွင်းတူးစင်နှင့် ယာဉ်များ သွားလာမှုကို လျော့ချရန်။ (ဥပမာ- သစ်တော၊ ဗိသုကာနေရာများ၊ ရှေးဟောင်းအမွေအနှစ် ဇရိယာများ၊ စသည်ဖြင့်)		ထိခိုက်လွယ်သော နေရာများတွင် တွင်းတူးစင်နှင့် ယာဉ်များ သွားလာမှုကို လျော့ချရန်။		ကာလ တလျောက်လုံး	၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
			၃.၁.၁.၂ ညအချိန်တွင် ဆောက်လုပ်ရေးလုပ်ငန်းများနှင့် ယာဉ်/တွင်းတူးစင်များ ပြောင်းရွှေ့ခြင်းကို လျော့ချရန်။		ညအချိန်တွင် ဆောက်လုပ်ရေးလုပ်ငန်းများ နှင့် ယာဉ်/တွင်းတူးစင်များ ပြောင်းရွှေ့ခြင်းကို လျော့ချခြင်း။			
			၃.၁.၁.၃ တွင်းနေရာများ၊ ယာယီတဲနေရာနှင့် လမ်းပန်းဆက်သွယ်ရေးနေရာတွင် သဘာဝပေါက်ပင်များ ရှင်းလင်းခြင်းကိုအနည်းဆုံးဖြစ်အောင် ကန့်သတ်ရန်။		သဘာဝပေါက်ပင်များ ရှင်းလင်းခြင်းကို အနည်းဆုံးဖြစ်အောင် ကန့်သတ်ခြင်း။			
			၃.၁.၁.၄ စက်ကိရိယာများကို အသုံးမပြုပါက စက်သတ်ထားရန်။		အသုံးမပြုချိန်တွင် စက်ကိရိယာများကို စက်သတ်ထားခြင်း။			
			၃.၁.၁.၅ လုပ်ငန်းခွင်တွင် ဆူညံသံများ ဖြစ်ပေါ်သောအခါ အသံကာကွယ်ပစ္စည်းများအသုံးပြုရန်။		လုပ်ငန်းခွင်တွင် ဆူညံသံများ ဖြစ်ပေါ်သောအခါ အသံကာကွယ်ပစ္စည်းများ အသုံးပြုခြင်း။			
			၃.၁.၁.၆ ဆူညံသံ ဖြစ်ပေါ်စေသော ယာဉ်ကြောပိတ်ဆို့မှုကို ရှောင်ရှားရန်		လုပ်ငန်းဆောင်ရွက်မှုမစတင်မီ			

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			ပို့ဆောင်ရေး အစီအစဉ်ကို အကောင်အထည်ဖော်ရန်။		သွားလာရေးစီမံခန့်ခွဲမှုအစီအစဉ်ကို အကောင်အထည်ဖော်ခြင်း။			
			၃.၁.၁.၇ ပစ္စည်းများ အသုံးပြုချိန်တွင် နိမ့်သည့်နေရာတွင်ထားပြီး သယ်ယူရာတွင် ပြုတ်မကျအောင် သတိပြုဆောင်ရွက်ရန်။		ပစ္စည်းများသယ်ယူရာတွင် နိမ့်သည့်နေရာတွင်ထားပြီး ပြုတ်မကျစေရန် ကြီးကြပ်ခြင်း။			
၄။ အပေါ်ယံ ရေအရည်အသွေး	၄.၁ လမ်းနှင့် တွင်းများ/ ယာယီစခန်းများနှင့် လုပ်ငန်းခွင်အတွင်း ရေစီးဆင်းမှု ဆောက်လုပ်ခြင်း။	၄.၁.၁ အပေါ်ယံရေစီးဆင်းမှု ပြောင်းလဲခြင်းနှင့် ရေအရည်အသွေး ကျဆင်းခြင်း။	၄.၁.၁.၁ ရေစီးဆင်းမှုကို အနှောင့်အယှက်ဖြစ်နိုင်သော နေရာများတွင် တွင်းဖောက်ခြင်းကို ရှောင်ရှားရန်။	နိမ့်သော	ရေစီးဆင်းမှုကို အနှောင့်အယှက် မဖြစ်အောင် တွင်းများကို ဒီဇိုင်းရေးဆွဲခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
			၄.၁.၁.၂ သဘာဝ ရေစီးဆင်းမှုကို ထိန်းထားရန် ရေနုတ်မြောင်းများ (မြေအောက်ပိုက်လိုင်း/ တာရိုး) တည်ဆောက်ရန်။ MOGEနှင့် သက်ဆိုင်ရာ အာဏာပိုင် အဖွဲ့အစည်းများအားလုံးမှ ခွင့်ပြုချက်များ တောင်းခံဆောင်ရွက်သွားပါမည်။		သဘာဝရေစီးဆင်းမှုကို ထိန်းထားရန် ရေနုတ်မြောင်းများ (မြေအောက်ပိုက်လိုင်း/ တာရိုး)များကို ဒီဇိုင်းရေးဆွဲခြင်း။			
၅။ မြေဆီလွှာအရည်အသွေး	၅.၁ လမ်းနှင့် တွင်း / ယာယီစခန်းများ တည်ဆောက်ခြင်း။	၅.၁.၁ ဆောက်လုပ်ရေး ကာလ အတွင်း မြေသိပ်သည်းခြင်း (သို့မဟုတ်) တိုက်စားမှုများကြောင့်	၅.၁.၁.၁ တွင်းနေရာများနှင့် လမ်းများတွင် မြေဆီလွှာသိပ်သည်းခြင်းကို ကန့်သတ်ရန်။	နိမ့်သော	တွင်းနေရာများနှင့် လမ်းများတွင်သာ မြေသိပ်သည်းစေသည့် ဆောင်ရွက်မှုများ ဆောင်ရွက်ရန်။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
		မြေဆီလွှာ အရည်အသွေး လျော့ကျခြင်း။	၅.၁.၁.၂ ဆောက်လုပ်ရေးကာလ အတွင်း လုပ်ငန်းခွင်ဧရိယာများ အနည်းဆုံးဖြစ်စေရန်။		ဆောက်လုပ်ရေးကာလအတွင်း လုပ်ငန်းခွင်ဧရိယာကို အနည်းဆုံးဖြစ်စေခြင်း။			
			၅.၁.၁.၃ ရေစီးရေလာ ကောင်းမွန်စေရန်အတွက် ထိရောက်သော ရေစီးဆင်းမှုထိန်းချုပ်ခြင်းနှင့် ဒီဇိုင်းများရေးဆွဲထားရန်။		စီမံကိန်းပတ်ဝန်းကျင်တွင် ရေစီးရေလာကောင်းမွန်စေရန် အတွက် ဆောင်ရွက်ခြင်း။			
ဂေဟဗေဒဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း								
၆။ အပင်နှင့် သတ္တဝါများ	၆.၁ လမ်းနှင့် တွင်း / ယာယီစခန်းနေရာ များ ဆောက်လုပ်ခြင်းအတွက် မြေယာရှင်းလင်းခြင်း။	၆.၁.၁ သဘာဝပေါက်ပင် ပေါက်ရောက်ရာ နေရာများ အရည်အသွေး လျော့ကျခြင်း (သို့မဟုတ်) ပျက်ဆီးခြင်း။	၆.၁.၁.၁ လုပ်ငန်းဆောင်ရွက်ရန် ဒီဇိုင်းရေးဆွဲရာတွင် တန်ဖိုးရှိသော သဘာဝပေါက်ရောက်ရာ နေရာများကို ရှောင်ရှားရန်။	နိမ့်သော	တန်ဖိုးရှိသောသဘာဝပေါက်ပင် ပေါက်ရောက်ရာနေရာများကို ရှောင်ရှားခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
			၆.၁.၁.၂ စီမံကိန်းဧရိယာ (လမ်း၊ ယာယီစခန်း၊ တွင်းနေရာ)များ တွင်သာ သဘာဝပေါက်ပင်များကို ဖယ်ရှားရန်။		စီမံကိန်းဧရိယာတွင်သာ သဘာဝပေါက်ပင်များကို ဖယ်ရှားခြင်း။			
			၆.၁.၁.၃ တွင်းနေရာများကို ရှင်းလင်းစွာ မှတ်သားရန်နှင့် ယာဉ်များကို ပတ်ဝန်းကျင် မြေများတွင် သွားလာခြင်းကို တားမြစ်ထားရန်။		တွင်းနေရာများကို ရှင်းလင်းစွာမှတ်သားရန်နှင့် ယာဉ်များကို ပတ်ဝန်းကျင်မြေများတွင်သွားလာခြင်းကို တားမြစ်ထားခြင်း။			
လူမှုရေးဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်း								
၇။ မြေအသုံးပြုမှု	၇.၁	၇.၁.၁ ထုံးတမ်းစဉ်လာ	၇.၁.၁.၁ မြေယာပိုင်ဆိုင်မှု ကော်မတီ၏	ကောင်းသော	မြေပိုင်ရှင်နှင့်	PTTEP SA	ဆောက်လုပ်ရေး	မြေယာလျော်

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
	ဆက်သွယ်ရေးလမ်း/ တွင်းနှင့် ယာယီစခန်းနေရာများ ဆောက်လုပ်ခြင်း။	အသုံးပြုခြင်းကို ပြောင်းလဲခြင်း။	ဆုံးဖြတ်ချက်အရ မြေပိုင်ရှင်နှင့် မြေအသုံးပြုသူများအား ပွင့်လင်းမြင်သာစွာ သင့်တင့်သော လျော်ကြေးအား ပေးရန်။		မြေအသုံးပြုသူများအား ပွင့်လင်းမြင်သာစွာ သင့်တင့်သော လျော်ကြေးအား ပေးခြင်း။		ကာလ တလျောက်လုံး	ကြေး မှတ်တမ်းများ
			၇.၁.၁.၂ မြေပိုင်ရှင်များနှင့် ဒေသဆိုင်ရာ အာဏာပိုင်များမှ ခွင့်ပြုချက်များ ရယူရန်။		မြေပိုင်ရှင်များနှင့် ဒေသဆိုင်ရာအာဏာပိုင်များမှ ခွင့်ပြုချက်များ ရယူပါမည်။			
			၇.၁.၁.၃ စီမံကိန်း ဆောင်ရွက်မှုများ မစတင်မီ ပတ်ဝန်းကျင်မြေပိုင်ရှင်များကို ကြိုတင်အသိပေးထားရန်။		စီမံကိန်းဆောင်ရွက်မှုများ မစတင်မီ ပတ်ဝန်းကျင်မြေပိုင်ရှင်များကို ကြိုတင်အသိပေးခြင်း။			
			၇.၁.၁.၄ စီမံကိန်း ပြီးဆုံးသောအခါ သဘောတူညီချက်အရ မြေယာများကို သက်ဆိုင်ရာ အဖွဲ့များသို့ ပြန်လည်ပေးအပ်ရန်။		စီမံကိန်း ပြီးဆုံးသောအခါ သဘောတူညီချက်အရ မြေယာများကို ပြန်လည်ပေးအပ်ပါမည်။			
၈။ ပို့ဆောင်ဆက်သွယ်ရေး	၈.၁ တွင်းတူးစင် ပြောင်းရွှေ့ခြင်းနှင့် ကိရိယာနှင့် ယဉ်များ အသုံးပြုခြင်း။	၈.၁.၁ ယဉ်ကြောပိတ်ဆို့ခြင်း	၈.၁.၁.၁ ယာဉ်များအားလုံးကို ပြုပြင်ထိန်းသိမ်းထားပြီး စီမံကိန်း လုံခြုံစိတ်ချရမှု စံနှုန်းများကို လိုက်နာပါမည်။ ယာဉ်မောင်းများသည် ကျန်းမာရေးကောင်းမွန်ပြီး လိုင်စင်များ ကိုင်ဆောင်ထားရပါမည်။ အရက်သေစာ သောက်စားခြင်း (သို့မဟုတ်) လုပ်ဆောင်ချက်များကို ထိခိုက်နိုင်သော ဆေးဝါးများ သောက်သုံးခြင်းမပြုရန်။	နိမ့်သော	ယာဉ်များအားလုံးကို ထိန်းသိမ်းခြင်းနှင့် လုံခြုံရေးစံချိန်စံညွှန်းများ၊ ဆေးဝါးနှင့် အရက်သေစာ ဥပဒေများကို လေးစားလိုက်နာခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			၈.၁.၁.၂ အမြန်နှုန်း ကန့်သတ်ထားခြင်းကို လိုက်နာရန်။		အမြန်နှုန်း ကန့်သတ်ချက်များကို လိုက်နာခြင်း။။			
			၈.၁.၁.၃ ကုန်ပစ္စည်းကြီးများ သယ်ဆောင်ရာတွင် ဒေသဆိုင်ရာ အာဏာပိုင်များကို အကြောင်းကြားပြီး ဟွန်းနှင့်မီးအလင်းရောင်များဖြင့် အချက်ပေးရန်။		ကုန်ပစ္စည်းကြီးများသယ်ဆောင်ရာတွင် ဒေသဆိုင်ရာအာဏာပိုင်များ ကို အကြောင်းကြားပြီး ဟွန်းနှင့်မီးအလင်းရောင် ဖြင့် အချက်ပေးခြင်း။			
			၈.၁.၁.၄ သွားလာရေးလမ်းများနှင့် လမ်းမကြီးများတွင် ယာဉ်သွားလာမှု အချက်ပြမီးများ(သို့မဟုတ်)အလံများ ကို တပ်ဆင်ထားရန်။		သွားလာရေးလမ်းများနှင့်လမ်း မကြီးများတွင် ယာဉ်သွားလာမှုအချက်ပြမီးမျ ား (သို့မဟုတ်)အလံများကို တပ်ဆင်ထားခြင်း။			
			၈.၁.၁.၅ တိုင်ကြားမှုများကို စစ်ဆေးပြီး ကိုင်တွယ်ဖြေရှင်းရန်။ တိုင်ကြားမှုများကို မှတ်တမ်းတင်ထားပြီး လိုက်နာဆောင်ရွက်ရန်။		တိုင်ကြားမှုများကို စစ်ဆေးပြီး PTTEP SA နှင့် MOGE လိုအပ်ချက်များအရ ဆောင်ရွက်ရန်။			
			၈.၁.၁.၆ ဆောက်လုပ်ရေး၊ အဆင့်မြင့်တင်ခြင်း (သို့မဟုတ်) လမ်းဖောက်လုပ်ခြင်းများ မပြုမီ MOGE နှင့် သက်ဆိုင်ရာ အစိုးရဌာနများမှ ခွင့်ပြုချက် ရယူရန်။		ဆောက်လုပ်ရေး၊ အဆင့်မြင့်တင်ခြင်း (သို့မဟုတ်) လမ်းဖောက်လုပ်ခြင်းများ မပြုမီ MOGE နှင့် သက်ဆိုင်ရာ အစိုးရဌာနများမှ ခွင့်ပြုချက် ရယူခြင်း။			

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			၈.၁.၁.၇ လေးလံကြီးမားသောကိရိယာများ သယ်ယူပို့ဆောင်ခြင်းမပြုမီ လမ်းအန္တရာယ်အကဲဖြတ်ခြင်းကို ဆောင်ရွက်ရန်။		လေးလံကြီးမားသောကိရိယာ များ သယ်ယူပို့ဆောင်ခြင်းမပြုမီ လမ်းအန္တရယ် အကဲဖြတ်ခြင်းကို ဆောင်ရွက်ခြင်း။			
၉။ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု	၉.၁ အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများ	၉.၁.၁ အိမ်သုံးစွန့်ပစ်ပစ္စည်း များ သည် လေဖြင့်လွင့်ပါသွားနိုင် ပြီး ရောဂါများ ဖြစ်ပွားနိုင်ပါသည်။	၉.၁.၁.၁ ရေနံတူးဖော်ခြင်း အသိပညာပေးပွဲ အတွက် PTTEP SA စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုအစီအစဉ်ကို ဆောင်ရွက်ရပါမည်။	နိမ့်သော	PTTEP SA စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်ကို အကောင်အထည်ဖော်ခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်
			၉.၁.၁.၂ အန္တရယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို စနစ်တကျ သိုလှောင်ပြီး အမိုက်စွန့်ပစ်ရန် သယ်ယူပို့ဆောင်ခြင်း အတွက် သင့်လျော်ပြီး လုံခြုံစိတ်ချရသော အမှိုက်ပုံးများကို အသုံးပြုရန်။					
			၉.၁.၁.၃ အပြည်ပြည်ဆိုင်ရာ စံချိန်စံညွှန်းများအရ သန့်စင်ခြင်းနှင့် စွန့်ပစ်ခြင်းများ ဆောင်ရွက်ရန်။					
			၉.၁.၁.၄ စီမံကိန်းဧရိယာတွင် ကောင်းမွန်သော အိမ်သန့်ရှင်းရေး နည်းလမ်းများကို ဆောင်ရွက်ရန်။					
			၉.၁.၁.၅ အိမ်သုံးနှင့် အခြားစွန့်ပစ်ပစ္စည်းများကို ခွဲခြားပြီး					

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			အညွှန်းများတပ်၍ ထိန်းသိမ်းထားရန်။					
			၉.၁.၁.၆ ပြန်လည်အသုံးပြု၍ ရသော စွန့်ပစ်ပစ္စည်းများအတွက်အညွှန်းတပ်ထား သော အမှိုက်ပုံးများဖြင့် စွန့်ပစ်ရန်။					
			၉.၁.၁.၇ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုနှင့် သက်ဆိုင်ရာ ဥပဒေများ၏လိုအပ်ချက်များကို လိုက်နာရန်။					
			၉.၁.၁.၈ မိလ္လာကန်များနှင့် မိလ္လာရေလွှဲကန်များကို ဆောက်လုပ်ရန်။					
			၉.၁.၁.၉ အန္တရယ်မရှိသော စွန့်ပစ်ပစ္စည်းများကို ဒေသဆိုင်ရာ မြို့နယ် စည်ပင်သာယာရေးကော်မတီနှင့် စွန့်ပစ်ရမည်။					
	၉.၂ တွင်းတူးဖြတ်စများ နှင့် ဓါတုပစ္စည်းများ ကိုင်တွယ်ခြင်းနှင့် စွန့်ပစ်ခြင်း။	၉.၂.၁ တွင်းတူးအရည်မှ ဓါတုပစ္စည်း ပါဝင်မှုကြောင့် ဒေသရှိ ရေနှင့် မြေအရည်အသွေးများ ပြောင်းလဲခြင်း။	၉.၂.၁.၁ တွင်းတူးဖြတ်စများနှင့် အရည်များကို ပတ်ဝန်းကျင် ဇရိယာများသို့ စွန့်ပစ်ခြင်းမပြုရန်။	အလယ်အလတ်	PTTEP SA စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်ကို အကောင်အထည်ဖော်ခြင်း။ အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ သန့်စင်ခြင်းနှင့် စွန့်ပစ်ခြင်းကို လိုင်စင်ရ ကန်ထရိုက်တာများဖြင့် ဆောင်ရွက်ပြီး စွန့်ပစ်ပစ္စည်း	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တစ်လျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
					စီမံခန့်ခွဲမှု ဝန်ဆောင်မှု ရှိသော နေရာတွင် စွန့်ပစ်ရန်အတွက် ရန်ကုန်သို့ သယ်ဆောင်ပါမည်။			
			၉.၂.၁.၂ အစိုင်အခဲ ထိန်းချုပ်သည့် ကိရိယာကို အသုံးပြုခြင်းအားဖြင့် ဖြတ်စများနှင့် တွင်းတူးအရည်များ စွန့်ပစ်မှု ထုထည်ကို လျော့ချခြင်း။					
			၉.၂.၁.၃ ဓါတုပစ္စည်းများ အားလုံးကို ဆီယိုဖိတ်မှု အချက်ပြကိရိယာနှင့်အတူ လုံခြုံစိတ်ချရသော နေရာတွင် သိုလှောင်ခြင်း။					
			၉.၂.၁.၄ အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို SDS နှင့်အညီ ကိုင်တွယ်၊ သိုလှောင်ခြင်း။					
			၉.၂.၁.၅ ဓါတုပစ္စည်း ကိုင်တွယ်သော အလုပ်သမားများ အားလုံးကို ဓါတုပစ္စည်းအန္တရာယ် အသိပညာပေး သင်တန်းများဖွင့်ပေးခြင်း။					
			၉.၂.၁.၆ PPE အသုံးပြုခြင်း။					
			၉.၂.၁.၇ လေဝင်လေထွက်ကောင်းပြီး ထိန်းချုပ်ထားသော နေရာများတွင်သာ ဓါတုပစ္စည်းများကို ကိုင်တွယ်ခြင်း။					
			၉.၂.၁.၈ လောင်စာဆီသိုလှောင်ကန်များကို					

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			ဘေးနံရံများဖြင့် ကာရံထားခြင်း။					
			၉.၂.၁.၉ ညစ်ညမ်းနိုင်သည့် နေရာများကို အခြား မညစ်ညမ်းသည့်နေရာများမှ သီးသန့်ခွဲထားခြင်း။ ကွန်ကရစ်ကန်ထဲသို့ ရေစုဆောင်းရန်အတွက် ညစ်ညမ်းနိုင်သည့် နေရာများတွင် ရေနှုတ်မြောင်းစနစ်ထားရှိခြင်း။					
			၉.၂.၁.၁၀ ယာဉ်များကို ထိန်းသိမ်းမှု ဆောင်ရွက်စဉ်အတွင်း ယာဉ်အောက်၌ ဆီခံခွက် ထားရှိရန်။ ယာဉ်ထိန်းသိမ်းမှုများကို မယိုစိမ့်နိုင်သော မျက်နှာပြင်ပေါ်တွင်သာ ဆောင်ရွက်ရန် (ဥပမာ- မိုးကာ)					
			၉.၂.၁.၁၁ ယိုဖိတ်မှု သန့်စင်သည့် ကိရိယာများ ထားရှိပြီး ယိုဖိတ်မှုများကို သန့်စင်သည့် အဖွဲ့ကို သင်တန်းပေးခြင်း။ ဆီ (သို့မဟုတ်) ဓါတုပစ္စည်း ယိုဖိတ်မှုများအတွက် ယိုဖိတ်မှု တုန့်ပြန်သည့် အစီအစဉ်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း။					
			၉.၂.၁.၁၂ တွင်းတူးစင်သယ်ယူပြီးနောက်					

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
			သန့်စင်ထားသော ဖြတ်စများကို bioremediation မဆောင်ရွက်မီ ယာယီထားရှိသည့် ဖြတ်စတွင်းထဲသို့ စွန့်ပစ်ခြင်း။ (သို့မဟုတ်) သတ်မှတ်ထားသော စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်သည့် နေရာ၌ စွန့်ပစ်ခြင်း။					
			၉.၂.၁.၁၃ စွန့်ပစ်ကျင်းထဲတွင် ဖြတ်စများနှင့် ရေဆိုးများ၏ ညစ်ညမ်းမှုအဆင့်ကို စောင့်ကြည့်စစ်ဆေးခြင်း။					
	၉.၃ အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းများ	၉.၃.၁ တွင်းတူးအရည်မှ ဓါတုပစ္စည်း ပါဝင်မှုကြောင့် ဒေသရှိ ရေနှင့် မြေအရည်အသွေးများ ပြောင်းလဲခြင်း။	၉.၃.၁.၁ အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို လိုင်စင်ရ ကန်ထရိုက်တာများဖြင့် သန့်စင်ခြင်းနှင့် စွန့်ပစ်ခြင်း။ ၉.၃.၁.၂ PTTEP SA သည် အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများအားလုံးကိုအသိအမှတ်ပြုထားသော စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်သည့်နေရာသို့ ပို့ဆောင်ခြင်း။	အလယ်အလတ်	PTTEP SA စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်ကို အကောင်အထည်ဖော်ခြင်း။ အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ သန့်စင်ခြင်းနှင့် စွန့်ပစ်ခြင်းကို လိုင်စင်ရ ကန်ထရိုက်တာများဖြင့် ဆောင်ရွက်ပြီး စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဝန်ဆောင်မှု ရှိသော နေရာတွင် စွန့်ပစ်ရန်အတွက် ရန်ကုန်သို့ သယ်ဆောင်ပါမည်။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တစ်လျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်
၁၀။ လူမှု-စီးပွားရေး	၁၀.၁ ဆောက်လုပ်ရေးလုပ်ငန်းများ အတွက်	၁၀.၁.၁ အလုပ်အကိုင်/ဝင်ငွေ အခွင့်အလမ်းများ။	၁၀.၁.၁.၁ စီမံကိန်းနေရာမှ အရည်အသွေးပြည့်မီ သော ဒေသခံအလုပ်သမားများ အား	ကောင်းသော	ဒေသဆိုင်ရာအာဏာပိုင်များနှင့် တွေ့ဆုံဆွေးနွေးပြီး အရည်အသွေး ပြည့်မီသော	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	လုပ်ငန်း	ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	လျော့ချရေးနည်းလမ်းများ	ကြွင်းကျန် သက်ရောက်မှု များ	အထူးဆောင်ရွက်ချက်	တာဝန်ရှိသူများ	အချိန်ဇယား	မှတ်တမ်း
	ဆောင်ရွက်မှု		ခန့်ထားခြင်း။		ဒေသခံအလုပ်သမားများကို ခန့်အပ်ခြင်း။			အစီအစဉ်
			၁၀.၁.၁.၂ အနီးအနားရှိ ကျေးရွာနှင့် မြို့များကို အထောက်အကူပြုနိုင်ရန် ဖြစ်နိုင်ပါက ဒေသထောက်ပံ့မှုနှင့် ဝန်ဆောင်မှုများကို အသုံးပြုဆောင်ရွက်ရန်။					
			၁၀.၁.၁.၃ အထူးသဖြင့် ကျွမ်းကျင်လုပ်သားနှင့် အသင့်အတင့် ကျွမ်းကျင်သော လုပ်သားများအတွက် ဒေသခံလုပ်သားများအား ဦးစားပေးငှားယူရန်။					
			၁၀.၁.၁.၄ စီမံကိန်းဝင်းအတွင်း အလုပ်သမားများကို ကန့်သတ်ထားပြီး ဒေသခံများနှင့် ဆက်ဆံမှုများကို ခွင့်မပြုရန်။	အလယ်အလတ်	စီမံကိန်းဝင်းအတွင်း အလုပ်သမားများကို ကန့်သတ်ထားပြီးဒေသခံများ နှင့် ထိတွေ့ဆက်ဆံမှုများကို ခွင့်မပြုခြင်း။			
	၁၀.၂ အလုပ်သမားများနှင့် လူမှုဆက်ဆံရေးမျုး ရောက်ရှိလာခြင်း။	၁၀.၂.၁ အခြားဒေသမှ အလုပ်သမားများနှင့် ဒေသခံ အလုပ်သမားများကြား အပြင်းပွားမှုများ။	၁၀.၂.၁.၁ နည်းပညာဆိုင်ရာမဟုတ်သော လုပ်ငန်းများအတွက် အရည်အသွေးပြည့်မီ သော ဒေသခံအလုပ်သမားများ ကို ခန့်အပ်ရန်။	နိမ့်သော	ဒေသခံအလုပ်သမားများ ငှားရမ်းခြင်းနှင့် အရည်အသွေးပြည့်မီသော ဒေသခံ အလုပ်သမားများ ခန့်အပ်ခြင်းအတွက် ဒေသခံအာဏာပိုင်များနှင့် ညှိနှိုင်းဆွေးနွေးခြင်း။	PTTEP SA	ဆောက်လုပ်ရေး ကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှု အစီအစဉ်

ဇယား (၁-၁၂) စီစဉ်မထားသော အဖြစ်အပျက်များအတွက် လျော့ချရေးနည်းလမ်းများနှင့် ကတိကဝတ်ဇယား

စီစဉ်မထားသော အဖြစ်အပျက်များ								
၁။ ပေါက်ကွဲခြင်း	၁.၂ တွင်းတူးခြင်း	၁.၂.၁ ဟိုက်ဒရိုကာဗွန်၊ မီးလောင်ခြင်း နှင့် ပေါက်ကွဲမှုများအား သက်သာစေခြင်း။	၁.၂.၁.၁ လက်ရှိတွင်းများတွင် တွင်းတိမ်ဓါတ်ငွေ့ အန္တရာယ်ကို စစ်ဆေးရန်။ ၁.၂.၁.၂ ပေါက်ကွဲမှုကာကွယ်သည့် ကိရိယာကို တပ်ဆင်ထားပြီး အများဆုံးဖိအားကို ခံနိုင်အောင် ဆောင်ရွက်ထားပြီး လုပ်ငန်းစဉ်များအတိုင်း စမ်းသပ်ထားရန်။ PTTEP SA \ အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်နှင့် ပေါက်ကွဲမှု အရေးပေါ်အစီအစဉ်များကို လိုက်နာရန်။ ပေါက်ကွဲမှုများကို ကာကွယ်ရန် PTTEP SA ၏ SSHE ပေါင်းစပ်ထားသော စီမံခန့်ခွဲမှုစနစ် နည်းလမ်းစဉ်နှင့် လုပ်ငန်းလည်ပတ်ထိန်းချုပ်ခြင်းများကို ဆောင်ရွက်ရပါမည်။	အလယ်အလတ်	ပေါက်ကွဲမှုများကို ကာကွယ်ရန် PTTEP SA ၏ SSHE ပေါင်းစပ်ထားသော စီမံခန့်ခွဲမှုစနစ် နည်းလမ်းစဉ်အရ ဆောင်ရွက်ပြီး အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ် ထိန်းချုပ်မှုများကို လိုက်နာဆောင်ရွက်ခြင်း။	PTTEPSA	စီမံကိန်းကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှုစနစ်
၂။ မီး (သို့မဟုတ်) ပေါက်ကွဲထွက်ခြင်း	၂.၂ ဆီသိုလှောင်ခြင်း နှင့် မီးလောင်စေသော အရင်းအမြစ်များ	၂.၂.၁ ဖြစ်နိုင်ခြေရှိသော ပေါက်ကွဲထွက်ခြင်း (သို့မဟုတ်) တွင်းတူးစင် (သို့မဟုတ်) ယာယီတဲနေရာမှ မီးများ (သို့မဟုတ်) လောင်စာများ။	၂.၂.၁.၁ ပေါက်ကွဲမှုများကို ကာကွယ်ရန် PTTEP SA၏ SSHE ပေါင်းစပ်ထားသော စီမံခန့်ခွဲမှု စနစ် နည်းလမ်းစဉ်နှင့် လုပ်ငန်းလည်ပတ်ထိန်းချုပ်ခြင်းများကို ဆောင်ရွက်ရပါမည်။ ၂.၂.၁.၂ မီးသတ်ဆေးဘူးများ၊	အလယ်အလတ်		PTTEPSA	စီမံကိန်းကာလ တလျောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှုစနစ်

			အချက်ပေးအသံများနှင့် အချက်ပြလေလွင့်ပူပေါင်းများ (လုပ်ငန်းခွင်တစ်ခုလုံးမှ မြင်သာစေရန်)					
			၂.၂.၁.၃ ဒေသရှိ မီးသတ်ကားများကို ကြိုတင်စီစဉ်ထားရန်။					
၃။ လောင်စာ၊ ဓါတုပစ္စည်းများ (သို့မဟုတ်) အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ/ ယိုဖိတ်မှုများ	၃.၂ လောင်စာ၊ ဓါတုပစ္စည်းများ၊ အန္တရာယ်ရှိပစ္စည်းများ (သို့မဟုတ်) စွန့်ပစ်ပစ္စည်းများ။	၃.၂.၁ လေအရည်အသွေး၊ မြေဆီလွှာအရည်အသွေး၊ မြေပေါ်ရေ၊ မြေအောက်ရေ၊ သက်ရှိသတ္တဝါနှင့် လူများအား ထိခိုက်စေနိုင်သော ယိုဖိတ်မှုအန္တရာယ်။	၃.၂.၁.၁ ဓါတုပစ္စည်းများ၊ ဟိုက်ဒရိုကာဗွန်နှင့် အန္တရာယ်ရှိပစ္စည်းများ (သို့မဟုတ်) စွန့်ပစ်ပစ္စည်းများကို လုံခြုံစိတ်ချစွာ သိုလှောင်ထားပြီး စိတ်ချရသော ဆောင်ရွက်မှု နည်းလမ်းများကို အသုံးပြုရပါမည်။	အလယ်အလတ်	ဓါတုပစ္စည်းများ၊ ဟိုက်ဒရိုကာဗွန်နှင့် အန္တရာယ်ရှိပစ္စည်းများ (သို့မဟုတ်) စွန့်ပစ်ပစ္စည်းများကို လုံခြုံစိတ်ချစွာ သိုလှောင်ထားပြီး စိတ်ချရသော ဆောင်ရွက်မှု နည်းလမ်းများကို အသုံးပြုမည်ဖြစ်ပြီး PTTEP SA ၏ ERPတွင် ဓါတုပစ္စည်းများ၊ ဟိုက်ဒရိုကာဗွန်နှင့် အန္တရာယ်ရှိ ပစ္စည်းများ (သို့မဟုတ်) စွန့်ပစ်ပစ္စည်းများ ဖိတ်စင်ခြင်းအား တုန့်ပြန်မှု ပါဝင်ပါသည်။	PTTEPSA	စီမံကိန်းကာလ တလျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှုစနစ်
			၃.၂.၁.၂ ယိုဖိတ်မှုထိန်းချုပ်ခြင်းနှင့် ပြန်လည်သန့်စင်သော ကိရိယာများကို သိုလှောင်ဧရိယာအနီးတွင် ထားရှိရန်။					
			၃.၂.၁.၃ ဓါတုပစ္စည်းများ၊ ဟိုက်ဒရိုကာဗွန်နှင့် အန္တရာယ်ရှိ					

			ပစ္စည်းများ (သို့မဟုတ်) စွန့်ပစ်ပစ္စည်းများ ယိုဖိတ်မှုများအတွက် တုန့်ပြန်မှု နည်းလမ်းစဉ်သည် PTTEP SA ၏ ERP နှင့် ယိုဖိတ်မှု အရေးပေါ်အစီအစဉ်တွင် ပါဝင်ပါမည်။					
၄။ပို့ဆောင်ဆက်သွယ်ရေး မတော်တဆဖြစ်မှုများ	၄.၂ ယာဉ်နှင့် စက်ပစ္စည်း အသုံးပြုမှု	၄.၂.၁ ဖြစ်နိုင်ခြေရှိသော ဒဏ်ရာရခြင်း (သို့မဟုတ်) သေဆုံးခြင်းများနှင့် ပတ်ဝန်းကျင် ညစ်ညမ်းခြင်း	၄.၂.၁.၁ SSHE ပေါင်းစပ်ထားသော စီမံခန့်ခွဲမှုစနစ် နည်းလမ်းစဉ်များကို လိုက်နာရန်။	အလယ်အလတ်	ပို့ဆောင်ဆက်သွယ်ရေး မတော်တဆဖြစ်မှုများကို တားဆီးရန် PTTEP SA ၏ SSHE ပေါင်းစပ်ထားသော စီမံခန့်ခွဲမှုစနစ် နည်းလမ်းစဉ်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း။	PTTEP SA	စီမံကိန်းကာလ တစ်လျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှုစနစ်
			၄.၂.၁.၂ ပြင်းထန်သော ထိခိုက်ဒဏ်ရာများ (သို့မဟုတ်) အရေးပေါ်ကိစ္စများအတွက် ပြင်ပဆေးခန်းဝန်ဆောင်မှုများအပါအဝင် ဆေးရုံလွှဲသည့်စနစ်။					
၅။ လျှောင်	၅.၂ မြေမျက်နှာပြင်၏ ရုပ်ပိုင်းဆိုင်ရာ ရွေ့လျားမှု	၅.၂.၁ ဖြစ်နိုင်သော ရုပ်ပိုင်းဆိုင်ရာ ပျက်စီးမှုများမှာ အဆောက်အဦးပြိုကျခြင်း၊ ပေါက်ကွဲခြင်း၊ မီး (သို့မဟုတ်) ယိုဖိတ်ခြင်း။	၅.၂.၁.၁ PTTEP SA ၏ အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ရန်။	နိမ့်သော	PTTEP SA ၏ အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း။	PTTEP SA	စီမံကိန်းကာလ တစ်လျှောက်လုံး	PTTEP SA ၏ SSHE စီမံခန့်ခွဲမှုစနစ်

ဇယား (၁-၁၃) ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ စောင့်ကြည့်စစ်ဆေးခြင်း

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	အညွှန်း/ တိုင်းတာသည့် Parameter	လုပ်ငန်းစဉ်	အဆိုပြုကြာချိန်နှင့် စောင့်ကြည့်မှု အကြိမ်အရေအတွက်	တည်နေရာ
လေအရည်အသွေး	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	<u>နည်းလမ်း</u> • ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂)နှင့်အတူ ၂၀၁၅ ခုနှစ်တွင် စတင်အသုံးပြုသော အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတလွှတ်မှု) လမ်းညွှန်ချက်များ • WHO လေအရည်အသွေး လမ်းညွှန်ချက် (၂၀၀၆)နှင့် ဖြည့်စွက်ချက်။	ကြာချိန်- တစ်ရက် **အကြိမ်အရေအတွက်** • ဆောက်လုပ်ရေးကာလ၊ တွင်းတူးခြင်းနှင့် တွင်းစမ်းသပ်ခြင်းအဆင့်များ။ • ၁ ကီလိုမီတာအတွင်းရှိ ဒေသခံပြည်သူများကို ပုံမှန် စောင့်ကြည့်စစ်ဆေးရန် လိုအပ်ပါမည်။ • လေအရည်အသွေးနှင့် ပတ်သက်ပြီး တိုင်ကြားမှုများကို တုန့်ပြန်ရန် (လိုအပ်ပါက) ထပ်မံ၍ လေအရည် အသွေး တိုင်းတာခြင်းကို ဆောင်ရွက်ရပါမည်။	အနီးဆုံး လေအရည်အသွေး တိုင်းတာသည့် လက်ခံရှိရာနေရာ (သို့မဟုတ်) တိုင်ကြားထားသည့် ဧရိယာ၏ လေတိုက်ရာ အောက်ဘက် (လိုအပ်ပါက)
ဆူညံသံ	• L_{eq}24 hr. • L_{max} • L_{dn}	<u>နည်းလမ်း</u> • နောက်ခံဆူညံသံ၊ ကြွင်းကျန်ဆူညံသံ၊ သီးခြားထွက်နေသော ဆူညံသံအား တိုင်းတာခြင်း၊ အမျိုးအစား (၁) (သို့) (၂) အသံအနိမ့်အမြင့်ကို တွက်ချက်ခြင်းနှင့် ၎င်းတို့အားလုံးသည် IEC စံနှုန်းများနှင့် ကိုက်ညီရပါမည်။ • ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂)နှင့်အတူ ၂၀၁၅ ခုနှစ်တွင် စတင်ထိရောက်လာသော အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ။ • ပြည်သူလူထုအား ဆူညံမှုများကို ကမ္ဘာ့ ကျန်းမာရေးအဖွဲ့ (WHO)(၁၉၉၉) လမ်း	**ကြာချိန်- တစ်ရက်** **အကြိမ်အရေအတွက်** • ဆောက်လုပ်ရေးကာလ၊ တွင်းတူး ခြင်းနှင့်တွင်းစမ်းသပ်ခြင်း အဆင့်များ။ • ၁ ကီလိုမီတာအတွင်းရှိ ဒေသခံ ပြည်သူများကို ပုံမှန်စောင့်ကြည့် စစ်ဆေးရန် လိုအပ်ပါမည်။ • ဆူညံသံနှင့် ပတ်သက်ပြီး တိုင်ကြားမှုများကို တုန့်ပြန်ရန် ထပ်မံ၍ ဆူညံသံ တိုင်းတာခြင်းကို ဆောင်ရွက်ရပါမည်။ (လိုအပ်ပါက)	တွင်းတူးစင်မှ မီတာ ၁၀၀ အကွာ

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	အညွှန်း/ တိုင်းတာသည့် Parameter	လုပ်ငန်းစဉ်	အဆိုပြုကြာချိန်နှင့် စောင့်ကြည့်မှု အကြိမ်အရေအတွက်	တည်နေရာ
		ညွှန်ချက်များနှင့်အညီဆောင်ရွက်ပါမည်။		
မြေဆီလွှာ	ရုပ်ပိုင်းဆိုင်ရာ တိုင်းတာမှုများ • pH • Soil texture • Salinity • Conductivity • Temperature • Cl⁻ ဓါတုဗေဒဆိုင်ရာ တိုင်းတာမှုများ • Petroleum Hydrocarbons • Total PAH, Total DDT, Total PCBS. • Heavy Metals: As, Cd and Cd-compound, • Cr^{6+}, Pb, Hg, Ni, Cu, Zn, Vanadium, Total Nitrogen and Total Phosphorus	နည်းလမ်းများ • တိုင်းတာမှုများကို U.S. EPA ခွဲခြမ်းစိတ်ဖြာမှု နည်းလမ်းများကို လိုက်နာခြင်း။ • ၂၀၁၇ခုနှစ်၊ ပတ်ဝန်းကျင် ဝန်ကြီး ဌာန၏ ကနေဒီယမ် ကောင်စီ မှ coarse grained စိုက်ပျိုး မြေဆီလွှာများ အတွက် စံချိန်စံညွှန်းများ။ ပတ်ဝန်းကျင်နှင့် ကျန်းမာရေး ကာကွယ်မှုများ အတွက် Canadian Soil Quality Guidelines များ။ • ပတ်ဝန်းကျင်ဝန်ကြီးဌာန၏ ကနေဒီယမ်ကောင်စီ၊ ၂၀၀၈ခုနှစ်၊ မြေဆီလွှာထဲရှိ ရေနံနှင့် ဟိုက်ဒရို ကာဗွန် (PHC) အတွက် CANADA- WIDE STANDARDS • Ontario မြေဆီလွှာ၊ မြေအောက် ရေနှင့် အနည်အနစ် စံချိန်စံညွှန်း များ၊ ကနေဒါမှ Environmental Protection Act (9-Mar-04) ၏ Part XV ကို အသုံးပြုရန်။	• ယိုဖိတ်ခြင်း၊ ဖိတ်စင်ခြင်းများ ရှိပါက တွင်းပိတ်သိမ်းပြီးနောက် သုံးလအတွင်း နေရာကို မူလအခြေအနေရောက်အောင် ပြန်လည်ထိန်းသိမ်းရပါမည်။	စီကိန်းနေရာ ယိုဖိတ်ခြင်း (သို့မဟုတ်) ဖိတ်စင်သည့် နေရာများတွင်။
မြေပေါ်ရေ	ရုပ်ပိုင်းဆိုင်ရာ တိုင်းတာမှုများ • pH • Conductivity • Temperature • SS • TDS • Salinity ဓါတုဗေဒဆိုင်ရာ တိုင်းတာမှုများ • DO	နည်းလမ်း • ရေနှင့် စွန့်ပစ်ရေများ စစ်ဆေးခြင်း အတွက် APHA-AWWA-WEF မှအကြံပြုထားသော စံချိန်စံညွှန်း နည်းလမ်းများကို လိုက်နာခြင်း။ • သောက်သုံးရေ အရည်အသွေး (GDWQ)အတွက် ကမ္ဘာ့ ကျန်းမာရေးအဖွဲ့ (WHO) လမ်းညွှန် ချက်များ။	• ယိုဖိတ်ခြင်း၊ ဖိတ်စင်ခြင်းများ ရှိပါက တွင်းပိတ်သိမ်းပြီးနောက် သုံးလအတွင်း နေရာကို မူလအခြေအနေရောက်အောင် ပြန်လည်ထိန်းသိမ်းရပါမည်။	• စီမံကိန်း၏ (အခြေခံအချက်များ) မကောက်ယူမီ မြေပေါ်ရေ နမူနာကောက်ယူသည့် နေရာတွင် • သက်ရောက်နိုင်ခြေရှိသော ရေအရင်းအမြစ်များ (ဖိတ်စင်ခြင်းနှင့် ယိုဖိတ်ခြင်းများ)

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	အညွှန်း/ တိုင်းတာသည့် Parameter	လုပ်ငန်းစဉ်	အဆိုပြုကြာချိန်နှင့် စောင့်ကြည့်မှု အကြိမ်အရေအတွက်	တည်နေရာ
	• BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn ဇီဝဗေဒဆိုင်ရာ တိုင်းတာမှုများ • TCB			
မြေအောက်ရေ	ရုပ်ပိုင်းဆိုင်ရာ တိုင်းတာမှုများ • pH • Conductivity • Temperature • TDS • Salinity ဓါတုဗေဒဆိုင်ရာ တိုင်းတာမှုများ • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	<u>နည်းလမ်း</u> • ရေနှင့် စွန့်ပစ်ရေများ စစ်ဆေးခြင်း အတွက် APHA-AWWA-WEF မှအကြံပြုထားသော စံချိန်စံညွှန်း နည်းလမ်းများကို လိုက်နာခြင်း။ • သောက်သုံးရေ အရည်အသွေး (GDWQ) အတွက် ကမ္ဘာ့ ကျန်းမာရေးအဖွဲ့ (WHO) လမ်းညွှန်ချက်များ။	ယိုဖိတ်ခြင်း၊ ဖိတ်စင်ခြင်းများ ရှိပါက တွင်းပိတ်သိမ်းပြီးနောက် သုံးလအတွင်း နေရာကို မူလအခြေအနေရောက်အောင် ပြန်လည်ထိန်းသိမ်းရပါမည်။	• အနီးဆုံး မြေအောက်ရေတွင်းများ (သို့မဟုတ်) တွင်းအနီးနားဧရိယာ။ • ဖိတ်စင်နိုင်ခြေရှိသော ဧရိယာ
တွင်းတူးခြင်းမှ ဖြတ်စများ	• ကလိုရိုက် (WBM အတွက်) • ဖြတ်စပေါ်ရှိ ဆီများ (SBMအတွက်) • ပြဒါး (in stock Barite) • ကတ်ဒမီယန် (in stock Barite)	<u>နည်းလမ်း</u> • ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) နှင့်အတူ ၂၀၁၅ ခုနှစ်တွင် စတင်ထိရောက်လာသော အမျိုးသား	• မရောနှောမီ/ အမှိုက်ကျင်းထဲသို့ မစွန့်ပစ်မီ တွင်းတူးခြင်းအဆင့် ပြီးဆုံးမှုပေါ် မူတည်၍။	• ဖြတ်စတွင်းများမှ စမ်းသပ်တူးဖော်တွင်းများ

ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်များ	အညွှန်း/ တိုင်းတာသည့် Parameter	လုပ်ငန်းစဉ်	အဆိုပြုကြာချိန်နှင့် စောင့်ကြည့်မှု အကြိမ်အရေအတွက်	တည်နေရာ
		ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ။		
တွင်းတူးခြင်းအတွက် အသုံးပြုသော ဓါတုပစ္စည်းများ	• ဓါတုပစ္စည်း အမျိုးအစား • အသုံးပြုသည့် ပမာဏ	• ဓါတုပစ္စည်းအမျိုးအစားနှင့် အသုံးပြုသည့် ပမာဏကို နေ့စဉ်မှတ်တမ်းထားရန်။	• တွင်းတူးခြင်း ပြီးဆုံးသောအခါ အစီရင်ခံစာတွင်ထည့်သွင်းဖော်ပြရန်။	• စီမံကိန်းဧရိယာ
အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများ	• စွန့်ပစ်ခြင်း	• အမျိုးအစားနှင့် စွန့်ပစ်သည့်နေရာအလိုက် စွန့်ပစ်ပစ္စည်း ပမာဏကို နေ့စဉ်မှတ်တမ်းထားရန်။	• တွင်းတူးခြင်းအဆင့်	• စီမံကိန်းနေရာအားလုံး
လူမှုရေး	• တိုင်ကြားခြင်းများ • စောင့်ကြည့်စစ်ဆေးခြင်းနှင့် ဖြေရှင်းခြင်း။	• တိုင်ကြားမှုများကို မှတ်သားခြင်း။ • စောင့်ကြည့်ခြင်း၊ စစ်ဆေးခြင်းနှင့် သင့်လျော်သော ဖြေရှင်းမှုများကို အကောင်အထည်ဖော်ခြင်း။	• အဆင့်အားလုံး	• စီမံကိန်းဧရိယာ၊ စီမံကိန်း ပတ်ဝန်းကျင်ရှိ ပြည်သူလူထုနှင့် သယ်ယူပို့ဆောင်ရေး လမ်းကြောင်းများ။
ပြည်သူလူထုနှင့် လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေးနှင့် လုံခြုံစိတ်ချရမှု	• မတော်တဆဖြစ်စဉ်များ • မတော်တဆဖြစ်ရပ်များ • လျှော့ချရေးနည်းလမ်းများ	• မတော်တဆဖြစ်မှုများ (သို့) ဆောက်လုပ်ရေးကာလအတွင်း မတော်တဆ ဖြစ်နိုင်ခြေများကို မှတ်တမ်းတင်ထားပြီး ထိခိုက်မှု အနည်းအများနှင့် လျှော့ချရေး နည်းလမ်းများကို သတ်မှတ်ခြင်း။ • မတော်တဆဖြစ်ရပ်များအတွက် အကျဉ်းချုပ်အစီရင်ခံစာကို ပြုစုခြင်း။	• အဆင့်အားလုံး	• စီမံကိန်းဧရိယာ၊ စီမံကိန်းပတ်ဝန်းကျင်ရှိ ပြည်သူလူထုနှင့် သယ်ယူပို့ဆောင်ရေး လမ်းကြောင်းများ။

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

၁.၉။ လူထုတွေ့ဆုံဆွေးနွေးခြင်းနှင့် ထုတ်ဖော်ပြောကြားခြင်း

၁.၉.၁။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအဆင့် လူထုတွေ့ဆုံဆွေးနွေးခြင်း

PTTEP SA သည် အဆိုပြုစီမံကိန်းကို အထက်ရာထူးပုဂ္ဂိုလ်များ သိရှိစေရန်နှင့် စီမံကိန်းလုပ်ငန်းစဉ်များ၊ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှုနှင့် လူထုတွေ့ဆုံဆွေးနွေးခြင်းအစီအစဉ်များအတွက် သဘောတူထောက်ခံချက် ရရှိဖို့ရန် အလို့ငှာ ၂၀၁၈ ခုနှစ် ဇန်နဝါရီ ၁၂ရက်နေ့တွင် မကွေးတိုင်းဒေသကြီးဝန်ကြီးချုပ်နှင့် တွေ့ဆုံဆွေးနွေးခဲ့ပြီးနောက် ၂၀၁၈ ခုနှစ် ဇန်နဝါရီ ၁၅ရက်နေ့တွင် သရက်ခရိုင် အုပ်ချုပ်ရေးမှူး ၊သရက်မြို့နယ် အုပ်ချုပ်ရေးမှူးတို့နှင့်လည်း တွေ့ဆုံဆွေးနွေးခဲ့ပါသည်။ လူထုတွေ့ဆုံဆွေးနွေးပွဲ အစီအစဉ်ကို အခန်း(၉) တွင် အသေးစိတ်ဖော်ပြထားပါသည်။

ပထမအကြိမ် ကျင်းပပြုလုပ်သော စီမံကိန်းသက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးပွဲအား သက်ဆိုင်ရာ အာဏာပိုင်အဖွဲ့ဝင်များ၊ ဒေသခံများ ဖြင့် စီမံကိန်းဧရိယာများတွင် ကျင်းပ ပြုလုပ်ခဲ့ပါသည်။ ကျေးရွာ ၃၄ ရွာမှ စုစုပေါင်း ၈၁၄ ယောက် ပါဝင်တက်ရောက် ဆွေးနွေးခဲ့ပါသည်။

စီမံကိန်းသက်ဆိုင်သူများနှင့်တွေ့ဆုံပွဲအားအောက်ပါအတိုင်းကျင်းခဲ့ပါသည်။

- စီမံကိန်းလုပ်ငန်းအကြောင်းအရာများအား ရှင်းလင်းတင်ပြခြင်း၊ ဒေသခံများနှင့် အစုအဖွဲ့လိုက်ဆွေးနွေးခြင်း၊ ပြည်တွင်း၊ ပြည်ပ အခြေစိုက်လူမှုကူညီရေး အဖွဲ့အစည်းများ၊ စိတ်ဝင်စားသည့် အဖွဲ့အစည်းများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း။
- လူမှုစစ်တမ်းများ ကောက်ယူခြင်း။

လူမှုစစ်တမ်းကောက်ယူမှုရလဒ်များအရ ၈၈% သောဒေသခံများသည် စီမံကိန်းဖွံ့ဖြိုးတိုးတက်ရေး လုပ်ဆောင် ချက်များကို လက်ခံကြပါသည်။ ၇% သောဖြေဆိုသူများမှာ တိကျစွာဖြေကြားခြင်းမရှိပါ။

ပတ်ဝန်းကျင်အခြေခံ နမူနာကောက်ယူခြင်းနှင့် လူမှုစီးပွားရေးအခြေအနေ စစ်တမ်း ကောက်ယူခြင်းကို အောက်ပါ **ဇယား(၁-၁၁)** အတိုင်း ၂၀၁၈ ခုနှစ် ဖေဖော်ဝါရီလ အစောပိုင်းတွင် ဆောင်ရွက်ခဲ့ပါသည်။

ဇယား (၁- ၁၄) ပထမအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးခြင်း အချိန်ဇယားနှင့် သက်ဆိုင်သူများ

ရက်စွဲ	အချိန်	အစည်းအဝေးကျင်းပသည့်နေရာ	ပါဝင်ပတ်သက်သူများ/ကျေးရွာများ
ဖေဖော်ဝါရီလ ၅ ရက်	၀၉:၃၀ မှ ၁၁:၃၀	သက်ရက်မြို့နယ်ခန်းမ	၁။ မြို့နယ်နှင့် ခရိုင်အဆင့်ရှိ အရာရှိများ ၂။ သစ်တောဦးစီးဌာန နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန ၃။ အစိုးရမဟုတ်သော အဖွဲ့အစည်းများ ၄။ လူမှုရေးအသင်းအဖွဲ့များ ၅။ သတင်းမီဒီယာများ
ဖေဖော်ဝါရီလ ၅ ရက်	၁၄:၀၀ မှ ၁၆:၀၀	ပိတောက်ပင်ကျေးရွာ	၁။ ကျောက်ဦး ၂။ လှိုင်ချွန် (အကြီး) ၃။ လှိုင်ချွန် (အသေး) ၄။ ပိတောက်ပင် ၅။ စခန်းကြီး

			၆။ တောင်ဘော ၇။ မြောက်ဘော ၈။ ရေနံမြေ
ဖေဖော်ဝါရီလ ၆ ရက်	၁၄:၀၀ မှ ၁၆:၀၀	ဘော်ကျေးရွာ	၁။ တံစည်းခေါက် (အရှေ့) ၂။ တံစည်းခေါက် (အနောက်) ၃။ တလုတ်ပင် ၄။ မိုးနတ်ကုန်း ၅။ တပ်ရွာ ၆။ ဘော် (မြောက်) ၇။ ဘော် (တောင်) ၈။ အင်းလည် ၉။ ပေါက်ဖြူ ၁၀။ စမ်းမကြီး ၁၁။ အုတ်ပုံ
ဖေဖော်ဝါရီလ ၇ ရက်	၁၄:၀၀ မှ ၁၆:၀၀	အုန်းမွန်တောကျေးရွာ	၁။ စမ်းလည် ၂။ ငါးဘတ်ကျ ၃။ အုန်းမွန်တော ၄။ ဖန်းပြင် ၅။ ရွာသစ် ၆။ ပေကုတင် ၇။ ရှမ်းရွာကျော် ၈။ ရေမြက် ၉။ပက်မခန် ၁၀။ ဇီးတော ၁၁။ အလတ်လယ် ၁၂။ အုန်းနဲတဲကြီး
ဖေဖော်ဝါရီလ ၈ ရက်	၁၄:၀၀ မှ ၁၆:၀၀	ပါးပွတ်	၁။ တုံ ၂။ ပါးပွတ် ၃။ ပေါက်အူးကား

၁.၉.၂။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအဆင့် အုပ်စုဖွဲ့ဆွေးနွေးခြင်းများ

အုပ်စုဖွဲ့ဆွေးနွေးခြင်းတွင် အောက်ပါအခမ်းအနားအစီအစဉ်များ ပါဝင်ပါသည်။

၁။ လူထုတွေ့ဆုံဆွေးနွေးခြင်း အစည်းအဝေးအား ဖွင့်လှစ်ကြေညာခြင်း
၂။ PTTEP SA ရှိဝန်ထမ်းများအား မိတ်ဆက်ပေးခြင်း
၃။ ဦးမျိုးမင်းစိုး (မြန်မာ့ရေနံနှင့် သဘာဝဓါတ်ငွေ့လုပ်ငန်း) မှ အဖွင့်အမှာစကားပြောကြားခြင်း
၄။ PTTEP SA မှ ရေနံတူးဖော်ခြင်းဆိုင်ရာ ဗီဒီယိုအား ပြသခြင်း
၅။ PTTEP SAမှ အကြံပေးအရာရှိ ဦးခင်မောင်ကြီးမှ ကုမ္ပဏီအကြောင်း ရှင်းလင်းတင်ပြခြင်း
၆။ တူးဖော်ရေးအင်ဂျင်နီယာ ဦးဝဏ္ဏဝင်းမှ တွင်းတူးရေးလုပ်ငန်းစဉ်များအား ရှင်းလင်းတင်ပြခြင်း
၇။ EQM ကုမ္ပဏီမှ ဦးခွန်ဆက်သာနှင့် Mr. Dylan Jenkins မှ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အကြောင်း ရှင်းလင်းတင်ပြခြင်း

၈။ အမေးအဖြေကဏ္ဍ

မြို့နယ်အစည်းအဝေးနှင့် ရပ်ရွာအစည်းအဝေးတွင် ပတ်သက်ဆက်နွယ်သူများဘက်မှ တင်ပြခဲ့သော အဓိကစိုးရိမ်ပူပန်မှု (၂)ခုကို **ဇယား (၁-၁၂)** တွင် အသေးစိတ်ဖော်ပြထားပါသည်။

ဇယား (၁-၁၅) ပထမအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲမှ အဓိကတွေ့ရှိချက်များ

မေးခွန်း/ အကြံပြုချက်	ပြန်လည်ဖြေကြားချက်	လျော့ချရေးနည်းလမ်းများ
လက်ရှိလက်ယက်တွင်းဆောင်ရွက်နေသူများသည် PTTEP SA မှ ခွင့်ပြုချက်ရရှိပါက လုပ်ကွက်အတွင်း ၎င်းတို့၏ထုတ်လုပ်မှုကို ဆက်လက်ဆောင်ရွက်နိုင်ရန် တောင်းခံခြင်း။	လက်ယက်တွင်းအများစုသည် ပေ ၃၀၀-၁၂၀၀ မှ ထုတ်ယူပြီး PTTEP SA ၏ ခန့်မှန်းအနက်မှာ ပေ ၉၀၀၀- ၁၅၀၀၀ ကြောင်း PTTEP SA နှင့် MOGE တို့သည် သက်ဆိုင်သူများအား ပြောကြားခဲ့ပါသည်။ ရှာဖွေမှုမတူညီသည့်အတွက် PTTEP SA သည် လက်ရှိလက်ယက်တွင်း တူးဖော်နေသူများအား အနှောင့်အယှက်မဖြစ်စေပါ။ PTTEP SA သည် လုပ်ငန်း ဆောင်ရွက်သည့် ကုမ္ပဏီတစ်ခုဖြစ်ပြီး မြန်မာ့ရင်းနှီး မြှုပ်နှံမှု ကော်မတီ (MIC) နှင့် မြန်မာ့ရေနံနှင့် သဘာဝဓါတ်ငွေ့ လုပ်ငန်း (MOGE) ၏ ခွင့်ပြုချက်အရဆောင်ရွက်နေပါသည်။ ထို့ကြောင့် PTTEP SA သည် လုပ်ကွက်အတွင်း ဆောင်ရွက်နေသော လက်ယက်တွင်းများအတွက် ထောက်ခံချက် ပေးရန် အခွင့်အာဏာမရှိပါ။	• PTTEP SA သည် လက်တူးတွင်း ဆောင်ရွက်နေမှုအား အနှောင့်အယှက်မပေးပါ။ • PTTEP SA သည် လက်ယက်တွင်း နေရာများကို ရှောင်ပြီး တွင်းတူးရန် ဒီဇိုင်းရေးဆွဲ ပါမည်။
မြေယာပိုင်ဆိုင်မှုအထောက်အထား မပြနိုင်သော မြေပိုင်ရှင်များအတွက် လျော်ကြေး	လျော်ကြေးကိစ္စနှင့် ပတ်သက်၍ ကျေးရွာဥက္ကဌနှင့် ရပ်မိရပ်ဖများ၏ အကြံပြုချက်များအရ မြေယာလျော်ကြေး ကော်မတီနှင့် ပူးပေါင်းဆောင်ရွက်ပြီး လျော်ကြေးကိစ္စကို ဖြေရှင်းပါမည်။	• မြေပိုင်ရှင်နှင့် မြေအသုံးပြုသူများအား ပွင့်လင်းမြင်သာပြီး မျှတသော လျော်ကြေးပေးရန်။ • မြေပိုင်ရှင်များနှင့် ဒေသအာဏာပိုင်များထံမှ ခွင့်ပြုချက်များရယူရန်။ MOGE သို့ တင်ပြရန်။ • ပတ်ဝန်းကျင် မြေပိုင်ရှင်များကို စီမံကိန်းလုပ်ငန်းမစတင်မီ ရက်သတ္တပတ် ၂ပတ်အလိုတွင် အကြောင်းကြားရန်။

၁.၉.၃။ EIA အဆင့် လူထုတွေ့ဆုံဆွေးနွေးခြင်း

ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲကို ၂၀၁၈ခုနှစ်ဧပြီလတွင် ကျင်းပခဲ့ပါသည်။ ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲ၏ ရည်ရွယ်ချက်မှာ ကနဦးEIAအစီရင်ခံစာမူကြမ်းကို သက်ဆိုင်သူများထံ တင်ပြရန် ဖြစ်ပါသည်။

ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲကို ပထမအကြိမ်လူထုတွေ့ဆုံပွဲ ကျင်းပခဲ့သော မြို့နယ်နှင့် ရွာများတွင် ကျင်းပခဲ့ပါသည်။ ၎င်းလူထုတွေ့ဆုံပွဲကို ရွာပေါင်း ၃၄ ရွာမှ စုစုပေါင်း ၈၅၂ ယောက် တက်ရောက်ခဲ့ပါသည်။

(ဇယား ၁-၁၃) MOGE ၊ PTTEP SA နှင့် IEM/EQM တို့သည် လူထုတွေ့ဆုံဆွေးနွေးပွဲ ကျင်းပရန်အတွက် ဆွေးနွေးရန်နှင့် အကူအညီများရယူရန် သက်ဆိုင်ရာမြို့နယ်အုပ်ချုပ်ရေးမှူးများနှင့် သွားရောက်တွေ့ဆုံခဲ့ပါသည်။ မြို့နယ်အုပ်ချုပ်ရေးမှူးသည် လူထုတွေ့ဆုံဆွေးနွေးပွဲ အချိန်ဇယားကို လက်ခံအတည်ပြုပြီးသည်နှင့် တပြိုင်နက် IEM/EQM သည် ကနဦး EIA အစီရင်ခံစာ ကို တင်ပြရန်နှင့် သင့်လျော်သော ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် ဖော်ဆောင်ရန်အတွက် သက်ဆိုင်သူများမှ အကြံပြုချက်/စိုးရိမ်ပူပန်မှုများကို ရယူရန် လူထုတွေ့ဆုံဆွေးနွေးပွဲကို ဆောင်ရွက်ခဲ့ပါသည်။

ဇယား (၁-၁၆) ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲ အချိန်ဇယားနှင့် သက်ဆိုင်သူများ

နေ့စွဲ	အချိန်	ကျင်းပရာနေရာ	သက်ဆိုင်သူများ/ ကျေးရွာများ	တက်ရောက်သူ
ဧပြီလ ၂၄ ရက်	နံနက် ၉:၀၀ မှ ၁၁:၀၀	သရက်မြို့နယ်ခန်းမ	၁။ မြို့နယ်နှင့် ခရိုင်အဆင့် အာဏာပိုင်များ ၂။ သစ်တောနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန (ECD) ၃။ NGOs ၄။ CSOs ၅။ မီဒီယာများ	၁၁၉
ဧပြီလ ၂၄ ရက်	နေ့လည် ၂:၀၀ မှ ၄:၀၀	ဘောကျေးရွာ	၁။ တံစည်းခေါက် (အရှေ့) ၂။ တံစည်းခေါက် (အနောက်) ၃။ တလုတ်ပင် ၄။ မိုးနတ်ကုန်း ၅။ တပ်ရွာ ၆။ ဘော် (မြောက်) ၇။ ဘော် (တောင်) ၈။ အင်းလည် ၉။ ပေါက်ဖြူ ၁၀။ စမ်းမကြီး ၁၁။ အုတ်ပုံ	၂၂၉
ဧပြီလ ၂၅ ရက်	နံနက် ၉:၀၀ မှ ၁၁:၀၀	အုန်းမွှန်တောကျေးရွာ	၁။ စမ်းလည် ၂။ ငါးဘတ်ကျ ၃။ အုန်းမွှန်တော ၄။ ဇန်းပြင် ၅။ ရွာသစ် ၆။ ပေကုတင် ၇။ ရှမ်းရွာကျော် ၈။ ရေမြက် ၉။ပက်မခန် ၁၀။ ဇီးတော ၁၁။ အလတ်လယ် ၁၂။ အုန်းနဲတဲကြီး	၂၃၂
ဧပြီလ ၂၆ ရက်	နံနက် ၉:၀၀ မှ	ပိတောက်ပင်ကျေးရွာ	၁။ ကျောက်ဦး	၂၁၂

	၁၁:၀၀		၂။ လေယှိုင်ချွန် (အကြီး) ၃။ လေယှင်ချွန် (အသေး) ၄။ ပိတောက်ပင် ၅။ စခန်းကြီး ၆။ တောင်သော ၇။ မြောက်သော ၈။ ရေနံမြေ	
ဧပြီလ ၂၆ ရက်	နေ့လည် ၂:၀၀ မှ ၄:၀၀	ပါးပွတ်ကျေးရွာ	၁။ တုံ ၂။ ပါးပွတ် ၃။ ပေါက်အုံးကား	၆၀

၁.၉.၄။ EIA အဆင့် အုပ်စုဖွဲ့ဆွေးနွေးခြင်းများ

မြို့နယ်နှင့် ကျေးရွာများတွင်ကျင်းပခဲ့သော ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲသို့ တက်ရောက်လာသူများသည် ပထမအကြိမ် လူထုတွေ့ဆုံပွဲကဲ့သို့ပင် အလားတူ စိုးရိမ်ပူပန်မှုများကို မေးမြန်းခဲ့ပါသည်။ ၎င်းတို့၏ အဓိကပြဿနာများ၊ စိုးရိမ်ပူပန်မှုများနှင့် အကြံပြုချက်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

ဇယား (၁-၁၇) ဒုတိယအကြိမ် လူထုတွေ့ဆုံဆွေးနွေးပွဲမှ အဓိကအချက်အလက်များ

မေးခွန်း/ အကြံပြုချက်များ	ပြန်လည်ဖြေကြားချက်	လျော့ချရေးနည်းလမ်းများ
စောင့်ကြည့်စစ်ဆေးခြင်း- PTTEPSA၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက် မှုများကို တတိယ အဖွဲ့အစည်း အဖြစ် မည်သူက စောင့်ကြည့် စစ်ဆေးမည်နည်း။	စောင့်ကြည့်စစ်ဆေးခြင်းအတွက် PTTEP SA သည် ၎င်း၏ ဆောင်ရွက်မှုများကို ခြောက်လတစ်ကြိမ် ECD သို့ တင်ပြရပါမည်။ လိုအပ်ပါက မကွေးတိုင်းဒေသကြီး ECD နှင့် အခြားအစိုးရအဖွဲ့အစည်းများက လာရောက် စစ်ဆေးပါလိမ့်မည်။	• ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေနှင့် EIA လုပ်ထုံးလုပ်နည်း၏ လိုအပ် ချက်များအရ ပုံမှန် စောင့်ကြည့် စစ်ဆေးခြင်း အစီရင်ခံစာကို ECD သို့ တင်ပြရပါမည်။
အလုပ်အကိုင်- ဒေသခံများအတွက် အလုပ်အကိုင် အခွင့်အလမ်းများ။	တွင်းတူးခြင်းအတွက် ပညာရှင်အလုပ်သမားများသည် နိုင်ငံခြားသားများ (သို့မဟုတ်) အခြားနေရာမှ လူများကို ခန့်အပ်ပါမည်။ PTTEP SA သည် ဒေသခံအလုပ်သမားများကို ဦးစားပေးခန့်အပ်ရန် အကြံပြုချက်အား မှတ်သားသွားပါမည်။	• ဒေသစီးပွားရေးနှင့် အဓိကစိုက်ပျိုးရာသီအပေါ် သက်ရောက်မှုများကို ကန့်သတ်ရန် ဒေသခံများအား အလုပ်ခန့်အပ်ခြင်း အတွက် ဒေသအာဏာပိုင်များနှင့် တိုင်ပင်ဆွေးနွေးခြင်း။ • အချို့အလုပ်နေရာများအတွက် အရည်အသွေးပြည့်မီသော ဒေသခံ အလုပ်သမားများကို အလုပ်ခံအပ်ခြင်း။ • မကျွမ်းကျင်သော အလုပ်သမားများနှင့် အနည်းငယ်ကျွမ်းကျင်သော အလုပ်သမားများနေရာများတွင် ဒေသခံများကို အလုပ်ခန့်ထားရန် ကန်ထရိုက်တာများအား တွန်းအားပေးခြင်း။
မြေယာလျော်ကြေး- PTTEP SA က မြေယာလျော်ကြေး ပေးချေခြင်းနှင့် သင့်တင့်သော ဈေးနှုန်း	မြေယာပိုင်ဆိုင်မှုကော်မတီ (မြေစာရင်းဌာန အပါအဝင် ဒေသအာဏာပိုင်၊ MOGE နှင့် PTTEPမှပုဂ္ဂိုလ်များ)သည် မြေယာလျော်ကြေး ကိစ္စကို ကိုင်တွယ်ပါမည်။	• မြေပိုင်ရှင်နှင့် မြေအသုံးပြုသူများအား ပွင့်လင်းမြင်သာပြီး မျှတသော လျော်ကြေးပေးရန်။

		• မြေပိုင်ရှင်များနှင့် ဒေသအာဏာပိုင်များထံမှ ခွင့်ပြုချက်များရယူရန်။ MOGE သို့ တင်ပြရန်။
လမ်းဖောက်လုပ်ခြင်း- လမ်းဖောက်လုပ်မှု အစီအစဉ်	လမ်း၏ အကျယ်သည် ၈ မီတာရှိပါမည် (မိုးရေစီးရန်အတွက် မြောင်းများ အပါအဝင်)။ PTTEP SA သည် ရွာလမ်းမကြီးနှင့် တံတားအဖွဲ့အစည်းများနှင့် မြေယာလျော်ကြေးကော်မတီများ၏ ခွင့်ပြုချက်များ တောင်းခံပြီးမှသာ လမ်းဖောက်လုပ်ပါမည်။	• PTTEP SA သည် လမ်းဖောက်လုပ်ရန်အတွက် ရွာလမ်းမကြီးနှင့် တံတားအဖွဲ့အစည်းများနှင့် မြေယာလျော်ကြေး ကော်မတီများ၏ ခွင့်ပြုချက်များ တောင်းခံရန်။ • တင်ပြထားသော မြေနှင့် လမ်းများအတွက် မြို့နယ် အုပ်ချုပ်ရေးရုံးများသည် ကွင်းဆင်းလေ့လာမှုများ ဆောင်ရွက်ပါမည်။
လက်တူးတွင်း ဆောင်ရွက်မှုများ- အကယ်၍ PTTEP SA ၏ တွင်းတူးဧရိယာသည် လက်တူးတွင်း ဆောင်ရွက်နေသော ဧရိယာနှင့် ထပ်နေပါက မည်သို့ ဆောင်ရွက်မည်နည်း။	PTTEP SA ၏ တွင်းတူးဖော်မှုသည် လက်ရှိဒေသမှ တပိုင်တနိုင်ဆောင်ရွက်နေသော တွင်းတူး လုပ်ငန်းကို ထိခိုက်စေမည်မဟုတ်ပါ။ အဘယ့်ကြောင့်ဆိုသော် ယခုတူးမည့်အနက်သည် ပေ ၁၀၀၀၀ အထက်ရှိပြီး လက်တူးတွင်းများ ဆောင်ရွက်နေမှုကို ထိခိုက်နိုင်မည် မဟုတ်ပါ။	• PTTEP SA သည် လက်ယက်တွင်း ဆောင်ရွက် နေမှုများအားအနှောင့်အယှက်မပေးပါ။ • PTTEP SA သည် လက်တူးတွင်းနေရာများကို ရှောင်ပြီး တွင်းတူးရန် ဒီဇိုင်းရေးဆွဲပါမည်။
လူမှုရေး ပူးပေါင်းဆောင်ရွက်မှု အစီအစဉ် (CSR)	PTTEP သည် နောက်တူးမည့် တွင်းများအတွက် CSR အစီအစဉ်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ပါမည်။	• စီစဉ်ထားသော CSR အစီအစဉ်ကို PTTEP SA မှ အကောင်အထည်ဖော် ဆောင်ရွက်ရန်။
လမ်းလုံခြုံရေး- ယာဉ်ကြောပိတ်ဆို့မှု တိုးလာခြင်းကြောင့်ဒေသတွင် လမ်းအန္တရာယ်ဖြစ်ပေါ်မှုကို တိုးလာစေခြင်း။	PTTEP SA တွင် SSHE မူဝါဒနှင့် လုပ်ငန်းစဉ်များ ရှိပါသည်။ အကယ်၍ ယာဉ်မောင်းများသည် ၄င်းလိုအပ်ချက်များကိုမလိုက်နာပါက ဒေသခံများ က PTTEP SA ၏ တာဝန်ရှိသူများသို့ သတင်းပေး တိုင်ကြား နိုင်ပါသည်။	• လမ်းကြောပိတ်ဆို့မှု အချက်ပြများ (သို့မဟုတ်) အလံများကို လမ်းဆုံများနှင့် လမ်းမကြီးများတွင် ထားရှိရန်။ • ကန်ထရိုက်တာများအားဖြင့် ပို့ဆောင်ဆက်သွယ်ရေး ထိခိုက်မှုများကို လျော့ချရန် သင်တန်းအစီအစဉ်များဖြင့် တင်းကျပ်စွာ ဆောင်ရွက်ရန်။ • PTTEP SA သည် ကြီးမားသော ပစ္စည်း ကိရိယာများ သယ်ဆောင်ခြင်း မပြုမီ လမ်းအန္တရာယ် အကဲဖြတ်ခြင်းကို ဆောင်ရွက်ရပါမည်။

၁.၁၀။ နိဂုံး

ပတ်ဝန်းကျင်ဆိုင်ရာ ပြဿနာများအားလုံးကို မပြောပလောက်သော (သို့မဟုတ်) နိမ့်သော အဆင့်အဖြစ် သတ်မှတ်ထားပြီး ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများကို လျော့ချရန် စီမံခန့်ခွဲနိုင်ပါသည်။ ယာဉ်ကြောပိတ်ဆို့မှု၊ စွန့်ပစ်ပစ္စည်း စွန့်ထုတ်မှုနှင့် အလုပ်သမားများ ပြောင်းရွှေ့လာမှု အပါအဝင် လူမှုရေးဆိုင်ရာ ပြဿနာများကို အလယ်အလတ်အဖြစ် သတ်မှတ်ထားပါသည်။ ဒေသခံလူထုသည် အဆိုပြုတွင်းတူးမည့်နေရာနှင့် နီးကပ်သောကြောင့် ၎င်းလုပ်ဆောင်မှုအားလုံးကို စောင့်ကြည့်စစ်ဆေးရန် လိုအပ်ပါလိမ့်မည်။

အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများ၊ ဓါတုရွှံ့များနှင့် တွင်းတူးအမှိုက်များအပါအဝင် ကျန်းမာရေး ပြဿနာများ၊ ကူးလူး ဆက်ဆံရာမှ ဖြစ်ပေါ်နိုင်သောရောဂါများ ထုတ်လွှတ်မှုများကို အလယ်အလတ်အဆင့်အဖြစ် သတ်မှတ်ထားပါသည်။ ဒေသခံလူထုနှင့် နီးသော စီမံကိန်းနေရာများတွင် ၎င်းတို့ကို စောင့်ကြည့်စစ်ဆေးရန် လိုအပ်ပါသည်။ ဒေသတွင်းကျန်းမာရေး ဝန်ဆောင်မှု အဆောက်အဦးများမရှိသောကြောင့် PTTEP SA သည် အစမ်းတွင်း တူးဖော်မည့် ကာလတစ်လျှောက် လုပ်ငန်းခွင်တွင် ဆေးခန်းတစ်ခုထားရှိပါမည်။ စွန့်ပစ်ပစ္စည်းများအားလုံးကို အပြည်ပြည်ဆိုင်ရာ စံနှုန်းများနှင့် ကိုက်ညီစေရန်သီးခြားစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုအစီအစဉ်ကို ဆောင်ရွက်ရပါမည်။ ဟိုက်ဒရိုဂျင် ဆာလဖိုက်သည် အန္တရာယ်ရှိစေနိုင်ပြီး တပ်ဆင်ခြင်းနှင့် စမ်းသပ်ခြင်းများအတွက် စောင့်ကြည့်စစ်ဆေးသည့် ကိရိယာများ လိုအပ်ပါသည်။ အရေးပေါ်တုန့်ပြန်မှုကိရိယာများ အသုံးပြုရာတွင် လေ့ကျင့်သင်ကြားထားသော သူများဖြင့် ဆောင်ရွက်ရန် လိုအပ်ပါသည်။

ကြိုတင်စီစဉ်မထားသော ဖြစ်ပျက်မှုများကြောင့် ကြွင်းကျန်သက်ရောက်မှု အလယ်အလတ်အဆင့်ရှိနိုင်ပြီး လျှောင် ဖြစ်ပေါ်နိုင်မှုမှာအလွန်ရှားပါသည်။ စီစဉ်မထားသော ဖြစ်ပျက်မှုများ မဖြစ်ပေါ်နိုင်အောင် ဆောင်ရွက်ခြင်းသည် လက်ရှိ သင်တန်းအစီအစဉ်များနှင့် လုပ်ငန်းခွင်အရေးပေါ်တုန့်ပြန်မှုအစီအစဉ်များနှင့်ဆက်စပ်နေပါသည်။ တရားမဝင် မူးယစ်ဆေးဝါး သုံးစွဲမှုစစ်ဆေးခြင်းကို အကြံပြုထားပြီး ၎င်းသည်ဤဒေသတွင်ဗဟုသုတရှိပြီးသောကိစ္စရပ်တစ်ခု ဖြစ်ပါသည်။ ပေါက်ကွဲထွက်ခြင်းကို လျော့ချရန် BOP ကို တပ်ဆင်ပြီး စမ်းသပ်ရန် လိုအပ်ပါသည်။ တွင်းတူးခြင်း လုပ်ငန်းစဉ်ကို ဂရုတစိုက် အကောင်အထည်ဖော် ဆောင်ရွက်ရန်လိုအပ်ပါသည်။ မီးဘေးအန္တရာယ်နှင့် ဆက်စပ်နေသော ပေါက်ကွဲမှုဘေးအန္တရာယ်များ အတွက် ပုံမှန်စောင့်ကြည့်စစ်ဆေးခြင်းများ ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ မီးဘေးကြောင့် ပျက်ဆီးမှုများကို လျော့ချနိုင်ရန် မီးသတ်ဆေးဘူးများကိုလည်း ထားရှိပေးရပါမည်။

ဤဒေသသည် ယခင်ကလျှောင်ဖြစ်ပေါ်ဖူးပြီး လျှောင်ကြောင့်ဖြစ်ပေါ်လာသော သက်ရောက်မှုများကိုလျော့ချရန် ဒီဇိုင်းများကို ထည့်သွင်းစဉ်းစားရန် လိုအပ်ပါသည်။ ကြိုတင်စီစဉ်မထားသော ဖြစ်ရပ်များအတွက် လုပ်ငန်းခွင် အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်များ လိုအပ်ပြီး ဖြစ်နိုင်ပါက အစမ်းတွင်း တူးဖော်ခြင်းလုပ်ငန်းမစတင်မီ ဝန်ထမ်းများအားလုံးကို သင်တန်းပို့ချရန်လိုအပ်ပါသည်။

အကြံပြုချက်များ-

အောက်ပါအချက်များကို အကြံပြုထားပါသည်။

- ဆောင်ရွက်မှုအဆင့်အားလုံးအတွက် သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးရန် အကြံပြုထားသည်ကို အကောင် အထည်ဖော် ဆောင်ရွက်ရန်။
- လုပ်ငန်းခွင်စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်ကို ဆောင်ရွက်ရန်။
- PTTEP ၏ အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်ကို အသုံးချရန်။
- စီမံကိန်းမစတင်မီ အကြံပြုထားသော သင်တန်းအစီအစဉ်များကို ဆောင်ရွက်ရန်။
- ဒေသခံလူထုအား ထိခိုက်မှု မရှိသည်ကို သေချာစေရန် ရယူမည့် ရေအရင်းအမြစ်ကို ဖော်ထုတ်ပြရန်။
- လုပ်ကွက်အတွင်းတည်ရှိနေသော တွင်းနေရာများကို ပြန်လည်ပြုပြင်ပြီး MOGE သို့ပြန်လည်လွှဲအပ်ပါမည်။

- **အခန်း (၈)** တွင် ဖော်ပြထားသော ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် အတိုင်း လိုက်နာဆောင်ရွက်ရန်။

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1. EXECUTIVE SUMMARY

1.1 Context of the Project

This EIA Report has been prepared in accordance with the Environmental Rules and Associated Environmental Impact Assessment Procedure, issued by the Ministry of Natural Resources and Environmental Conservation (MONREC) under powers conferred on them to do so by sub-section (b) of Section 42 of the Environmental Conservation Law, according to Notification No. 9/2012 of the Government of the Republic of the Union of Myanmar. All Myanmar legislative requirements and International Guidelines and Standards, which shall be adhered to as a minimum for the EIA study have been summarized and included.

PTTEP South Asia Limited (PTTEP SA) has been granted the petroleum concession onshore Block MOGE-3, owned by Myanma Oil & Gas Enterprise (MOGE). Block MOGE-3 encompasses 1,217 square kilometers (km^2) and is located in the Southern part of Magway region in the dry, central zone of the Myanmar lowlands as shown in **Figure 1-1**. The MOGE-3 Block coordinates are detailed in **Table 1-1**.

PTTEP SA has completed 2D and 3D Seismic Acquisition in Block MOGE-3 and vicinity area during 2016-2017. Regarding the Production Sharing Contract (PSC), PTTEP SA will conduct an exploration drilling campaign in Block MOGE-3. The EIA will be investigating eight (8) locations with four (4) wells being selected for exploration well drilling starting in Q4 of 2018. The estimated duration for drilling 4 wells is 4 months. Well testing is estimated to take place over a 5-month period. The primary objectives of the onshore exploration drilling project in Block MOGE-3 are to:

1. Explore the hydrocarbon potential in Block MOGE-3;
2. Fulfill the PSC commitments.

Table 1-1: Coordinates of Block MOGE-3 Boundary

	Point	X	Y
MOGE-3	A	390736.44	2163862.50
	B	414338.81	2163734.25
	C	415839.94	2110240.25
	D	394798.38	2110348.25
	E	394038.91	2130641.75
	A	390736.44	2163862.50

Note: Datum – UTM WGS84 Zone 46N

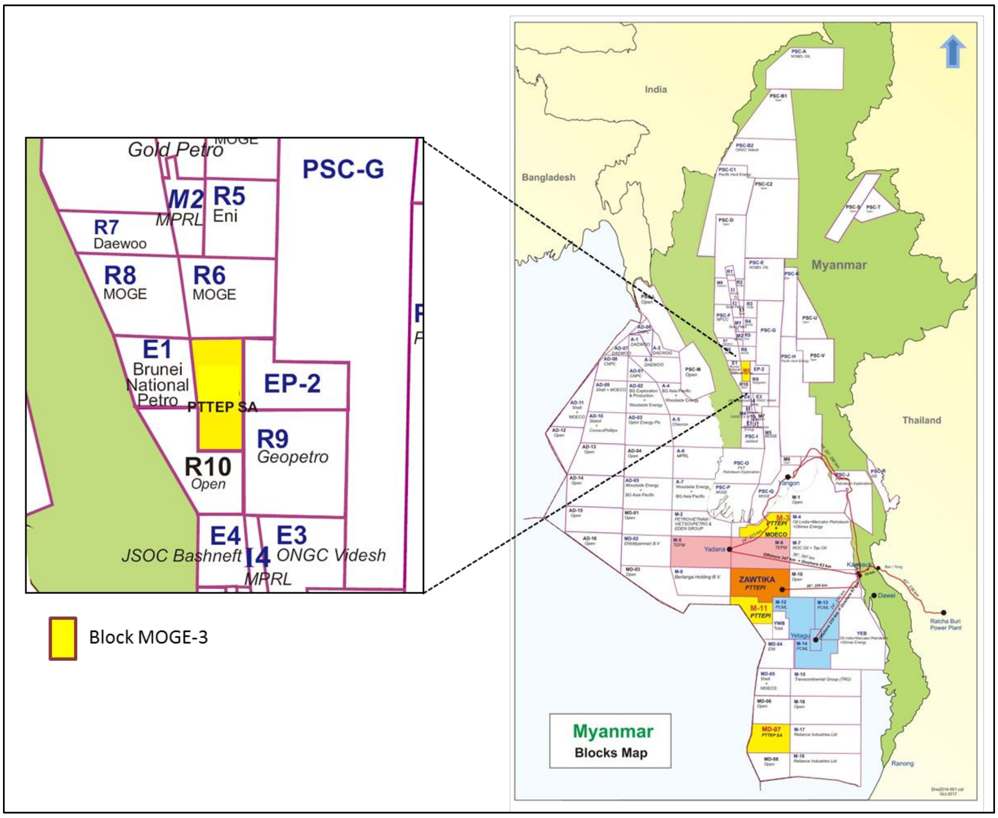


Figure 1-1: Block MOGE-3 Location

1.2 Project Proponent

PTTEP South Asia Limited (PTTEP SA), a subsidiary company of PTTEP, as Myanmar's long-term and trusted partner, are part of Myanmar's sustainable economic, social, environmental and human capital development.

Company Name	PTTEP South Asia Limited
Address	3rd Floor, Vantage Tower, 623 Pyay Road, Kamayut Township 11041, Yangon, Myanmar.
Principal Contact Person	U Phone Thet Khaing Daw Thiri Aung
Phone Number	95 (1) 652700 ~04
Email Address	PhoneThetK@pttep.com ThiriAung@pttep.com

1.3 Policy, Legal and Institutional Framework

Under Section 7 of the Environmental Conservation Law and Articles 52 and 53 of the Environmental Conservation Rules of the Republic of the Union of Myanmar, PTTEP SA is required to undertake an EIA to obtain an Environmental Compliance Certificate (ECC) for the proposed Project.

The Project will be undertaken in line with a number of national and local standards and laws. Local laws relating to EIA include:

- Myanmar Environmental Conservation Laws, 2012 (Section 7(o), 14,15,29)
- Environmental Conservation Rules, 2015 (Regulation 69)
- Environmental Impact Assessment Procedure, 2015 (Section 87,102 to 110,113,115)
- National Environmental Quality (Emissions) Guideline (2015)

Additional details on the policy and regulatory framework are presented in **Chapter 3** of the EIA Report.

1.4 Project Description and Alternatives

1.4.1 Objective

Purpose of this document is to provide an overview of PTTEP SA plans to develop an exploration drilling campaign in onshore Block MOGE-3 with a maximum of four (4) exploration wells being drilled out of the eight (8) proposed locations covered in the Environmental Impact Assessment Investigation. The full project description is presented in **Chapter 4** of the EIA report.

1.4.2 Project Justification

In 2017, PTTEP SA successfully completed 2D and 3D Seismic Acquisition which was located in Thayet and Kanma Township, Magway Region, Myanmar.

PTTEP SA is planning to conduct a drilling campaign in 2018-2019 in order to explore petroleum potential in Block MOGE 3 and fulfill the PSC commitments.

1.4.3 Project Alternatives

1.4.3.1 No Project

If the proposed exploration project is not implemented, economic benefits generated by the project would not occur. Benefits lost would include the following:

1. Employment generation and project expenditures during exploration drilling;
2. Potential loss/delay of petroleum production from the site;
3. Loss of revenue for the Myanmar and local governments through Production Sharing Contracts (PSC);
4. The future contribution of crude oil from this area would need to be replaced with an equivalent amount sourced from overseas. Importing crude oil from outside Myanmar has associated impacts from transportation (emissions, potentials for spills) as well as cost implications;

1.4.4 Drilling Location

Four (4) drilling locations will be selected based on eight (8) potential EIA study locations for the 2018-2019 drilling campaign which shown in **Table 1-2**.

Table 1-2: Locations of the potential wells

Location	Lat	Long	X	Y
Tazigauk	19°33'38.60"N	95° 0'28.31"E	395928.46	2163173.72
Monatkon	19°30'41.12"N	94°59'38.90"E	394456.61	2157726.21
Ngabetkya	19°25'58.09"N	94°59'14.95"E	393707.23	2149029.74
Banbyin	19°24'55.98"N	95° 1'17.48"E	397269.74	2147099.80
Padaukpin	19°22'26.34"N	95° 4'40.02"E	403152.41	2142467.30
Sakangyi	19°22'20.51"N	95° 6'16.96"E	405979.52	2142273.20
Talaba	19° 21' 47.05"	95° 00' 30.29"	395860.02	2141299.88
Natmi	19°13'7.12"N	95° 1'11.83"E	396981.65	2125310.31

Note: Datum – UTM WGS84 Zone 46N

The coordinates of proposed EIA survey locations are found in **Table 1-3**. The EIA study areas are shown in **Figure 1-2**.

The main reservoir target of exploration wells are mainly Sandstone/Siltstone from intermediate to deep level. PTTEP SA intends to use a typical land-drilling rig for this drilling campaign. There is no suitable existing accommodation, such as hotels or guest houses, within a reasonable distance of the proposed well sites, so a temporary camp site will be established near to the well sites. The planned camp site will be located 3 km outside of Thayet town by the main road. The area of the camp site is about 100 m x 100 m.

Table 1-3: Proposed Well Site Study Areas

NO.	Name	Point	Site locations	
			X	Y
1	Monatkon (1.5x1.0)	A	394709.19	2158286.50
		B	393203.56	2158036.25
		C	393366.63	2157041.50
		D	394858.75	2157310.50
		A	394709.19	2158286.50
2	Ngabetkya (1.5x2.9)	A	393414.31	2151523.25
		B	393388.00	2148628.00
		C	394924.53	2148614.25
		D	394941.78	2151524.50
		A	393414.31	2151523.25
3	Padaukpin (1.5x2.4)	A	402207.16	2142989.00
		B	403472.00	2143755.25
		C	404363.38	2142242.25
		D	404061.78	2141230.50
		E	403427.91	2140887.00
		A	402207.16	2142989.00
4	Sakangyi (1.5x2.0)	A	405637.53	2142382.00
		B	406476.13	2140568.00
		C	407846.34	2141208.50
		D	406979.91	2143009.50
		A	405637.53	2142382.00
5	Banbyin (2.5x1.5)	A	395217.00	2148262.00
		B	395059.88	2146797.50
		C	397584.28	2146552.50
		D	397705.88	2148044.25
		A	395217.00	2148262.00
6	Tazigauk (1.0x1.5)	A	395505.84	2163660.25
		B	396457.84	2163292.00
		C	395874.16	2161881.00
		D	394910.84	2162277.50
		A	395505.84	2163660.25
7	Natmi-North (1.5x2.0)	A	394925.84	2126137.50
		B	396166.38	2127034.00
		C	397445.50	2125354.00
		D	396269.91	2124437.50
		A	394925.84	2126137.50
8	Talaba (1.0x2.5)	A	394504.31	2142758.50
		B	395402.31	2143255.25
		C	396643.63	2141031.75
		D	395685.53	2140537.50
		A	394504.31	2142758.50

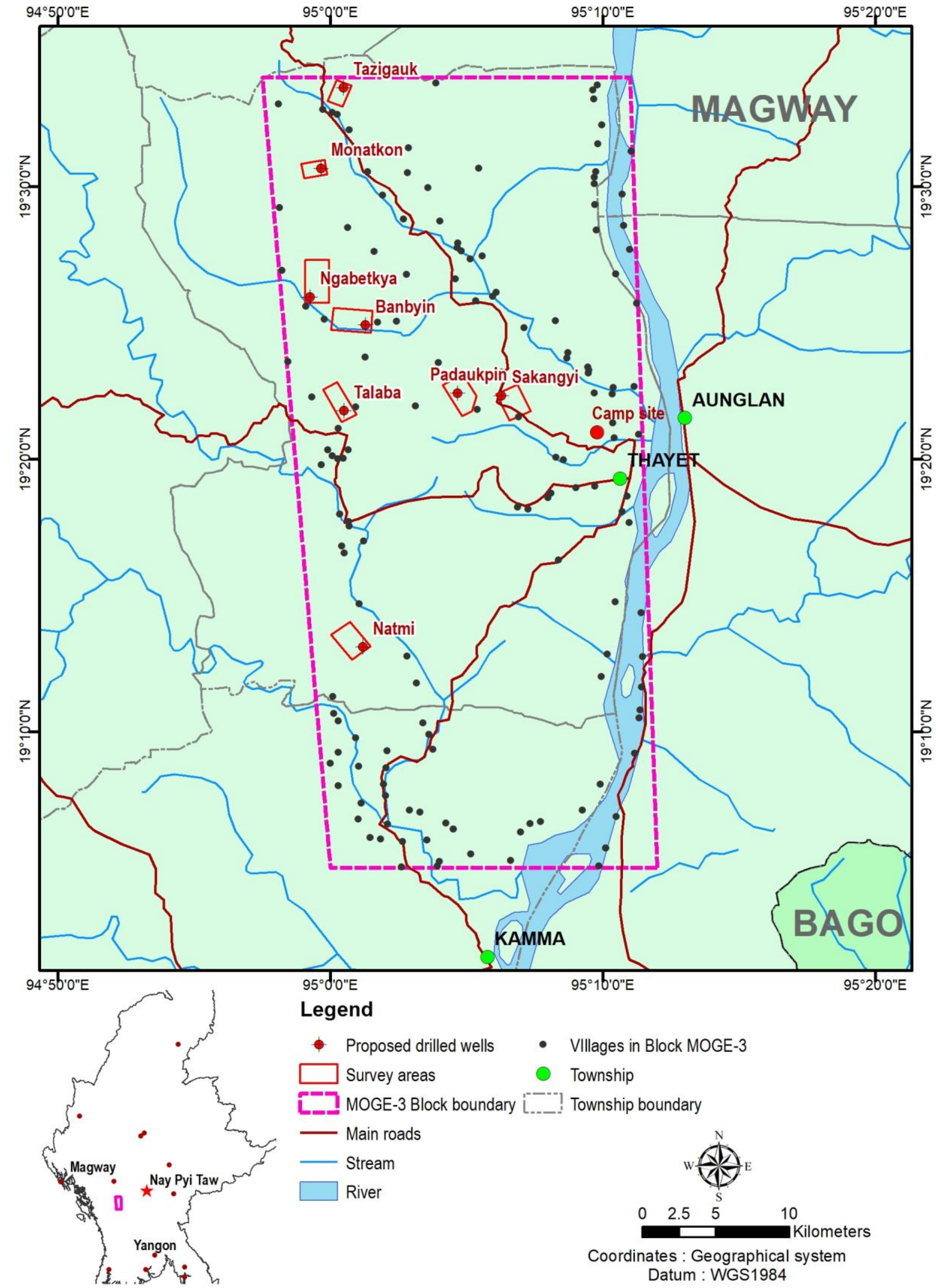


Figure 1-2: EIA Survey Locations

1.4.5 Project Schedule

PTTEP SA is planning to spud the first well in December 2018. Each well will have similar drilling schedule which can be divided into 3 phases.

- Construction Phase: ± 150 days (60 days for road and 90 days for well site)
- Drilling and Testing Operations Phase: ± 60 days (30 days for drilling and 22 days max. for testing)
- Well Suspension/Abandonment Phase and Site Restoration: ± 30 day

The overall project schedule is included in **Table 1-4**.

1.4.6 Exploration Drilling Phases

Major activities of project consist of Construction Phase, Drilling Phase, Well Testing Phase and Well Completion, Suspension, Abandonment or Contingency Well.

- **Construction Phase**
  - PTTEP SA will acquire the area for wellsite construction
  - Wellsite will be constructed with area of 220 x 260 m
  - Access road will be upgraded from existing condition or required new construction approx. with 8m width.
- **Drilling Phase**
  - Wells will be drilled using a land rig
  - The rig will be mobilized to the wellsite by heavy truck.
  - Several land transportation trucks will provide support throughout drilling phase, including transportation of materials, equipment, chemicals and wastes
- **Well Testing Phase**
  - After drilling, the well will be tested to indicate the presence of hydrocarbon
  - Well testing operation is required to support for future production phase in this area
  - Well testing can require burning and flaring of high pressure gas
- **Well Completion, Plug & Abandonment**
  - Once finished well testing, well will be permanently isolated and abandoned
  - Cement plugs and mechanical plugs are placed in the borehole to seal the well.
  - The equipment and facilities will be removed and retrieved.
  - The drilling rig will be demobilized from wellsite.
- **Restoration Phase**

  After completion of all activities, the work site will be made ready to handback to MOGE, local authorities or communities in the agreed condition

Table 1-4: Project Timeline of MOGE-3 Exploration Drilling Campaign

Well	Duration																														
	2018							2019												2020											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Well#1 PDP																															
Well#2 MNK																															
Well#3 NBK																															
Well#4 SKG																															

Remark: Construction Phase | Drilling Phase | Well Testing Phase | Site Restoration Phase

1.5 Description of the Environment

Environmental, Social and Health data collection will focus on the project area and will relate specifically to the issues identified during the screening of how each project activity may impact the environment. The initial study area is within a 5 km radius of each planned exploration drilling well. The complete description of the environment is presented in **Chapter 5** of the EIA report.

1.5.1 Study Limit & Methodology

International Environmental Management Co. Ltd. (IEM) and Environmental Quality management Co., Ltd (EQM) conducted an onshore environmental baseline sampling program, opinion & attitude surveys and focus group meetings in Block MOGE-3 covering Thayet Township, Thayet District, Magway Region Myanmar. The survey results and analysis will be incorporated into an EIA of MOGE-3 Petroleum Exploration Drilling project operated by PTTEP SA.

IEM completed the following:

1. Interviews with Thayet General Administrative Department (GAD), Forestry Department and City Development Committee (CDC) officials on environmental, social and historic & archaeological information.
2. 412 opinion & attitude surveys in the block from 34 villages
3. 16 samples for surface water in the block
4. 16 samples for groundwater in the block
5. 16 samples for soil in the block
6. 4 ambient air & 4 noise measuring stations in the block
7. Archaeological survey
8. Land use, biodiversity and ecological survey
9. Traditional ecological knowledge surveys

1.5.2 PHYSICAL COMPONENT

1.5.2.1 Topography

The exploration drilling project is located on the western portion of the Central Lowlands physiographic zone. The topography is a mixture of valleys and hilly/mountainous terrain.

1.5.2.2 Climate & Air Quality

Block MOGE-3 is at the southern edge of central dry zone which has higher rain than Magway Station. The 30 year period (1981-2010), the average annual rainfall was 1,227 mm. The minimum temperature was ranged between 16.2 - 24.8 °C and the maximum temperature was ranged between 31 - 38.7 °C throughout the year.

Air quality shown exceeding of small particular dust ($PM_{2.5}$ and PM_{10}) due to dry area and agricultural activities

1.5.2.3 Noise

Noise level were normal both day and night time ($L_{eq\ 24hr}$ and L_{dn}) except the night time equivalent noise level at Tazigauk Village (46 dB) which was higher than both the Myanmar EG and WHO Guideline standards

1.5.2.4 Soil & Sediment

Most soil samples were good condition and free of hydrocarbon except one location at feeding ground land was high hydrocarbon

Some soil samples found high Chromium (Cr) and Nickel (Ni) which potentially from fertilizer, pesticide or wastewater irrigation

1.5.2.5 Surface Water

Most of the surface water were good condition. Total Suspended Solid (TSS) was found in some river, canal.

High Iron (Fe) levels also can be found in all locations which were attributed to naturally high iron content resulting from geological weathering

1.5.2.6 Groundwater

Most of groundwater samples were good condition but high Conductivity (EC) and Total Dissolved Solid (TDS) which was not recommended for drinking.

High Iron (Fe) levels were found in some locations which were attributed to natural geological weathering in the area.

1.5.3 BIOLOGICAL COMPONENTS

1.5.3.1 Ecoregion & Protect Species

The exploration drilling project is located on the western portion of the Central Lowlands physiographic zone. The topography is a mixture of valleys and hilly/mountainous terrain within *Irrawaddy Moist Deciduous Forest*, has been defined (WWF 2015). Regional mapping of native vegetation cover and land use in Block MOGE-3 shows the land is classified as scrubland. However, the predominance of land has been converted to agricultural purposes for most of the block. The endangered species that were identified in the biodiversity site assessment and interviews included the dhole (*Muntiacus feae* - EN), fishing cat (*Prionailurus viverrinus* – EN), Flat-headed Cat (*Prionailurus planiceps - EN*) and the Green Peafowl (*Pavo muticus* – EN).

1.5.3.2 Protected Areas

There are no officially established protected areas in Block MOGE-3. A global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. There are only reserved forest areas near the 8 proposed well locations: Thel Phyu Reserved Forest and Ka Toe Taung Reserved Forest. All wellsite areas are outside the reserved forest as confirmed by Thayet Forestry Department. Existing Social Setting.

1.5.4 SOCIO-ECONOMIC COMPONENTS

1.5.4.1 Administration & Governance

The project is located in the Thayet Township, Thayet District of the Magway Region. The General Administration Department (GAD) under the Ministry of Home Affairs acts as the backbone of the local administration.

1.5.5 Demographics

According to the 2014 Myanmar Population and Housing Census the population of Thayet District included 738,047 people. The total area of this block is 1134.4 sq. km (438 sq. miles). Magway Region is the largest of Myanmar's seven regions, with an area of 17,306 square miles (44,820 km^2). Magway Region is made up of 5 districts, one of which is Thayet district which has an area of 4,750 square kilometres. On the west is the Arakan Yoma range, and on the east the Pegu Yomas range. The chief river is the Ayeyarwady River, which traverses Thayet from north to south. The drainage finds its way to the Ayeyarwady River by three main streams. The chief products in Thayet district are rice, cotton, oil-seeds and tobacco; cutch is also very abundant, as is the manufacture of dye-stuff.

The distances to sensitive receptors are included in **Table 1-5**.

Table 1-5: Distances to Sensitive Receptors for Each Potential Well Site.

Well 01: Monatkon		Distance (km)	Direction
Village	Bow (S)	2.4	E
	Bow (N)	2.6	NE
	Inn Lel	3.0	E
	Moe Nat Kone	3.3	NE
River/ stream	Tazi canal	2.0	E
	Ayayarwady R.	18.3	E
Forest	Thae Phyu RF	25.0	S

Well 02: Nga Bet Kya		Distance (km)	Direction
Village	Nga Bet Kya	0.7	SW
	Ohn Mun Taw	1.7	SE
	San Lel	2.6	W
River/ stream	Pun canal	0.6	SW
	Ayayarwady R.	20.0	E
Forest	Thae Phyu RF	17.0	S

Well 03: padaukpin		Distance (km)	Direction
Village	Pi Tauk Pin	1.8	SE
	Nga Hlaing Chon	2.3	NW
	Kyauk Oe	3.0	SW
River/ stream	Pun canal	5.4	NE
	Ayayarwady R.	13	E
Forest	Thae Phyu RF	9.0	SW

Well 04: Sa Kan Gyi		Distance (km)	Direction
Village	Taung Baw	1.6	N
	Sa Kan Gyi	1.65	SE
	Pi Tauk Pin	2.08	SW
River/ stream	Pun canal	3.7	NE
	Ayayarwady R.	9.8	E
Forest	Thae Phyu RF	9.8	SW

Well 05: Ban Byin		Distance (km)	Direction
Village	Ban Byin	0.8	E
	Ywar Thit	2.0	E
	Pay Ka Tin	2.1	SW
River/ stream	Pun canal	0.1	N
	Ayayarwady R.	18.2	E
Forest	Thae Phyu RF	13.8	SE

Well 06: Tazigauk		Distance (km)	Direction
Village	Tazigauk (E)	1.8	SW
	Tazigauk (W)	1.9	SW
	Ta Loke Pin	2.0	SW
	Moe Nat Kone	2.9	S
River/ stream	Tazi canal	2.9	S
	Ayayarwady R.	17.0	E
Forest	Thae Phyu RF	30.0	S

Well 07: Natmi		Distance (km)	Direction
Village	Pauk U Kar	3.1	NE
	Ton	3.2	SE
	Ma Gyi Pin	3.5	SW
	Pon Nar	3.6	NW
River/ stream	Pani canal	2.2	E
	Mindon Canal	3.9	SW
	Ayayarwady R.	17.0	E
Forest	Thae Phyu RF	2.6	NE

Well 08: Talaba		Distance (km)	Direction
Village	Shan Kyaw	0.8	E
	Yae Myet	1.3	SW
	Taung Myint	2.2	NW
River/ stream	Pani canal	3.5	SW
	Ayayarwady R.	20.0	E
Forest	Thae Phyu RF	9.0	S

1.5.6 Ethnicity

The Region is made up mostly of Buddhist Bamars. There are some very small minorities of other ethnic groups, including Chins, Rakhine, Kayin and Shan. All respondents are Buddhist.

1.5.7 Agriculture and Industry

Land use in Block MOGE-3 study area is dominated by agricultural activities particularly dry land cultivation.

The state-owned enterprise consists of 5-acre blocks inside Thayet Township. These state-owned enterprise have been granted for 6 hand dug oil & gas companies. These hand-dug operations are drilling less than 1000 ft.

Waste Management

The Thayet township waste management system is open dumpsite with open burning. The waste disposal site is nearly 4.5 acre that is located about 3 mile from the township. Total waste generation is 4 ton per day and most of the wastes are domestic wastes.

1.5.7.1 Local Socio-Economic Context

Socio-economic **Opinion & Attitude Survey** of 411 households in relevant villages
Concern and recommendations are:

1.1 The Village Leader is responsible for most (89 %) of community decision making
1.2 Most households surveyed (98%) own their land where they live; 54% of villagers have documents, 43% have permission but do not have documents, and 4% have neither document nor permission.
1.3 35% had an annual income of 1,000,001-2,000,000 kyat and 31% with an annual income of 2,000,001-3,000,000 kyat.
1.4 Over 62% of those surveyed had an educational level between Grade 4-9.
1.5 The main source of drinking water comes from protected dug well/ pond/ spring/ rain water (43%), tube well (36%), unprotected dug well and river/stream (16%).

1.5.8 CULTURAL COMPONENTS

IEM collected available archaeological finds in the area. The project area consist of agricultural, feeding grounds, open forestland, fallow and uncultivated land areas.

No historical & archaeological sites are located in the project area as confirmed by Thayet GAD.

1.5.9 VISUAL COMPONENTS

Magway Mya Thalun Pagoda and Minbu Shwesettaw are famous destinations of Magway Region. Thayet Township has a golf course that was established by the British in 1887 and an old war fort.

There are no tourist attractions of note in project areas within Block MOGE-3.

1.6 Impact and Risk Assessment and Mitigation Measures

An initial screening assessment of project activities consisted of developing a summary matrix of project activities against environmental, social and health parameters to determine if potential impacts were considered significant or not. If any issues were considered significant, then these were assessed in more detail. Qualitative and quantitative analyses were conducted to assess potential impacts on

environmental, social or health receptors that may be caused by the proposed project activities. The impact analysis criteria are summarized in **Chapter 6**.

The impact assessment also included an assessment of unplanned events. The assessment examines the potential of the project to result in major hazardous events (such as a fire or oil spill from a blow-out) or environmental hazards to impact the project and the environment (such as earthquakes). The risk assessment includes a qualitative and a quantitative evaluation of risks to help further define the probability and potential consequences of these major hazardous events, and to evaluate the significance and the areas that might be impacted by these events. Specific systems for the further management of the significant risks are then proposed. Residual risk was determined after management measures were defined.

The residual risk rankings of the impact assessment of the Exploration Drilling unplanned events on environmental, social, health and unplanned aspects are summarized below in **Table 1-6** to **Table 1-10**.

Table 1-6: Construction and Installation Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1. Topography	1.1 Well Site and Camp Construction	1.1.1 Disturbance to local topography	Low
2. Air Quality	2.1 Well Site and Camp Construction	2.1.1 Deterioration of air quality due to dust.	Low
	2.2 Equipment use during Site and Road Construction	2.2.1 Deterioration of air quality due to vehicle emissions.	Low
	2.3 Equipment use during Site and Road Construction	2.3.1 GHG Release contributing to climate change	Low
3. Noise	3.1 Use of machines/engines during construction and transportation	3.1.1 Increase in noise levels from machines/engines	Low
4. Surface Water Hydrology	4.1 Construction of roads and well / camp sites	4.1.1 Alteration of surface water hydrology	Low
5. Surface Water Quality	5.1 Construction of roads and well / camp sites and site runoff and drainage	5.1.1 Degradation of surface water quality from runoff/drainage	Low
6. Groundwater Quality	6.1 Hazardous/Non Hazardous waste management and chemical handling	6.1.1 Contamination of groundwater from waste, chemicals and wastewater	Low
7. Soil quality	7.1 Construction of roads and well / camp sites	7.1.1 Degradation of soil quality through compaction or erosion during construction.	Low
Ecological Environmental Impact Assessment			
8. Flora and Fauna	8.1 Site Clearing for Construction of roads and well / camp sites	8.1.1 Degradation or destruction of natural habitat	Low
	8.2 Construction of roads and well / camp sites	8.2.1 Habitat degradation from construction	Low
	8.3 Site Runoff and Drainage	8.3.1 Habitat degradation of aquatic biota	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Social Impact Assessment			
9. Land Use	9.1 Purchase of land access road/well pad and camp site	9.1.1 Change of traditional use.	Positive
10. Transport	10.1 Rig Move and Equipment and Vehicle Use.	10.1.1 Disruption of traffic	Low
		10.1.2 Damage to roads	
11. Water Use	11.1 Use of water public utility for construction and domestic use	11.1.1 Compete for water use of communities	Low
12. Drainage and Flooding	12.1 Surface runoff from roads, site and camp site	12.1.1 Increase runoff and change local drainage patterns	Negligible
13. Waste Management	13.1 Non Hazardous waste management	13.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	Low
14. Socio-Economy	14.1 Services Supply for Construction Activities	14.1.1 Employment/income and procurement opportunities for people, business and services in surrounding area	Positive
	14.2 In-migration of labour and social interaction	14.2.1 Potential conflict between workers from other regions and local communities	Low
Cultural Impact Assessment			
15. Historical, Archaeological and Cultural Resources	15.1 Construction of access road/well pad and camp site	15.1.1 Archaeological/ fossil finds within project area.	Negligible
Visual Impact Assessment			
16. Tourism and Recreational experience	16.1 Well Site, Road and Camp Construction	16.1.1 Disturbance and reduction of tourism and recreational experience	Negligible
Health Impact Assessment			
17. Public and Occupational Health	17.1 Well Site, Road and Camp Construction	17.1.1 Respiratory irritation and Exacerbation of asthma impact from dust	Medium
	17.2 Vehicle and Equipment Use during construction	17.2.1 Hearing impairment for workers and annoyance for public.	Negligible
	17.3 Construction Activities & Transportation	17.3.1 Traffic Accidents	Medium
	17.4 Non-Hazardous Waste Management	17.4.1 Food safety, Increase in vector-borne diseases: malaria, typhus and dengue and others.	Negligible

Table 1-7: Drilling Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1. Air Quality	1.1. Vehicle and Equipment Use	1.1.1. Deterioration of air quality due to dust.	Low
	1.2. Vehicle and Equipment Use	1.2.1. Deterioration of air quality due to vehicle emissions.	Low
	1.3. Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	Low
	1.4. Vehicle and Equipment Use	1.4.1. Climate Change due to GHG	Low
2. Noise	2.1. Well Drilling and Vehicle and Equipment Use	2.1.1. Increase in noise levels during exploration drilling.	Low
3. Heat and Light	3.1. Functional lighting on vehicles and drill rig, camp site and well site during Drilling Wells.	3.1.1. Lighting on the site at night	Negligible
4. Surface Water Quality	4.1. Site Runoff and Drainage	4.1.1. Contamination of surface water from runoff and drainage	Low
	4.2. Hazardous/non-hazardous waste management	4.2.1. Degradation of surface water quality from disposal of domestic sewage and grey water	Low
5. Soil Quality	5.1. Drill site Site Runoff and Drainage	5.1.1. Contamination of soil from runoff	Low
6. Groundwater Quality	6.1. Loss of circulation during Drilling wells	6.1.1. Groundwater degradation from drilling	Low
	6.2. Infiltration from the waste pit and sub-irrigation field	6.2.1. Deterioration of shallow Groundwater	Low
Ecological Environmental Impact Assessment			
7. Terrestrial Flora and Fauna	7.1. Drilling Activities and Labour and Accommodations	7.1.1. Aquatic biota and habitat disturbed from workers' activities	Low
Social Impact Assessment			
8. Transport	8.1. Heavy Equipment on Road	8.1.1. Damage to roads	Low
9. Water Use	9.1. Use of public utility for water resources	9.1.1. Water usage of project affects the community's water supply.	Low
10. Power Use	10.1. Power for drilling operations and work camp	10.1.1. Increase or decrease of available power for local community	Negligible
11. Waste Management	11.1. Non Hazardous waste management	11.1.1. Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and groundwater and vector for disease	Low
	11.2. Hazardous waste management	11.2.1. Hazard waste contaminate to environment.	Low
	11.3. Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1. Localized change in water quality and soil quality from chemical composition of drill fluids	Medium
12. Socio-Economy	12.1. Employment opportunities and	12.1.1. Employment and income	Positive

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
	Use of local goods and services		
Health Impact Assessment			
13. Occupational and Public Health	13.1. Rig, Generators and Equipment	13.1.1. Health impact from noise	Negligible
	13.2. Well Drilling Support Activities & Transportation	13.2.1. Traffic Accidents	Medium
	13.3. Non Hazardous waste management	13.3.1. Health impact from Non-Hazardous Waste	Low
	13.4. Handling and Disposal of Hazardous Waste	13.4.1. Health impact from hazardous Waste	Low
	13.5. Hazardous waste management and chemical handling	13.5.1. Health impact from Mud, Chemicals and Drilling Waste	Low
	13.6. Labour and Accomodations	13.6.1. Health impact from Communicable Diseases	Low

Table 1-8: Well Testing Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1 Air Quality	1.1 Vehicle and Equipment Use	1.1.1 Deterioration of air quality due to dust.	Low
		1.1.2 Deterioration of air quality due to combustion of diesel fuel and flaring.	Low
	1.2 Well testing releasing hydrogen sulphide	1.2.1 Deterioration of air quality due to hydrogen sulphide	Low
	1.3 Flare Emissions	1.3.1 Climate Change due GHG	Low
2 Noise	2.1 Flaring during Well Testing	2.1.1 Increase in noise levels during well testing.	Low
3 Light and Heat	3.1 Flaring during Well testing	3.1.1 Increase in light at night from flaring	Low
4 Surface Water Quality	4.1 Non Hazardous waste management	4.1.1 Contamination of surface water from drained domestic waste and grey water	Low
5 Soil Quality	5.1 Non Hazardous waste management	5.1.1 Contamination of soil from drained domestic waste and grey water	Low
Ecological Environmental Impact Assessment			
6 Terrestrial Flora and Fauna	6.1 Labour and Accommodations	6.1.1 Habitat degradation from workers' activities	Low
	6.2 Flaring during Well Testing	6.2.1 Habitat degradation from light and heat	Low
Social Impact Assessment			
7 Transport	7.1 Vehicle and Equipment Use	7.1.1 Disruption of traffic	Low
		7.1.2 Damage to roads.	
8 Waste Management	8.1 Hazardous/Non Hazardous waste	8.1.1 Domestic waste can be a fire hazard, constitute.	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
	management	windblown litter, attract vermin, contaminate surface and groundwater and be a vector for disease	
		8.1.2 Hazard waste i.e. condensate	Low
9 Socio-Economy	9.1 Labour and Accomidations	9.1.1 Employment and Income	Positive
Health Impact Assessment			
10 Occupational and Public Health	10.1 Flaring	10.1.1 Heat exposure and Nuisance light from Light and heat	Low
	10.2 Flaring	10.2.1 Increase in respiratory illnesses/diseases, asthma, Disturbance psychological wellbeing from flaring emissions	Low
	10.3 Well Testing Support Activities & Transportation	10.3.1 Traffic Accidents	Medium
	10.4 Non-hazardous waste management	10.4.1 Waste can be a contaminate surface and groundwater, and be a vector for disease.	Low
	10.5 Hazardous waste management	10.5.1 Health impacts from Hazardous Waste	Low

Table 1-9: Well Abandonment Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environment Impact Assessment			
1. Topography	1.1 Site and Road abandonment and restoration	1.1.1 Disturbance to local topography	Low
2. Air Quality	2.1 Vehicle and Equipment Use	2.1.1 Deterioration of air quality due to dust.	Low
		2.1.2 Deterioration of air quality due to combustion of diesel fuel.	
		2.1.3 Climate Change due to GHG	
3. Noise	3.1 Vehicle and Equipment Use	3.1.1 Increase in noise levels from machines/engines during site demolition & restoration and transportation.	Low
4. Surface Water Hydrology	4.1 Hazardous/non-hazardous waste management	4.1.1 Potential contamination from spills or wastewater drainage to nearby water bodies during site restoration	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
5. Surface Water Quality	5.1 Restore Site	5.1.1 Alteration of surface water hydrology	Low
6. Soil Quality	6.1 Soil excavation for site restoration	6.1.1 Degradation of soil quality through compaction or erosion during site demolition & restoration.	Low
7. Groundwater Quality	7.1 Hazardous/Non Hazardous waste management and chemical handling	7.1.1 Contamination of groundwater from waste, chemicals and wastewater	Low
Ecological Environment Impact Assessment			
8. Terrestrial Flora and Fauna	8.1 Labour and Accomodations	8.1.1 Degradation or destruction of natural habitat and harvesting wild plants / animals	Low
	8.2 Site-Run off and drainage	8.2.1 Potential degradation or destruction of aquatic biota	Low
Social Impact Assessment			
9. Land Use	9.1 Return of Well site Land	9.1.1 Change of traditional use.	Positive
10. Transportation	10.1 Vehicle and Equipment Use	10.1.1 Disruption of traffic.	Low
	10.2 Site restoration	10.2.1 Damage to roads.	
11. Waste Management	11.1 Hazardous/non-hazardous waste management	11.1.1 Non-hazardous waste can be a contaminate surface and groundwater, and be a vector for disease.	Low
Health Impact Assessment			
12. Public and Occupational Health	12.1 Well Abandonment Support Activities & Transportation	12.1.1 Traffic Accidents	Medium
	12.2 Non-hazardous waste management	12.2.1 Exposure to contamination from non-hazardous wastes,	Negligible

Table 1-10: Unplanned Events Residual Risk Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
1. Blowout	1.1 Drilling	1.1.1 Release of uncontrolled volumes of hydrocarbons, Fire and Explosion	Medium
2. Fire or Explosion (not associated with Blowout)	2.1 Fuel Storage and Ignition Sources	2.1.1 Possible explosion or fire of drilling rig or at campsite, or fuel storage area	Medium
3. Fuel, Chemical or Hazardous Waste/Materials Spill	3.1 Storage of Fuel, chemicals, hazardous materials or waste	3.1.1 Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people	Medium
4. Transportation Accidents	4.1 Vehicle and Equipment Use	4.1.1 Possible injury or death to personnel; and localized contamination of environment	Medium
5. Earthquakes	5.1 Physical shifting of earths surface	5.1.1 Potential physical disruption cause building collapse, blowouts, fires or spills	Low

1.7 Cumulative Impacts

The objective of the cumulative impact assessment is to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s).

The screening/scoping of planned and unplanned project related activities assisted to identify potential environmental, social, health aspects where cumulative impacts could possibly occur. These areas include: Public and Occupational Health; Socioeconomic; Waste Management, Transportation; Flora and Fauna (including aquatic); Ground Water Quality; Surface Water Hydrology, Surface Water Quality, Soil, Noise and Air Quality. The key activities potentially causing these cumulative effects include: hazardous and non-hazardous waste; site runoff and drainage; handling of materials and chemicals; access roads and site construction; vehicles and equipment use, labour and accommodation and unplanned events (blowout, fire and explosion, chemical/hazardous materials spill).

Our cumulative impact assessment has determined that no cumulative impacts will occur. In addition it is determined that existing defined mitigation and monitoring measures for the planned four (4) well exploration drilling project will further prevent cumulative impacts from occurring as detailed in **Chapter 7**.

1.8 Environmental Management Plan (EMP)

1.8.1 Introduction

In the impact assessment, a number of potentially significant impacts were identified. For each of these project activities, management measures were defined to prevent and/or reduce the likelihood or magnitude of impacts and/or to limit the extent of an impact if one does occur. The proposed management measures take into account applicable guidelines, industry practices, expert judgement, design techniques, and operational control. The detailed Environmental Management Plan is detailed in **Chapter 8**.

In addition, environmental monitoring measures were designed to monitor the environment and project activities. The purpose of these monitoring measures is: to evaluate the effectiveness of the management measures that will be put in place; to assess compliance with Myanmar legislation, guidelines and standards; and to compare environmental conditions after implementation of the project to environmental baseline conditions to document possible change and/or impact.

1.8.2 ESH Mitigation & Monitoring Measures

A summary of the mitigation measures and specific action commitments for Construction and Installation Phase, Drilling Phase, Well Testing Phase, Abandonment Phase, and Unplanned Events is presented in **Table 1-11** and **Table 1-12**. Monitoring measures are included in **Table 1-13.**

Table 1-11: Key Mitigation Measures and Commitment List

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
Physical Environmental Impact Assessment								
1. Topography	1.1 Well & Camp Construction	1.1.1 Disturbance to local topography	1.1.1.1 Limit construction activities to well sites and access roads only.	Low	Limit construction activities to well sites and access roads area only.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
2. Air Quality	2.1 Well Site and Camp Construction	2.3.2 Deterioration of air quality due to dust.	2.3.2.1 Minimize land clearance to a minimum especially during the dry season.	Low	Minimize land clearance during dry season.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			2.3.2.2 Limit vehicle speed on access road and site site to minimize dust formation.		Limit vehicle speed on access road and site to minimize dust formation.			
			2.3.2.3 Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.		Cover all trucks transporting materials with tarpaulins or plastic.			
			2.3.2.4 Spray water on roads when needed to keep dust down. At least 1 time/day especially during dry season		Spray water on roads when needed to reduce dust.			
			2.3.2.5 Clean tires of the vehicles before leaving site if needed.		Cleaning of vehicles' tires before leaving site if needed.			
			2.3.2.6 Provide personal protective equipment to exposed field workers.		Provide all required personal protective equipment.			
			2.3.2.7 Use vehicles with dust flaps to prevent dust during driving.		Provide dust flaps to vehicles.			
	3.1 Well testing releasing hydrogen sulphide	2.3.3 Deterioration of air quality due to hydrogen sulphide	2.3.3.1 Install Gas Detectors to response during emergency situation.	Low	H2S detection and safety equipment is standard issue. PTTEP SA's emergency response plan (ERP) includes an H2S Contingency Plan	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			1.1.1.1 If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).					
			1.1.1.2 All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.					
			1.1.1.3 Limit well testing period where possible.					
3. Noise	3.1 Use of machines/ engines and equipment	3.1.1 Increase in noise levels from machines/engines	3.1.1.1 Minimize vehicles and rig transportation from sensitive environmental areas. (eg. Forest, Archeology area, Heritage area etc…)	Low	Minimize vehicles and rig transportation from sensitive environmental areas.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			3.1.1.2 Minimize construction activities and vehicle/rig movements in nighttime.		Minimize construction activities and vehicle/rig movements in nighttime.			
			3.1.1.3 Limit vegetation removal to a minimum at well site, camp site and access road.		Limit vegetation removal to a minimum.			
			3.1.1.4 Turn equipment/machinery off when not in use.		Turn equipment/machinery off when not in use.			
			3.1.1.5 Use enclosures when possible to contain noise on site.		Enclosures installed when possible to contain noise on site.			
			3.1.1.6 Implement transportation plan to avoid traffic issue that make noise pollution.		Journey Management Plan to be implement before operation start.			
			3.1.1.7 Materials should be lowered when practical and not dropped while transferring		Supervise materials lowered and not dropped while transferring.			
4. Surface Water Hydrology & Quality	4.1 Construction of roads and well / camp sites and site runoff	4.1.1 Alteration of surface water hydrology and degradation to water quality	4.1.1.1 Avoid construction of well sites in areas that may cause obstacles to water drainage.	Low	Engineer to design well sites to ensure no obstacles to water drainage.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
			4.1.1.2	Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant authorities.		Engineer to design and construct water drainage lines (culverts/causeway) to maintain natural drainage.			
5. Soil quality	5.1 Construction of roads and well / camp sites	5.1.1 Degradation of soil quality through compaction or erosion during construction.	5.1.1.1	Limit soil compaction only to well sites and access roads.	Low	Ensure soil compaction only conduct to well sites and access roads.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			5.1.1.2	Exposed site areas should be kept to a minimum during construction		Ensure exposed site areas should be kept to a minimum during construction			
			5.1.1.3	Provide effective construction site run-off control and design for good drainage.		Ensure to provide good drainage system around site.			
Ecological Environmental Impact Assessment									
6. Flora and Fauna	6.1 Site Clearing for Construction of roads and well / camp sites	6.1.1 Degradation or destruction of natural habitat	6.1.1.1	High valued habitat to be avoided where practicable in the design process.	Low	High valued habitat to be avoided.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			6.1.1.2	Remove vegetation in project areas only (roads, camp site, well site).		Remove vegetation in project areas only			
			6.1.1.3	Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.		Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.			
Social Impact Assessment									
7. Land Use	7.1 Purchase of land access road/well pad and camp site	7.1.1 Change of traditional use.	7.1.1.1	Transparent and fair compensation to land owners and users according to land acquisition committee decision	Positive	Ensure transparent and fair compensation to land owners and users.	PTTEP SA	Throughout Construction Phase duration	Land Compensation records

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			7.1.1.2 Ensure all permissions are obtained from landowners and local authorities.		All permissions must be obtained from landowners and local authorities.			
			7.1.1.3 Notify surrounding landowners before on location and time of project activities.		Notify surrounding landowners before on location and time of project activities.			
			7.1.1.4 Hand back the land to concerned parties with agreed condition after project completion.		Make sure to hand back the land with agreed condition after project completion.			
8. Transport	8.1 Rig Move and Equipment and Vehicle Use.	8.1.1 Disruption of traffic	8.1.1.1 Ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect performance.	Low	Maintain all vehicles and comply with project safety standards., drug and alcohol policy	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			8.1.1.2 Strictly Follow Speed Limits		Follow speed limits			
			8.1.1.3 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.		Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.			
			8.1.1.4 Provide traffic signs or flags at junction of access roads and main roads.		Provide traffic signs or flags at junction of access roads and main roads.			
			8.1.1.5 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.		Investigate any complaints and handle appropriately to PTTEP SA & MOGE requirements.			
			8.1.1.6 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.		Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
			8.1.1.7	Road Hazard Assessment will be conducted before transporting any large equipment.		Conduct the Road Hazard Assessment before transporting any large equipment.			
9. Waste Management	9.1 Non Hazardous waste management	9.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	9.1.1.1	A PTTEP SA Waste Management Plan for this drilling campaign will be developed.	Low	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
			9.1.1.2	Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring to waste disposer					
			9.1.1.3	Ensure treatment and disposal according to accepted international standard.					
			9.1.1.4	Enforce "Good Housekeeping" practices at project area.					
			9.1.1.5	Domestic and general waste to be segregated and stored using suitability labeled.					
			9.1.1.6	Dispose of waste in labelled containers for possible recycling					
			9.1.1.7	Implement requirements for waste management and related laws					
			9.1.1.8	Install septic tanks and soak away pit for holding sewage.					
			9.1.1.9	Non-hazardous wastes will be disposed with local city development committee.					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	9.2 Handling and Disposal of drill cuttings, drilled cutting and chemicals.	9.2.1 Localized change in water quality and soil quality from chemical composition of drill fluids	9.2.1.1 Drill cuttings and adhered fluids will not be discharged to surrounding area.	Medium	Implement the PTTEP SA Waste Management Plan on site. Ensure treatment and disposal of hazardous waste by licensed contractor and taken to Yangon for disposal at approved waste management facility.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			9.2.1.2 Volume of cuttings and fluids discharged will be minimised through use of solids control equipment.					Waste Management Plan
			9.2.1.3 Store all chemicals in secured and bunded storage area with oil spill kit.					Waste Manifest
			9.2.1.4 Hazardous wastes materials will be handled and stored in accordance with the corresponding SDS.					
			9.2.1.5 Implement awareness training on the hazards of the chemicals and chemical handling to all related workers					
			9.2.1.6 Enforce use of PPE.					
			9.2.1.7 Handle chemicals only in well-ventilated and controlled areas					
			9.2.1.8 Fuel storage tanks to be surrounded by bund wall.					
			9.2.1.9 Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the concrete pit.					
			9.2.1.10 Use oil catch pans under					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet). 9.2.1.11 Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. 9.2.1.12 Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility. 9.2.1.13 Monitor level of cuttings and dirty water in waste pit.					
	9.3 General Hazardous Waste	9.3.1 Localized change in water quality and soil quality from chemical composition of drill fluids	9.3.1.1 Ensure treatment and disposal of hazardous waste by licensed contractor. 9.3.1.2 PTTEP SA to send all general hazardous waste to approved waste management facility	Medium	Implement the PTTEP SA Waste Management Plan on site. Ensure treatment and disposal of hazardous waste by licensed contractor and taken to Yangon for disposal at approved waste management facility.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
10. Socio-Economy	10.3 Services Supply for Construction Activities	10.3.1 Employment/income and procurement opportunities	10.3.1.1 Employ qualified local workers from project location.	Positive	Meet with local authorities to discuss and design local employment hiring and Employ qualified local workers.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			10.3.1.2 Purchase local supplies and services, whenever possible to support nearby villages/towns.					
			10.3.1.3 Terms of contract for					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			recruitment of manpower in these project needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.					
			10.3.1.4 Restrict workers to within project boundaries and do not allow local interaction within the communities.	Low	Restrict workers to within project boundaries and do not allow local interaction within the communities.			
	10.4 In-migration of labour and social interaction	10.4.1 Potential conflict between workers from other regions and local communities	10.4.1.1 Employ qualified local workers for non technical work.	Low	Meet with local authorities to discuss and design local employment hiring and Employ qualified local workers.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System

Table 1-12: Unplanned Events Mitigation Measures and Commitment List

Unplanned Events								
11. Blowout	1.2 Drilling	1.2.1 Release of uncontrolled volumes of hydrocarbons, Fire and Explosion	1.2.1.1 Examination of existing wells to identify shallow gas hazards.	Medium	Ensure PTTEP SA's SSHE Integrated Management System Procedures and Emergency Response Plan operational controls are enforced to prevent a blowout/explosion	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			1.2.1.2 Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures.					
			1.2.1.3 Follow PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan					
			1.2.1.4 PTTEP SA's SSHE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.					
12. Fire or Explosion (not associated with Blowout)	2.2 Fuel Storage and Ignition Sources	2.2.1 Possible explosion or fire of drilling rig or at campsite, or fuel storage area	2.2.1.1 PTTEP SA's SSHE Integrated Management System Procedures and operational controls to prevent a fire/explosion.	Medium	Ensure PTTEP SA's SSHE Integrated Management System Procedures and Emergency Response Plan operational controls are enforced to prevent a fire/explosion.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			2.2.1.2 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).					
			2.2.1.3 Pre-arranged call out support from local fire brigades					
13. Fuel, Chemical or Hazardous Waste/Material	3.2 Storage of Fuel, chemicals,	3.2.1 Potential risk of spills to the environment	3.2.1.1 Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use	Medium	Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management

s Spill	hazardous materials or waste	affecting air quality, soil quality, surface water, groundwater, biota and people	governed by safe operating procedures.		use governed by safe operating procedures with Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP.			System
			3.2.1.2 Spill containment and recovery equipment will be available near storage areas.					
			3.2.1.3 Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP and Spill Contingency Plan.					
14. Transportation Accidents	4.2 Vehicle and Equipment Use	4.2.1 Possible injury or death to personnel; and localized contamination of environment	4.2.1.1 Follow SSHE Integrated Management System Procedures.	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			4.2.1.2 Referral system with external medical facilities for serious injuries or emergencies					
15. Earthquakes	5.2 Physical shifting of earths surface	5.2.1 Potential physical disruption cause building collapse, blowouts, fires or spills	5.2.1.1 Implement PTTEP SA's Emergency Response Plan.	Low	Implement PTTEP SA's Emergency Response Plan.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System

Table 1-13: Environmental, Social, and Health Monitoring Measures

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • Once during construction, drilling and testing phases • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn}	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • Once during construction, drilling and testing phases • If within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig
Soil	Physical parameters: • pH • Soil texture • Salinity • Conductivity	Method • Follow U.S. EPA Analytical Method per parameter • Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the	• Once after well abandoned and site restored within 3 months. In an event of spillage and leakage	Project site At the spillage or leakage areas

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
	• Temperature • Cl^- Chemical Parameters: • Petroleum Hydrocarbons • Total PAH, Total DDT, Total PCBS. • Heavy Metals: As, Cd and Cd-compound, • Cr^{6+}, Pb, Hg, Ni, Cu, Zn, Vanadium, Total Nitrogen and Total Phosphorus,	Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health • Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008 • Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada		
Surface water	Physical parameters: • pH • Conductivity • Temperature • SS • TDS • Salinity Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn Biological parameters: • TCB	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • World Health Organization's (WHO) Guidelines for drinking-water quality (GDWQ)	• Once after well abandoned and site restored within 3 months. • In an event of spillage and leakage	• At the same surface water sampling station before having project (Baseline) • Water sources which are potentially affected (in case of spillage of leakage)
Groundwater	Physical parameters: • pH • Conductivity • Temperature • TDS	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • World Health Organization's (WHO)	• Once after well abandoned and site restored within 3 months. • In event of spillage and leakage	• Nearest groundwater well or just off well pad area • Area of possible spill

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
	• Salinity Chemical Parameters: • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	Guidelines for drinking-water quality (GDWQ)		
Cuttings from drilling (in case of further using cuttings)	• Chloride (for WBM) • Oil on Cuttings (for SBM) • Mercury (in stock Barite) • Cadmium (in stock Barite)	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012,	• Upon Completion of Drilling Phase before mixing / burial disposal in waste pit.	• Exploration drilling well from cuttings pit.
Chemical use for drilling	• Type of chemical • Volume of use	• Daily record type of chemicals and volume used.	• Daily and report after drilling is completed	• Project area
Hazardous and Non-hazardous waste	• Manifest Disposal and Tracking Report	• Track waste volume by type and disposal location daily	• During Drilling Phase	• At all project locations
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• Throughout all phases	• Project area, community around project area, and transportation route
Public and Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• Throughout all phases	• Project area, community around project area, and transportation route

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

1.9 Public Consultation and Disclosure

1.9.1 Scoping Stage Public Consultation

PTTEP SA conducted a Courtesy Visit with Magway Regional Chief Minister on 12th January 2018 and Thayet District and Township Administrators on 15th January 2018 to ensure higher level aware of the proposed project and to get approval of project activities, EIA study and Public Consultation plan. The details of the public consultation program are included in **Chapter 9**.

The First Public Consultation was conducted with local authorities and communities within the project area. Totally 814 people from 34 villages attended and involved in this Public Consultation. The public consultation included:

- Stakeholders Meeting/Focus Group Discussions with communities, non-governmental organizations (NGOs), international NGOs, and community interest groups in urban and rural areas;
- Attitude and Opinion Survey of households

Of those interviewed, 88% agree with the proposed project development. 7% were not sure at this stage.

The environmental baseline and socio economic survey program was conduct in early February 2018 as per the schedule in **Table 1-14.**

Table 1-14: 1st Public Consultation Schedule and Stakeholders

Date	Time	Meeting Venue	Stakeholders Covered/Villages
5th February	09:30 – 11:30	Thayet Township Town Hall	1. Township & District Level Authorities 2. Forestry & ECD 3. NGOs 4. CSOs 5. Media
5th February	14:00 – 16:00	Padauk Pin village	1. Kyauk-O 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay
6th February	14:00 – 16:00	Baw village	1. Tazigauk (East) 2. Tazigauk (West) 3. Talokpin 4. Monatkon 5. Tat 6. Baw (North) 7. Baw (South) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon
7th February	14:00 – 16:00	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Ok Mun Daw 4. Banbyin

			5. Ywathit **6.** Pegadin **7.** Shanywakyaw **8.** Yemyet **9.** Pat Ma Kan **10.** Zidaw **11.** Ahlatlel 12. Ohnedegyi
8th Fbruary	14:00 – 16:00	Paput Village	**1.** Ton **2.** Paput **3.** Paukuga

1.9.2 Scoping Stage Focus Group Meetings

The focus group meetings included the following agenda:

1. Opening of Public Consultation meeting
2. Introduction to PTTEP SA personnel
3. Introductory speech by MOGE representative U Myo Min Soe
4. Showing PTTEP Myanmar Asset Video
5. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA
6. Presentation about Drilling operation by U Wunna Win, Drilling Engineer
7. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins (IEM)
8. Question and Answer

The stakeholders at the township meeting and at the villages raised two main concerns as detailed i**n Table 1-15.**

Table 1-15: Key Points from 1st Public Consultation Meetings

Question / Comment	Response	Mitigation Measures
The existing hand-dug operators requested if they could received permission from PTTEP SA to continue their hand-dug operations within the block.	PTTEP SA and MOGE informed the stakeholders that most of the hand dug wells are producing from about 300 – 1200 ft and the prospect of PTTEP SA is at about 9000 – 15000 ft. Due to the different prospects, PTTEP SA will not disturb hand dug wells operations. PTTEP SA is also an operator company and operating under permission of Myanmar Investment Committee and Myanma Oil and Gas Enterprise. So, PTTEP SA has no authority for endorsement of hand dug wells within the block.	• PTTEP SA will not disturb hand dug wells operations. • PTTEP SA to design well site areas to avoid hand dug well sites areas.
Compensation was a concern regarding landowner having no evidence form such as Land Registration Form.	Regarding compensation, villagers were informed that according to the decision and recommendation of village administer and village elders, the land compensation committee will be mechanism to address any compensation issues.	• Transparent and fair compensation to land owners and users • Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE. • Notify surrounding landowners 2 weeks before on location and time of project activities.

1.9.3 EIA Stage Public Consultation

The second public consultation meetings were completed in April 2018. The second public consultation meetings purpose is to present the draft preliminary EIA report to the stakeholders.

The second public consultation meetings completed in the same Township and Villages locations as the first Public Consultation. Totally 852 people from 34 villages attended the Public Consultation meetings. (**Table 1-16**) MOGE, PTTEP SA and IEM/EQM engaged with relevant Township Administrative Officers to discuss the public consultation plan and support needs. Once the public consultation schedule was agreed and assigned by Township Administrative Officers, IEM/EQM completed the Public Consultation Meetings to present the **draft preliminary EIA Report**, gather the suggestions/concerns from stakeholders for developing the appropriate Environmental Management Plan.

Table 1-16: 2nd Public Consultation Schedule and Stakeholders

Date	Time	Meeting Venue	Stakeholders Covered/Villages	Attendance
24th April	09:00 – 11:00	Thayet Township Town Hall	1. Township & District Level Authorities 2. Forestry & ECD 3. NGOs 4. CSOs 5. Media	119
24th April	14:00 – 16:00	Baw village	1. Tazigauk (East) 2. Tazigauk (West) 3. Talokpin 4. Monatkon 5. Tat 6. Baw (North) 7. Baw (South) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon	229
25th April	09:00 – 11:00	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Ok Mun Daw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi	232
26th April	09:00 – 11:00	Padauk Pin village	1. Kyauk-O 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay	212
26th April	14:00 – 16:00	Paput Village	• Ton • Paput • Paukuga	60

1.9.4 EIA Stage Focus Group Meetings

The stakeholders at the 2nd public consultation at the township meeting and at the villages raised similar concerns as the 1st public consultation. They key issues, concerns and recommendations are as follows:

Table 1-17: Key Points from 2nd Public Consultation Meetings

Question / Comment	Response	Mitigation Measures
Monitoring - Who will monitor and check the PTTEP SA environmental performance activities as the third parties?	For monitoring, the villagers were informed that PTTEP SA have to report these activities to the ECD every six month. Magway Regional ECD and other government organization will come and check our operation if necessary as the third party.	• Regular Monitoring Reports will be submitted to ECD as per the requirements of the Environmental Conservation Law and EIA procedure.
Employment – Job opportunities for local people.	Technical skilled workers especially for drilling will be foreigners or from other places will be employed in the project implementation. PTTEP SA will note the suggestions and plan to employ local workers as a first priority.	• Consult with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons. • Employ qualified local workers for some position. • Encourage contractor to recruit local unskilled and semi skilled workforce.
Land Compensation – How will PTTEP SA pay compensation for lands? Please pay reasonable prices.	Land acquisition committee (local authority, MOGE and PTTEP personnel including land record department) will handle land compensation issue.	• Transparent and fair compensation to land owners and users • Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE.
Road construction – What is the road construction plans?	PTTEP SA indicated that the width of the road is about 8 meters (including shoulders and channel for rain water flow). PTTEP SA can only build roads with the permission of the Village Road and Bridge Association and Land Compensation Committee.	• PTTEP SA will obtain the permission of the Village Road and Bridge Association and Land Compensation Committe. • The Township Administration Office will conducted a field survey for requested lands and roads.
Hand-dug operations - How PTTEP SA will manage if PTTEP SA drilling area is overlap with hand dug wells operations?	PTTEP SA noted that their drilling will not affect local self-employed drilling because the depth that we will drill is over 10,000 ft. PTTEP SA will not disturb hand dug wells operations.	• PTTEP SA will not disturb hand dug wells operations. • PTTEP SA to design well site areas to avoid hand dug well sites areas.
CSR - What is the CSR Plan?	PTTEP will implement a CSR program for the next drilling activities.	• PTTEP SA to implement their planned CSR program
Road Safety – The increase in traffic will cause a road hazard to local areas.	PTTEP SA has a SSHE Policy and Procedure. The villagers can inform PTTEP SA representative on site if drivers don't follow requirements.	• Provide traffic signs or flags at junction of access roads and main roads. • Strictly enforce training programs to reduce transport incident cases by its contractors. • PTTEP SA will conduct Road Hazard Assessment before transporting any large equipment.

1.10 Conclusion

All environmental issues are ranked as negligible or low and can be managed to minimize potential impacts. A number of Social issues are ranked as medium, including Traffic, Waste Disposal, and Labour in-migration. These activities will need to be monitored closely as communities are quite near to a number of the potential drill sites.

Health issues including Non-hazardous waste, mud chemicals and drilling waste, communicable diseases and flare emissions are ranked as medium. These will need to be monitored closely at those sites where communities are nearby. Health service infrastructure is not well developed in the communities and PTTEP SA will maintain its own clinic onsite during the entire exploration program. A specific waste management plan will be prepared to ensure that all wastes are managed to international standards. Hydrogen Sulphide is a potentially serious issue that requires monitoring equipment to be installed and tested, as well as having personnel trained on use of emergency response equipment.

Unplanned Events have all been ranked as having a medium residual risk, with the exception of earthquakes which are rare. Key to ensuring that unplanned events do not happen is linked to ongoing training programs and a site specific emergency response plan. Drug testing is recommended, as this is a known issue in the region.

To mitigate the potential for a blowout, a BOP needs to be installed and tested. Drilling procedures need to be carefully implemented. The risk of fire and related explosions requires that regular monitoring and inspection measures are in place, as well as fire extinguishers strategically placed to minimize any damage should a fire occur.

This region has had earthquakes in the past and design considerations need to be taken to minimize the impact of an earthquake should it occur. Site specific emergency response procedures for all unplanned events need to be in place and training conducted for all staff as appropriate prior to the start of the exploration drilling program.

Recommendations:

The following recommendations are provided:

- Implement recommended stakeholder engagement program for all activities phases.
- Prepare a site specific waste management plan.
- Apply PTTEP's Emergency Response Plan.
- Conduct recommended training program prior to project initiation.
- Evaluate water resource potential to ensure it does not impact local community.
- Identify, clean up and restore any legacy well sites located within the block and hand back to MOGE.
- Adopt and implement the EMP provided in **Chapter 8**.

2. INTRODUCTION

2.1 Background

In August 2014, PTTEP South Asia Limited (PTTEP SA), a subsidiary company of PTTEP was granted a Production Sharing Contract (PSC) for Myanmar Onshore Block MOGE-3, owned by Myanmar Oil & Gas Enterprise (MOGE) as shown in **Figure 2-1**.

Block MOGE-3 encompasses 1,217 square kilometers (km^2) and is located in the Southern part of Magway region in the dry, central zone of the Myanmar lowlands PTTEP SA has completed 2D and 3D Seismic Acquisition in Block MOGE-3 and vicinity area during 2016-2017. PTTEP SA plans to drill four (4) exploration drilling wells in Block MOGE-3 located in Thayet Township, Magway Region, Myanmar. The EIA will be investigating eight (8) locations with four (4) wells being selected for exploration well drilling in 2018-2019. PTTEP SA is planning to spud the first well in December 2018.

Referring to promulgation of Myanmar EIA procedure issued in December 2015, all sizes of drilling projects are required to conduct an Environmental Impact Assessment (EIA) Study and submit to consent authorities for consideration and approval prior to project commencement. PTTEP SA has selected an environmental consultant, International Environmental Management (IEM) Co. Ltd. and its local partner Environmental Quality Management (EQM) Co. Ltd. to conduct the EIA Study and prepare EIA Report for this project.

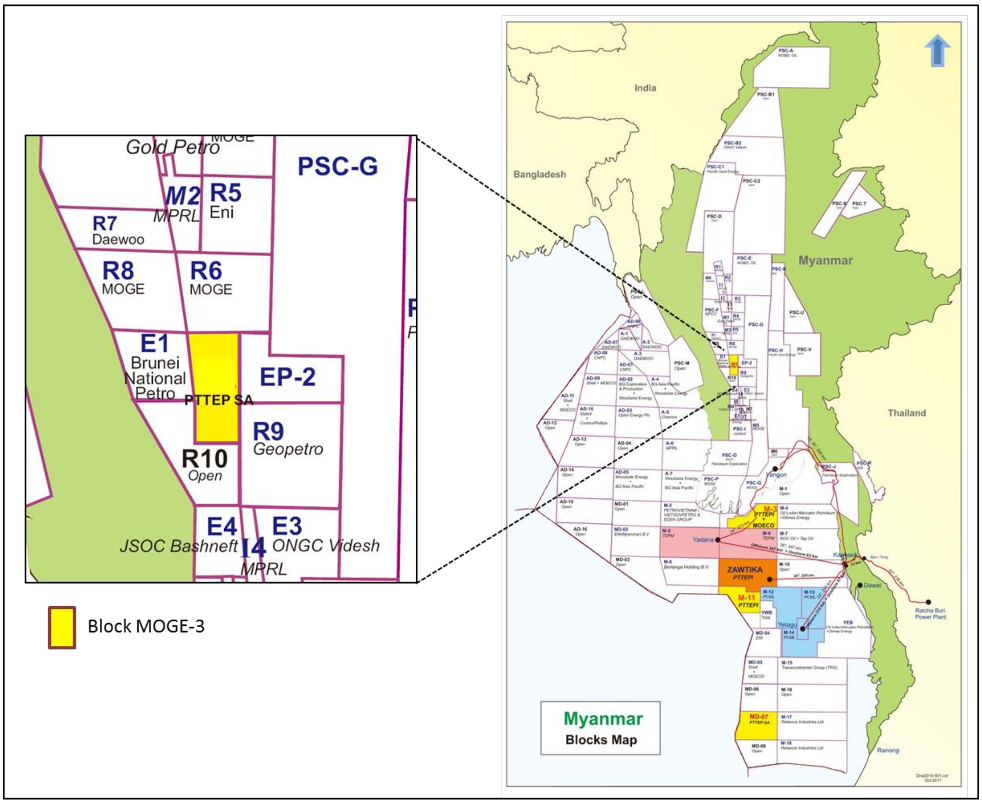


Figure 2-1: Block MOGE-3 Location

2.2 Project Proponent

PTT Exploration and Production Public Company Limited or PTTEP is a national petroleum exploration and production company of Thailand, dedicated to providing a sustainable petroleum supply to the countries in which it operates. Myanmar is the first international venture in Southeast Asia for PTTEP, arriving in Myanmar 28 years ago. The company has used its expertise and experience from the Gulf of Thailand to expedite its exploration and production activities in Myanmar. Currently, PTTEP is either working on or preparing to work in 5 separate oil and gas blocks in the country.

PTTEP South Asia Limited (PTTEP SA), a subsidiary company of PTTEP, as Myanmar's long-term and trusted partner, are part of Myanmar's sustainable economic, social, environmental and human capital development.

Company Name	PTTEP South Asia Limited
Address	3rd Floor, Vantage Tower, 623 Pyay Road, Kamayut Township 11041, Yangon, Myanmar.
Principal Contact Person	U Tin Myo Oo Daw Thiri Aung
Phone Number	95 (1) 652700 ~04
Email Address	TinMyoO@pttep.com ThiriAung@pttep.com

The PTTEP SA key persons for the EIA study are detailed in **Table 2-1**.

Table 2-1: PTTEP SA Key Persons for the EIA Study

Name	Position/Specialization
Sutus Preuksjamas	Safety, Security, Health and Environment Manager
Suphachittra Thongchavee	Government Affairs & External Relations Manager.
Kanchit Jantarangsi	Onshore Exploration Manager
Chatchai Kongdachudomkul	Drilling Operations Manager
U Khin Maung Gyi	Advisor, PSC
Suthat Kanjanakanti	Senior Environmental Engineer
Wunna Win	Drilling Engineer
ThiriAung	Officer, Social Development Projects
Zar Chi Saint	Environmental Engineer
Hsu Myat Maw	Associate Environmental Engineer

2.3 EIA Objectives

The purpose of this EIA report is to identify and, to the extent possible, quantify the potential negative impacts and positive benefits of the project with respect to the environment, human use values, quality of life and health. Once these impacts have been identified, prevention, mitigation, and monitoring measures will be proposed to minimize impacts.

The specific objectives of this report are to:

- Identify all planned activities and potential unplanned events;
- Establish an environmental, social and health baseline of the project area;
- Identify and assess potentially significant impacts based on existing conditions to:
    - Physical Resources;
    - Ecological Resources;
    - Human-Use Values;
    - Quality-of-Life Values;
    - Health.
- Identify and recommend mitigation measures to minimise potential impacts;
- Recommend a monitoring plan that can track changes in the existing environmental, social and health conditions over time and to ensure compliance with Myanmar legislation.

2.4 EIA Scope

The environmental, social and health impact assessment report for the Project includes:

- a review of applicable legislation;
- a detailed project description of the planned exploration drilling program;
- an evaluation and description of the existing environmental, social and health conditions;
- an environmental, social and health impact assessment, including both the positive and negative impacts during the construction, the operation and the abandonment period;
- proposed mitigation measures to prevent and or reduce the potential harmful impacts to the nearby environmental, social, and health conditions; and
- proposed monitoring program to monitor the environmental, social and health quality that may be affected by the Project.

2.5 Study Area

The overall study area of the project will cover a 5-km area of the proposed exploration well site areas in Block MOGE-3. The outline of the study area is shown in **Figure 2-2**.

The block wide study area will be used to identify sensitive receptors in the assessment of impacts on physical resources, biological resources, human use values, and quality of life values. Examples of sensitive receptors are schools, temples, water resources, residential areas, etc.

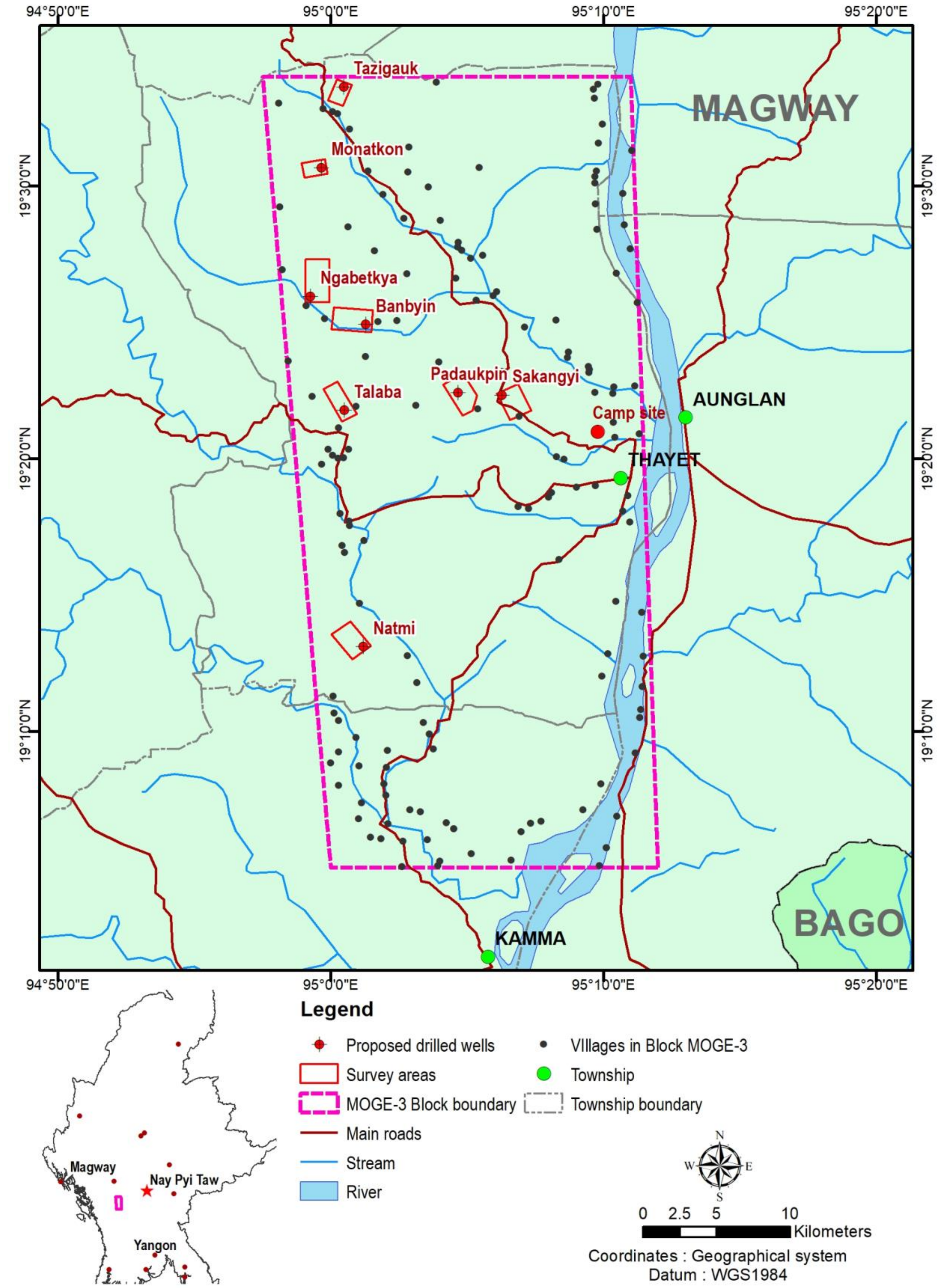


Figure 2-2: Block MOGE-3 Exploration Drilling Study Areas

2.6 Organization of EIA Implementation

The impact assessment was completed by the Myanmar registered consultant companies; International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM). The IEM & EQM consultant registrations are included in **Appendix 1**.

International Environmental Management Co. Ltd. (IEM) was established in 1992 and has evolved into a leading environmental consulting company solving a wide range of challenges for its private sector clients as well as government and non-government organizations throughout Asia and the Middle East. The IEM team focuses on providing comprehensive services with proven international experience, expertise and extensive project management capabilities in the following disciplines:

- Environmental and Natural Resource Management
- Environmental Site and Impact Assessment
- Environment, Social, Health & Safety Consulting
- Policy, Legislation and Regulatory Requirements
- Consulting Services in Corporate Social Responsibility

IEM is firmly committed to providing the highest quality consulting services tailored to our clients' needs through effective management, appropriate technologies and scientifically proven solutions to promote cost-efficiency and sustainable development goals. Based in Bangkok, Thailand, IEM also has country offices in Cambodia, Hong Kong, Myanmar and Vietnam.

International Environmental Management Co. Ltd
No.479, Bo Mhu Ba Htoo Road, 48 Ward, North Dagon Township, Yangon, Myanmar

Environmental Quality Management Co. Ltd (EQM) is a professional service company specializing Environmental, Social and Health Impact Assessments (ESHIA). Our workforce consists of experienced, professional and dedicated experts with over 14years progressive responsibility in environment programs and public health care in governmental and non- governmental organizations.

Furthermore, EQM has been carrying out the (ESHIA) projects as the pioneer group since 2009 in Myanmar. EQM is focused on commitment and was established through a partnership approach with our national and international clients.

Environmental Quality Management Co. Ltd
No. (233), Block 23, Sayeepin Lane
Thuwunna, Thingungyun Township, Yangon, Myanmar

2.7 Declaration of EIA Experts

International Environmental Management (IEM) and local specialists Environmental Quality Management (EQM) Myanmar declare this EIA was prepared in accordance with the Environmental Conservation Law (2012), Rules and Procedures under the guidance of the Ministry of Natural Resource and Environmental Conservation.

IEM and EQM endorse and confirm to Environmental Conservation Department:

- The accuracy and completeness of the EIA.
- The EIA has been prepared in compliance with applicable Environmental Conservation Law, Rules and Procedures;
- That all the information contained in the report is accurate and a truthful representation of all findings as relating to the Project.

2.7.1 EIA team

The impact assessment was conducted by Myanmar registered consultant companies International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM) The EIA team consisted of the individuals described in **Table 2-2**.

Table 2-2: EIA Assessment Team

No.	Name	Background / Expertise	Experience	Responsibility
IEM				
1	Ron Livingston	1979, Master's Degree in Natural Resources Management, University of Manitoba, Winnipeg, Manitoba, Canada. 1976, B.Sc., University of Manitoba, Winnipeg, Manitoba, Canada.	Mr. Livingston has more than 35 years of experience in natural resources and environmental management. Mr. Livingston is an environmental and social expert (registered in Thailand, Cambodia and Myanmar) with extensive experience with seismic, exploration drilling and production EIA project in the Hydrocarbon sector.	Senior Environmental & Social Expert
2	Dylan Jenkins	2008, B.Sc. (Biosystems Engineering), University of Manitoba, Canada	Mr. Dylan Jenkins is a Biosystems Engineer with IEM and responsible for managing environmental impact assessment projects. Mr. Jenkins graduated from the University of Manitoba with a Bachelor of Science in Biosystems Engineering. Mr Jenkins has 10 years of experience working in the geo-environmental engineering	Environmental Analyst / Biodiversity
3	KomgritPrawatlertudom	2009, B. Sc. (Marine Sciences), Chulalongkorn University, Thailand	Mr. Komgrit Prawatlertudom has 8 years experience as an Environmental Analyst with IEM and responsible for writing environmental impact assessment reports and field sampling. He has working experience in field sampling survey, on shore and offshore.	Environmental Sampling / Aquatic Biology
4	UbonwanSintopan	2007, MS. (Natural Resources Management), Asian Institute of Technology, Thailand 2004, B.S. (GEOGRAPHY), Chiang Mai University, Thailand	Ms. Ubonwan Sintopan has 10 years experience as a GIS Technician and Environmental Analyst. At IEM, she is responsible for preparation and support of the environmental impact assessment reports. She has more than 5 years experience in geographic information systems and has worked with GIS data applications, GPS, and Remote Sensing	Environmental Analyst / GIS
EQM				
1	Dr.Ohnmar May Tin Hlaing	2004 -2006, M.Sc in Environmental Engineering and Management, Asian Institute of Technology, Thailand 1986-1996, Bachelor of Medicine and Bachelor of Surgery, Institute of Medicine, Myanmar	Dr. Hlaing has 14 years working experience in the environmental and public health field. Dr. Hlaing's worked the National Government in the public health sector before becoming a consultant. Her direct experience includes chemical and pharmaceutical toxicology as well as poison control. Dr Ohnmar May Tin Hlaing is as an Environmental Health Consultant as well as Managing Director working on the environmental related projects particularly in Environmental, Social and Health Impact Assessments (ESHIA) projects as well as ambient and indoor air quality monitoring projects in Myanmar.	Senior Environmental & Health Expert / Local Coordinator

No.	Name	Background / Expertise	Experience	Responsibility
2	Daw Soe Moe Nwe	2013, B.Sc. (Forestry)	Ms. Soe Moe New has been working as an assistant Environmental Consultant for 5 years involving both environmental related projects and socio eco public consultation meetings and socieco surveys as well. She is taking the leading role in write up of the EMP projects in accordance with the senior environmental consultant advice.	Socio-economic Team Leader
3	U Khun Set Thar	2014, University of Forestry, Forestry	Khun has over 3 years' experience coordinating socio-economic programs and stakeholder engagement in local and international joint EMP, IEE and ESIA projects in Myanmar. His role was leading socio-economic surveys, biodiversity surveys and coordinating the Governmental Departments in Environmental and Social Considerations of the projects.	Socio-economic Team Leader / Biodiversity Survey
4	U ThihaHtut	2012, Dagon University, Microbiology	Mr. Thiha has over 6 years experiences coordinating socio-economic programs and stakeholder engagement in local and international joint EMP, IEE and ESIA projects in Myanmar. His role was leading socio-economic surveys, coordinating the Governmental Departments in Environmental and Social Considerations of the projects.	Socio-economic Team Leader
5	U AungZinnMinn	2016, BSc from University of Forestry 2018, Diploma in RS/GIS from University of Dagon	Mr. Zinn has 2 years working experience in the environmental field such as biodiversity survey, forest inventory, air and noise monitoring, water and soil sampling and also waste management. He has experience in biodiversity survey in onshore block RSF-5 (ENI).	Forestry & Biodiversity Survey
6	Daw No No Lwin	2014, Myanmar Maritime University, B.E (Naval Architecture)	Ms. No NoLwin has got about 4 years of experience as an environmental technician working in environmental related projects. She is a graduate of Myanmar Maritime University with a Bachelor of Engineering in Naval Architecture covering environmental engineering. She is also skilled at environmental and socio-economic surveys and organizing stakeholder/public consultation meetings. Her job description also includes preparation and translation of project related documents.	Social surveyor
7	Daw Thwe Thwe Htun	B.Sc. (Chemistry)	Ms. Thwe has 2 years working experience in the environmental field as a social surveyor. She graduated from the University of Dagon. She is also skilled at environmental and socio-economic surveys and organizing stakeholder/public consultation meetings.	Social surveyor
8	Daw Yoon Mi Mi Thaw	B.Sc. (Chemistry)	Ms. Yoon has 2 years working experience in the environmental field as a social surveyor. She is also skilled at environmental and socio-economic surveys and organizing stakeholder/ public consultation meetings.	Social surveyor

No.	Name	Background / Expertise	Experience	Responsibility
9	Daw MohMohAung	2006, Bachelor of Public Administration	Ms. Moh has 2 years working experience in the environmental field as a social surveyor. She is also skilled at environmental and socio-economic surveys and organizing stakeholder / public consultation meetings.	Social surveyor
10	Daw Pwint Wai Aung	2005, BA (Eco)	Ms. Pwin Wai has 2 years working experience in the environmental field as a social surveyor. She is also skilled at environmental and socio-economic surveys and organizing stakeholder / public consultation meetings.	Social surveyor
11	Daw Yin New Htwe	2006, BA (Eco)	Ms. Yin Nwe has 2 years working experience in the environmental field as a social surveyor. She is also skilled at environmental and socio-economic surveys and organizing stakeholder / public consultation meetings.	Social surveyor
12	U Ye Naung Htun	2013, University of Forestry, Forestry	Mr. Ye Naung Htun graduated from the University of Forestry, Yezin, Nay Pyi Taw, Myanmar on 2013. He has 2 years working experience on Air and Noise quality monitoring, waste management surveying, Biodiversity surveying and also had 2 years working experience on Forest plantation as a Plantation Assistant (Rakhine and Ayeyarwaddy Division) from 2013 to 2015.	Air / Noise
13	U Kyaw Ko Ko	2009, Dagon University, Maths	Mr. Kyaw Ko has 4 years of working experience in the environmental field as a Environmental Technician. He has many experiences in Air and Noise Monitoring. He graduated from the University of Dagon.	Air / Noise
14	Mg Soe Thu Aung	2015, B.Sc (Geology)	Mr. Soe has 1 year experience in the environmental field such as water and soil sampling, air and noise monitoring and social survey. He graduated from the Mgway University.	Water and Soil Sampling
15	U ZayZayKo	Diploma of Electrical Power	Mr. Zay Ko has working experience in the environmental field such as water and soil sampling about 2 years. He has diploma of Electrical Power from Industrial Training Center (ITC).	Water and Soil Sampling

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section lists all legislation relevant to the undertaking of industrial projects in Myanmar. The legislation can be divided into the categories as follows:

- PTTEP SA Corporate SSHE Policy (summarized in **Section 3.1**)
- Policy & Legal Framework (**Section 3.2**)
- Contractual and other Commitments (**Section 3.3**)
- Institutional Framework (**Section 3.4**)
- Project's Environmental, Social and Health Standards (**Section 3.5**)

3.1 PTTEP SA's SSHE Policy

3.1.1 PTTEP Corporate Vision

PTTEP will be a leading company that regards SSHE as a license to operate and strives to achieve Safety, Security, Health and Environment (SSHE) excellence by being a zero incident organization.

3.1.2 PTTEP Corporate Mission

- Prevent all incidents through operational and process safety management.
- Ensure compliance with and constantly manage and improve our well-established SSHE Management System and its readiness to be able to promptly and effectively respond to emergencies, crises, and security-related events;
- Help to deliver energy reliably and securely by using proven and environmentally friendly technology and by operating responsibly to ensure PTTEP's sustainable development.
- Create a generative SSHE culture that is ground in leadership at every level of the organization, from management to contractors, where everybody understand the crucial importance of SSHE risks, and uncompromisingly manages any SSHE risks in their own working environment;
- Achieve top quartile SSHE performance in exploration and production industry.

3.1.3 PTTEP SA Safety Security Health and Environment (SSHE) Policy

PTTEP Myanmar Asset is committed to safe Exploration and Production (E&P) Operations in Myanmar with an ultimate goal of "Target Zero - Nobody Gets Hurts in Our Operations" which covers (1) Zero Injury, (2) Zero Major Accident (e.g. zero major hydrocarbon leak, vehicle accident, ship collision), and (3) Zero Spill or External Complaint (e.g. zero complaint by authorities/ communities/ sea users).

To accomplish this, PTTEP Myanmar Asset implements Safety, Security, Health and Environmental Management System (SSHE-MS) that outlines the main principles and accountabilities to drive for continuous improvement. We are committed to:

- Comply with Myanmar SSHE laws, other applicable requirements and PTTEP Standards.
- Perform hazard identification and SSHE risk assessments so that risks are As Low As Reasonably Practicable
- (ALARP).
- Hold employees accountable for SSHE performance by setting and monitoring SSHE Plans and KPIs.
- Prevent operational and process incidents by implementing asset integrity programs and monitoring of Safety Critical Elements addressed in Safety Cases and complying with Management of Change (MOC) Standard.
- Work with contractors and suppliers to achieve PTTEP's SSHE requirement.
- Ensure all employees and contractors are assessed and maintain the required level of job and SSHE competency.
- Apply "Stop Work Authority Policy" for unsafe work by implementing Behavior-Based Safety (BBS) programs to improve positive SSHE culture.
- Implement security management for potential threats to safeguard personnel, assets, information and reputation.
- Promote occupational health and hygiene in the workplace by conducting health risk assessments, medical
- Surveillances, education and regular industrial hygiene monitoring.
- Prevent environmental impacts by strictly following the mitigation measures stated in Environmental Impact Assessment.
- Promote sustainable development by implementing waste management, greenhouse gas reduction and energy efficiency programs.
- Report, investigate and analyse SSHE incidents to prevent recurrence and close out corrective actions with evidence.
- Ensure that emergency and crisis management plans are proactive and effective.
- Ensure policy and SSHE Management System compliance through regular SSHE audits and Senior Management visits with corrective actions follow up for continuous improvement.

Strong leadership and commitment is a key successful implementation of this policy which is required from PTTEP employees and contractors at all levels.

3.1.4 PTTEP SA's Corporate Social Responsibility Policy

There are currently a number of ongoing CSR activities taking place by PTTEP SA for the MOGE-3 Exploration project, which are conducted in compliance with MOGE's "Guidelines for Implementation of CSR Programmes". Additional details on these CSR activities will be provided in **Chapter 9** of the EIA Report.

3.2 Policy and Legal Framework

3.2.1 Environmental Policy & Framework

Environmental legislation and arrangements for environmental conservation in Myanmar are developing rapidly. As part of Myanmar's reform process that involves the updating and enforcing environmental policy and legislation. The Framework for Economic and Social Reform (FESR 2013) and the National Comprehensive Development Plan (NCDP 2011-2030) continue Myanmar's goal of environmental conservation.

At present, all laws relating to the environment are being formulated and administered by the sectoral ministries and departments concerned. **Section 3.2.2** provides a list of environmental legislation relevant to the Project activities

3.2.2 National Environmental Legislation

3.2.2.1 Overview

The national legislation applicable to the Project comprises the following sources of law, listed hierarchically in accordance with the Constitution and other laws of Myanmar:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- Environmental Impact Assessment Procedure (2015);
- National Environmental Quality (Emission) Guideline (2015).

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

The latest enacted Constitution of the Republic of the Union of Myanmar (May 2008) provides the most up to date information on governing laws and regulations in Myanmar. The Constitution prevails over any other national legislation or international agreements. The key sections are 21 (a, d), 37 (a, b), 45, Section 347, Section 390.

The Myanmar Investment Law (2016);

The Myanmar Investment Law, enacted in 2016, vastly simplified the process for investment applications and offers a number of tax breaks, incentives, guarantees, rights and protections for business ventures. The Myanmar Investment Commission (MIC) is a government-appointed body formed under the Myanmar Investment Law.

The law includes provisions to restrict or prohibit investment activities which affect public health, the environment and ecosystems, which produce toxic waste or which engage with toxic chemicals; duties of investors to conduct business in such a way as to avoid environmental damage, air and water pollution, in accordance with existing laws as per the following sections. The key sections are 50 (d) 51 (a to f), 65 (e, f, g, i, j, k, l m, o, p, q).

Myanmar Environmental Conservation Laws (2012);

The Environmental Conservation Law (Pyidaungsu Hluttaw Law No. 9 / 2012) Key sections of importance are 7 (o), 14, 15, 24 and 29 related to pollution control and penalties (if) the proponent causes any pollution.

Environmental Conservation Rules (2014);

The Environmental Conservation Rules relating to the Environmental Conservation Law, were enacted on 5 June 2014, contain specific items relating to IEE, EIA and pollution prevention which fall under the powers of the Ministry Natural Resources and Environmental Conservation. The key sections of importance is 69.

Environmental Impact Assessment Procedure (2015);

Environmental Impact Assessment Procedures have been prepared by MONREC under the Environmental Conservation Law, 2012. It requires that the Project proponent has to include in its

evaluation environmental, social and health aspects of the environment, and has to identify and assess all adverse impacts and risks for environment, social issues and, if relevant, health that potentially could arise from the Project. Therefore this law will be effectively considered an EIA procedure framework. The key sections are paragraphs 87, 102 – 110, 113, 115, and 117.

National Environmental Quality (Emission) Guideline (2015)

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Section 2c) and NEQG 2015]. These Guidelines are noted to be the same as that recommended by the IFC General EHS Guidelines (2007) (World Bank Group, 2007) and the IFC sector specific guidelines (World Bank Group, 2015). The key relevant sections are 1, 4, 5, 6, 7, 9, 12 and 13.

3.2.2.2 Environmental Impact Assessment Procedure (2015)

The EIA Procedure for Myanmar was promulgated on 29th December 2015. The Ministry of Natural Recourses and Environmental Conservation (MONREC) implements the procedure. The EIA Procedure sets out the requirements for development, assessment and subsequent monitoring of an EIA. The requirements to conduct an EIA are outlined in the Environment Conservation Law (2012) and Environment Conservation Rules (2014).

Under Myanmar's EIA Procedure, there is a requirement for the undertaking of an IEE or an EIA in order to obtain an ECC for certain development projects.

The project proponent has to comply with CHAPTER VIII. Environmental Compliance Certificate, Conditions and Revisions to Conditions as follows:

Paragraph 87. Upon receipt of the written approval from the relevant authority, the Project Proponent has to commence implementation of the Project strictly in accordance with the conditions attached to the ECC and including the EMP, within such time as may be prescribed by the Ministry.

The project proponent has to comply with the Responsibility for all Adverse Impacts as follows:

Paragraph 102. The Project Proponent has to bear full legal and financial responsibility for:

a) all of the Project Proponent's actions and omissions and those of its contractors, subcontractors, officers, employees, agents, representatives, and consultants employed, hired, or authorized by the Project acting for or on behalf of the Project, in carrying out work on the Project; and

b) PAPs until they have achieved socio-economic stability at a level not lower than that in effect prior to the commencement of the Project, and will support programs for livelihood restoration and resettlement in consultation with the PAPs, related government agencies, and organizations and other concerned persons for all Adverse Impacts.

Paragraph 103. The Project Proponent has to fully implement the EMP, all Project commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the Project comply fully with all applicable Laws, the Rules, this Procedure, the EMP, Project commitments and conditions when providing services to the Project.

Paragraph 104. The Project Proponent has to be responsible for, and will fully and effectively implement, all requirements set forth in the ECC, applicable Laws, the Rules, this Procedure and standards.

Paragraph 105. The Project Proponent has to timely notify and identify in writing to the Ministry, providing detailed information as to the proposed Project's potential Adverse Impacts.

Paragraph 106. The Project Proponent has to during all phases of the Project (pre-construction, construction, operation, decommissioning, closure and post-closure), engage in continuous, proactive and comprehensive self-monitoring of the Project and activities related thereto, all Adverse Impacts, and compliance with applicable laws, the Rules, this Procedure, standards, the ECC, and the EMP.

Paragraph 107. The Project Proponent has to notify and identify in writing to the Ministry any breaches of its obligations or other performance failures or violations of the ECC and the EMP as soon as reasonably possible and in any event, in respect of any breach which would have a serious impact or where the urgent attention of the Ministry is or may be required, within not later than twenty-four (24) hours, and in all other cases within seven (7) days of the Project Proponent becoming aware of such incident.

Paragraph 108. The Project Proponent has to submit monitoring reports to the Ministry not less frequently than every six (6) months, as provided in a schedule in the EMP, or periodically as prescribed by the Ministry.

Paragraph 109. The project proponent has to submit the report according to paragraph 109 of Environmental Impact Assessment Procedure (2015).

The project proponent has to comply with Paragraph 113. For purposes of monitoring and inspection, the Project Proponent:

a) has to grant to the Ministry and/or its representatives, at any time during normal working hours, access to the Project's offices and to the Project site and any other location at which the Project activities or activities related to the Project are performed; and

b) from time to time as and when the Ministry may reasonably require, has to grant the Ministry access to the Project's offices and to the Project site and any other location at which the Project activities or activities related to the Project are performed.

Paragraph 115. In the event of an emergency, or where, in the opinion of the Ministry, there is or may exist a violation or risk of violation of the compliance by the Project with all applicable environmental and social requirements, the Project has to grant full and immediate access to the Ministry at any time as may be required by the Ministry.

Paragraph 117. The Project Proponent has to further ensure that the Ministry's rights of access hereunder will extend to access by the Ministry to the Project's contractors and subcontractors.

3.2.2.3 National Environmental Quality (Emission) Guideline, 2015

The project proponent has to comply with Paragraph 5.

The project proponent has to ensure emissions comply with General and industry-specific Guidelines as set out in Annex 1 – Emissions Guidelines for any project subject to EIA Procedure, as adopted by the Ministry, in order to protect the environment and to control pollution in the Republic of the Union of Myanmar.

The project proponent has to comply Paragraph 7

The project proponent recognizes that these Guidelines are intended to prevent pollution through reducing the mass of pollutants emitted to the environment, dilution of air emissions and effluents to achieve maximum permitted values is not acceptable. The specified guideline values have to be achieved, without dilution, at least 95 percent of the time that a project is operating, to be calculated as a proportion of annual operating hours.

The project proponent has to comply Paragraph 12.

As specified in the EIA Procedure, project proponent will engage in continuous, proactive and comprehensive self monitoring of the project and comply with applicable guidelines and standards. For purposes of these Guidelines, the project proponent will be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

The project proponent has to comply Paragraph 13

The project proponent will ensure that Air emissions, noise, odor, and liquid / effluent discharges will be sampled and measured at points of compliance as specified in the project EMP and ECC.

3.2.3 Project-Relevant Laws

The Myanmar Environmental Conservation Law, Environmental Conservation Rules, Environmental Quality (Emission) Standards are the first step to address all the complex environmental and social management issues faced by Myanmar. A number of other laws exists which, either directly or indirectly, relate to environmental and social management of the project. The other relevant Myanmar government agencies/ requirements applicable to the Project are summarized below:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- The Protection of Rights of National Race Law, 2015, Section 5
- The Petroleum and Petroleum Products Law, 2017, Section 10 (a, d), 15, 16, and 31 (a, d)
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- The Control of Smoking and Consumption of Tobacco Product Law, 2006, Section 9
- The Myanmar Fire Force Law, 2015, Section 25
- Shops and Establishments Law, 2016, Section 13 to 17, 21 and 24
- The Protection and Prevention of Antique Objective Law, 2015, Section 12
- The Protection and Prevention of Ancient Monument Law, 2015, Section 12, 15 and 20
- The Protection and Prevention of Cultural Heritage Area, 2015, Section 20, 23 and 29(b)
- The Employment and Skill Development Law, 2013, Section 5, 14 and 30 (a and b)
- Oil Fields (Labour & Welfare) Act, 1951
- The Workmen Compensation Act, 1923, Section 10 (a, b) and 11
- The Labour Organization Law, 2011, Section 17 to 22
- The Settlement of Labour Disputes Law, 2012, Section 38, 39, 40 and 51
- Minimums Wages Law, 2013, Section 12, 13 (b, c, d), 43 (e, f, g)
- Payment of Wages Law, 2016, Section 3, 4, 5, 7, 13, and 14
- Social Security Law, 2012, Section 11(a), 15, 18(b), 48(b), 49 and 75
- Leaves and Holidays Act, 1951
- Industrial use Explosive Substance, 2018, Section 6(c), 7(c), 12,13,15,16 and 18
- Land Acquisition Act 1894

- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993, Section 15 and 16
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)
- The Underground Water Act, 1930, Section 3 and 6(a)
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013, Section 16,17,23 and 27
- Import and Export Law, 2012, Section 7
- Myanmar Engineering Council Law, 2013
- State-Owned Economic Enterprises Law, 1989

3.2.4 International Environmental Conventions, Protocols and Agreements

Myanmar has ratified several international and regional conventions. Those relevant to the project are provided in **Table 3-1**.

Table 3-1: International and Regional Agreements and Conventions

No.	Conventions	Year (Ratified/ Acceded/Accepted)
Environment		
1	Plant Protection Agreement for the Southeast Asia and Pacific Region, Rome 1956	1959 (Ratified)
2	ICAO: ANNEX 16 to the Convention on International Civil Aviation Environmental Protection Vol. I and II, Aircraft Noise and Aircraft Engine Emission	Accession
3	Agreement on the Networks of Aquaculture Centres in Asia and the Pacific, Bangkok 1988	1990 (Accession)
4	Vienna Convention for the Protection of the Ozone Layer, Vienna 1985	Accession 16th Sep 1998 (Vienna) & Accession 24th Nov 1993 (Montreal)
5	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Entered into force 6th April 2015
6	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal 1987	1993 (Ratification)
7	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London 1990	1993 (Ratification)
8	United Nations Framework Convention on Climate Change (UNFCCC), New York 1992	1994 (Ratification)
9	Convention on Biological Diversity, Rio de Janeiro 1992	1994 (Ratification)
10	The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris 1972	1994 (Acceptance)
11	International Tropical Timber Agreement (ITTA), Geneva 1994	1996 (Ratification)
12	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought, Paris 1994	1997 (Accession)
13	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington DC 1973; and as amended in Bonn, Germany 1979	1997 (Accession)
14	ASEAN Agreement on Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	1997 (Signatory)
15	Kyoto Protocol to the Convention on Climate Change, Kyoto 1997	2003 (Accession)
16	ASEAN Agreement on Trans-boundary Haze Pollution	2003 (Ratification)
17	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)
18	Ramsar Convention on Wetlands of International Importance	2005 (Accession)
19	Establishment of ASEAN Regional Centre for Biodiversity	2005 (Signatory)
20	Declaration on ASEAN Heritage Parks	2003 (Signatory)
21	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	2004 (Ratification)
22	Catagena Protocol on Biosafety, Cartagena, 2000	2001 (Signatory)
Social, Labour and Health		
23	Universal Declaration of Human Rights (UNDHR)	signed
23	Convention on the Rights of the Child	1991 (acceded)
24	Convention on Elimination of All Forms of Discrimination against Women (CEDAW)	1997 (acceded)
25	Relevant ILO Conventions in force in Myanmar: • C1 Hours of Work (Industry)	

No.	Conventions	Year (Ratified/ Acceded/Accepted)
	• C14 Weekly Rest (Industry) • C2 Unemployment Convention, 1919 (No. 2) • C6 Night Work of Young Persons (Industry) Convention, 1919 (No. 6) • C11 Right of Association (Agriculture) Convention, 1921 (No. 11) • C14 - Weekly Rest (Industry) Convention, 1921 (No. 14) • C17 Workmen's Compensation (Accidents) • C18 - Workmen's Compensation (Occupational Diseases) Convention, 1925 (No. 18) • C19 Equality of Treatment (Accident Compensation) • C21 - Inspection of Emigrants Convention, 1926 (No. 21) • C26 - Minimum Wage-Fixing Machinery Convention, 1928 (No. 26) • C29 Forced Labour Convention • C42 Workmen's Compensation (Occupational Diseases) Revised 1934 • C52 Holidays with Pay • C63 Convention concerning Statistics of Wages and Hours of Work, 1938 (No. 63)Excluding Parts III and IV • C87 Freedom of Association and Protection of the Right to Organize • C182 - Worst Forms of Child Labour	

3.2.5 International Standards & Guidelines

The Project will also follow International Environmental guidelines and standards including World Bank /IFC (International Finance Corporation) Guidelines & Industry Standards as detailed in **Table 3-2**.

Table 3-2: International Guidelines

Applicable International Standards & Guidelines	
1	Equator Principles (2013)
2	International Financial Cooperation/ World Bank (IFC/WB) General Environmental Health and Safety (EHS) Guidelines (April 30, 2007) including sub-sections: • Environmental • Occupational Health and Safety • Community Health and Safety • Construction and Decommissioning
3	IFC Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development (2017).
4	IFC Performance Standards on Environmental and Social Sustainability (2012);
5	IFC/EBRD Guidance on Workers' Accommodation (2009)

3.3 Contractual and other Commitments

The project proponent and EIA consultant (IEM and EQM) endorses and confirms to Environmental Conservation Department:

- The accuracy and completeness of the EIA.
- The EIA has been prepared in compliance with applicable Environmental Conservation Law, Rules and Procedures;
- That all the information contained in the report is accurate and a truthful representation of all findings as relating to the Project.

The project proponent and its contractor and subcontractor will comply with EIA commitment, Environmental Management Plan that described in the EIA and all applicable Myanmar Laws & regulation requirements and all necessary International laws and Standards.

The project proponent commitments are detailed in **Table 3-3**.

Table 3-3: Project Relevant Commitment List

Laws and Regulations	Description
The Environment Conservation Law, 2012	
The project proponent has to comply **Section 7, Subsection {o)** of the law and will pay compensation if the project proponent causes environmental impacts. **The project proponent has to comply with Section 14.** The project proponent when causing a point source of pollution will treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards. **The project proponent has to comply with Section 15.** If the project proponent causes a point source of pollution they have to install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, it has to be arranged to dispose the wastes in accord with environmentally sound methods. **The project proponent will comply Section 24**. The project proponent has to allow The Ministry to conduct inspection whether or not it is performed in conformity with such terms and conditions or inform the relevant Government departments, Government organizations to carry out inspections. **The project proponent will comply Section 29**. Project proponent has to not violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law.	
Environmental Conservation Rules, 2014	
The project proponent has to comply with Rule 69. If the project proponent does not comply according to section 69, the project proponent will be prosecuted according to Environmental Conservation Law, Section 31.	
Myanmar Investment Law, 2016	
The project proponent has to comply with Chapter (12) Rights to Use Land, Section 50 as follows: (d) The project proponent has to register the land lease contract at the Office of Registry of Deeds in accordance with the Registration Act. **The project proponent has to comply with Chapter (13), Section 51 as follows:** (a) may appoint of any citizen who is a qualified person as senior manager, technical and operational expert, or advisor in his investment within the Union in accordance with the laws; (b) has to appoint them to replace, after providing for capacity building programs in order to be able to appoint citizens to positions of management, technical and operational experts, and advisors; (c) has to appoint only citizens for works which does not require skill; (d) has to appoint skilled citizen and foreign workers, technicians, and staff by signing an employment contract between project proponent and employee in accordance with the labor laws and rules; (e) has to ensure to obtain the entitlements and rights in the labor laws and rules, including minimum wages and salaries, leave, holidays, overtime fees, damages, compensation of the workman, social welfare, and other insurance related to workers in stipulating the rights and duties of employers and employees and occupational terms and conditions in the employment contract; (f) has to settle disputes arising among employers, among workers, between employers and workers, and technicians or staff in the investment in accordance with the applicable laws. **The project proponent has to comply with Chapter (16) Responsibilities of Investors, Section 65 as follows:** (e) has to immediately inform the Commission if it is found that natural mineral resources or antique objects and treasure trove not related to the investment permitted above and under the land on which the investor is entitled to lease or use and not included in the original contracts. If the Commission allows, the project proponent has to continue to carry out the investment in such land, and if not allowed, the project proponent has to transfer and carry out, by obtaining the permission, at the substituted place which is selected and submitted by him; (f) has to close and discontinue the investment only after payment of compensation to employees in accordance with applicable laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce; (g) has to abide by the applicable laws, rules, procedures and best standards practiced internationally for this investment so as not to cause damage, pollution, and loss to the natural and social environment and not to cause damage to cultural heritage; (i) has to close and discontinue the investment only after payment of compensation to employees in accordance with applicable laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce; (j) has to pay wages and salaries to employees in accordance with applicable laws, rules, procedures, directives and so forth during the period of suspension of investment for a credible reason; (k) has to pay compensation and indemnification in accordance with applicable laws to the relevant employee or his successor for injury, disability, disease and death due to the work; (l) has to supervise foreign experts, supervisors and their families, who employ in its investment, to abide by the applicable laws, rules, orders and directives, and the culture and traditions of Myanmar;	

(m) has to respect and comply with the labor laws; (n) has to have the right to sue and to be sued in accordance with the laws; (o) has to pay effective compensation for loss incurred to the victim, if there is damage to the natural environment and socioeconomic losses caused by logging or extraction of natural resources which are not related to the scope of the permissible investment, except from carrying out the activities required to conduct investment in a Permit or an Endorsement. (p) has to allow the Commission to inspect in any places, when the Commission informs the prior notice to inspect the investment; (q) has to take in advance a Permit or an Endorsement of the Commission for the investments which need to obtain prior approval under the Environmental Conservation Law and the procedures of environmental impact assessment, before undertaking the assessment. Such investments has to be submitted the situation of environmental and social impact assessment to the Commission during the permitted investment period. **The project proponent has to comply with Chapter 17 Insurance, Section 73 as follows:** The project proponent has to insure the types of insurance stipulated in the provision of the rules at any insurance enterprise that is entitled to carry out insurance businesses within the Union.	
Petroleum and Petroleum Products Law, 2017	
The Petroleum and Petroleum Products Law (the "PPPL") 2017 was enacted by Pyaydaungsu Htuttaw as Pyaydaungsu Hluttaw Law No. 20/2017 on 1st August 2017 to repeal the Petroleum Act 1934. The PPPL contains the provisions on import and export, transportation, storage, refinery, distribution, inspection and testing of petroleum and petroleum products and issuance of relevant licenses. Licenses for exportation, importation, transportation, transit, storage, refinery, distribution, testing of petroleum and any petroleum products must be obtained from the MOEE, other relevant Ministries and any business related with the petroleum products cannot be operated without a relevant license. The Relevant sections are 10 (a, d), 15 ,16, and 31 (a, d) Section 10. The project proponent has to receive permission and licenses from The Ministry of Natural Resources and Environmental Conservation to carry out the following functions relating to any petroleum and petroleum product; (a) issuing licence for the right to store for the storage tanks and warehouses; (d) if it occurs environmental impacts in carrying out petroleum and petroleum product business activities, taking action, as necessary , in accordance with the existing laws of on-site inspection; Section 15. The project proponent desirous to transport or store non-dangerous petroleum and petroleum products locally, has to obtain licence if it is more than 500 gallons. However, in storing 500 gallons and less, receptacle not exceeding 200 gallons has to be used. Section 16. The project proponent may without obtaining licence, store, import or transport any dangerous petroleum and petroleum product not exceeding six gallons not intended for sale. Section 31: The Project proponent (a) has to not violate any prohibition contained in the rules, regulations, bye-laws, notifications, orders, directives, procedures and conditions or fail the duty to implement; (d) has to not have the right to carry out without undertaking the environmental impacts, in operating petroleum and petroleum product business activities;	
Public Health Law, 1972	
Section 5	The project proponent has to accept any inspection, anytime, anywhere if it is needed.
Section 9	The project proponent will comply with Clause 9, Subsection 1 of Section 3. The project proponent has to provide required infrastructure relating to environmental health, such as garbage disposal, use of water for drinking and other purposes, radioactivity, protection of air from pollution, sanitation works and food and drug safety for all works.
The Prevention and Control of Communicable Disease Law, 1995 and Amendment of Prevention and Control of Communicable Diseases Law, 2011	
Section 3	In order to prevent the outbreak of Communicable Diseases, the project proponent has to work with the Department of Health shall to implement required activities under this section.

Section 4	The project proponent has to comply with the measures undertaken by the Ministry of Health and the Department of Health under section 3 in respect of prevention of the occurrence and spread of communicable disease and control thereof."
Section 9	If the project proponent notices occurrence of any of the following matters, the project proponent has to report immediately to the nearest health department or hospital: (a) enmasse death of animals including chicken and birds (b) (b) rat fall; (c) suspicion or occurrence of epidemic disease; occurrence of notifiable disease."
Section 11	The project proponent in order to prevent and control the spread of a Principal Epidemic Disease has to allow the the Health Officer to undertake the measures detailed in Section 11.
The Control of Smoking and Consumption of Tobacco Product Law, 2006	
The Control of Smoking and Consumption of Tobacco Product Law (No. 05/2006)	
Chapter VI - Functions and Duties of Person-in-charge	
Section 9	The project proponent has to establish a smoking area and establish notice board for non-smoking area, and to accept the inspection of Ministry of Health as follows: (a) keep the caption and mark referring that it is a non-smoking area at the place mentioned in section 6 in accordance with the stipulations. (b) arrange the specific place where smoking is allowed as mentioned in section 7, and keep the caption and mark also referring that it is a specific place where smoking is allowed, in accordance with the stipulations. (c) supervise and carry out measures so that no one can smoke at the non-smoking area. (d) accept the inspection when the supervisory body comes to the place for which they are responsible.
The Myanmar Fire Force Law, 2015	
The Myanmar fire force law, 2015 covers requirements for fire fighting and fire protection.	
The project proponent has to comply with Chapter 11, Section 25 as follows:	
Section 25	The project proponent has to implement the management of fire sub-station and required equipment to ensure (a) No absence for organizing separate fire force (b) No absence to set ready for fire safety equipment
Shops and Establishments Law, 2016	
Section 13, Project proponent has to ensure that on their project site: (a) Nobody under the age of 14 shall be allowed or required to work at a shop or at an establishment. (b) Nobody under the age of 16 shall be allowed to work more than the designated work time at a shop or at an establishment. **Section 14, Project proponent has to ensure that on their project site:** (a) Anyone who is over 14 and under 16 may work with the permission of a doctor stating in a recommendation letter that the person is fit to work. However, this person shall not be allowed to work more than 4 hours per day. (b) Nobody over 14 and under 16 shall be allowed or required to work from 6:00 pm to 6:00 am. (c) Nobody over 14 and under 16 shall be allowed or required to work at another shop or establishment on the same day after working at a shop or establishment. (d) No worker under 18 shall be allowed or required to perform work of a dangerous type or work at a dangerous workplace. (e) Anyone between 16 and 18 shall, with the recommendation of a doctor, be allowed to work at workplaces where it is safe and there is no impact on the mental and physical development, provided that this person has finished proficiency training for the relevant job, is able to understand and follow the directives for health and safety at the workplace, and is fit and healthy.	

Section 15, The project proponent- (a) Has to designate at least one day per week as off-day for the worker at the respective shop or establishment. (b) Has to not deduct the rightful salary of the worker for the off-day under sub-section (a). **Section 16, The project proponent has to pay the salary not later than 7 consecutive days after the salary payment period of the worker at the shop or establishment.** **Section 17, The project proponent** (a) Has to calculate and pay the overtime fees in compliance with the agreed overtime payments based on the worked overtime hours. (b) Has to not request overtime work without paying overtime fees according to sub-section (a). **Section 21, In the cases of this law, the project proponent** (a) Has to arrange the respective documents, lists, contracts, evidence, forms and samples to be inspected by the inspector. (b) Has to, upon request, submit the registration book kept under this law and the rules, evidence of being the owner or documents regarding the business of any shop or establishment to the inspector. **Section 24, The project proponent has to comply with the following at every shop and establishment.** (a) Has to arrange for cleaning, good ventilation, and health. (b) Has to arrange for fresh air and sufficient light. (c) Has to arrange for it not being louder than the specified noise level. (d) Has to arrange for the prevention of overheating [literal translation] and the prevention of fire hazards. (e) Has to arrange for sufficient first aid boxes and medicine for the employees according to the provisions.	
The Protection and Prevention of Antique Objective Law, 2015	
The Protection and Preservation of Antique Objects Law (No. 43/2015) covers requirements for the finding of antique objects.	
Section 12	If the project proponent finds any object which has no owner or custodian, has to promptly inform the relevant Ward or Village-Tract Administrator if they knows or if it seems reasonable to assume that the said object is an antique object.
The Protection and Prevention of Ancient Monument Law, 2015	
The Protection and Preservation of Ancient Monuments Law (No. 51/2015). The project areas are not near any protected or Ancient Monuments including the Zarli Mountain.	
Section 12	If the project proponent who finds who an ancient monument of over one hundred years old and above or under the ground or above or under the water which has no owner or custodian knows or it seems reasonable to assume that the said monument is an ancient monument, they have to promptly inform the relevant Ward or Village-Tract Administrative Office.
Chapter VII. Applying for prior Permission, Scrutiny and Issue	
Section 15	If the project proponent aiming at realizing any of the following within the specified area of an ancient monument has to apply to get prior permission to the Department: (b) constructing or extending or repairing new buildings including hotels, factories and residential buildings or fencing or extending a fence; (c) digging to search petroleum, natural gas, gem or mineral, piping petroleum and natural gas, constructing factories, connecting national grid, constructing communication tower, constructing or extending infrastructures such as road, bridge, airfield, irrigation and embankment; (d) connecting underground electric cable, communication cable and other underground works; (f) gold sieving, digging, burning bricks, digging well, lake, creek, ditch, gully, pit digging, refilling, levelling, mining, quarry, gravel digging and unearth sand, removing the mounds and hills which can damage the physical feature of the land;
Chapter VIII Prohibitions	
Section 20	The project proponent will not carry out any of the following acts which are assumed to cause damage to an ancient monument within the specified area of an ancient monument or of a listed ancient monument without obtaining written prior permission: (b) using machines which causes vibration within the specified place of an ancient monument and running various types of vehicles; (c) cultivating, gardening, breeding, fencing by blocking nearby an ancient monument or doing any other act which can affect an ancient monument; (d) emission of gas such as hot-air balloon which can affect an ancient monument;

	(e) landing and taking off and, flying aeroplane and helicopter which can directly or indirectly affect an ancient monument; (f) discarding chemical substance and rubbish which can affect an ancient monument and the environment.
State-Owned Economic Enterprises Law, 1989 (amended 97)	
This law sets out economic enterprises to be carried out soley by the government, as well as the rights of carrying out other economic enterprises, and the right to form organizations. Chapter III - Right of carrying out other Economic Enterprises Section 1 – The project proponent has the right to carry out any economic enterprise other than those prescribed under Section 3 to be carried out solely by the Government. Chapter V Offences and Penalties 1. If the project proponent is convicted of an offence of carrying out, without the permission of the Government, any economic enterprise prescribed under Section 3 to be carried out solely by the Government they will be punished with imprisonment for a term which may extend to a period of 5 years and may also be liable to a fine. Furthermore, property both moveable and immoveable relating to the economic enterprise may be confiscated. 2. If the project proponent is convicted of an offence of violating an order or any condition notified under section 4 or section 5 they will be punished with imprisonment for a term which may extend to a period of 3 years and may also be liable to a fine.	
The Employment and Skill Development Law, 2013	
Employment and Skill Development Law (No 29/2013). The key sections are 5, 14, and 30 (a and b).	
Section 5	The project proponent has to employ according to Section 5 of the Employment and Skill Development Law (No 29/2013)..
Section 14	The project proponent has to carry out the training program in accord with the work requirement in line with the policy of the skill development team to develop the skill relating to the employment for the workers who are proposed to appoint and working at present.
Section 30	(a) The project proponent has to put in to the fund monthly as put in fees without fail for the total wages of the subordinates and the supervisors' salary for not less than 0.5%; (b) The project proponent has to ensure that put in money paid under subsection (a) has to not be deducted from the wage and salary of the employees.
Oil Fields (Labour & Welfare) Act, 1951	
PTTEP SA has to comply with the worker welfare requirement stipulated in The 1951 Oilfields (Labour & Welfare) Act. This act prescribes a wide range of protection measures for O&G workers, covering health, safety and worker welfare issues. It also covers working hours, holidays and extensive prescriptions on employing children as well as setting up an inspection service, complemented by a range of penalties but it is unclear whether there has been inspection and enforcement of these basic provisions.	
The Workmen Compensation Act, 1923 (amended 2005)	
Workman's Compensation Act (1923) Amended by Law No 4/2005	
Section 10 (a, b) and 11	The project proponent has to compensate for death and injury during the working hours according to Workman's Compensation Act (1923) Amended by Law No 4/2005.
Labour Organization Law, 2012	
The Labour Organization Law, (No. 07/2011) and The Labour Organization Rules, 2012 were enacted to protect the rights of the workers, to have good relations among the workers or between the project proponent and the worker, and to enable to form and carry out the labour organizations systematically and independently.	
Section 17 to 22	The project proponent has to: • Recognize the labour organizations • Allow the member of executive committee assigned by the labour organization to perform their duty not exceeding two days per month • Assist as much as possible if the labour organizations requests help which is in the interest of the factory's workers.
The Settlement of Labour Dispute Law, 2012	
Settlement of Labour Dispute Law (No. 05/2012) Amended by Law No. 40/2014 was enacted for the settlement of labour disputes:	
Section 38	No project proponent will fail to negotiate and coordinate in respect of the complaint within the prescribed period without sufficient cause.
Section 39	No project proponent will alter the conditions of service relating to workers concerned in such dispute at the consecutive period before commencing the dispute within the period under investigation of the dispute before the Arbitration Body or Tribunal, to affect the interest of such workers immediately.

Section 40	No project proponent will proceed to lock-out or strike without accepting negotiation, conciliation and arbitration by Arbitration Body in accord with this law in respect of a dispute.
Section 51	If the project proponent, in the course of settlement of dispute, commits any act or omission, without sufficient cause, which by causing a reduction in production resulting so as to reduce the workers' benefits has to be liable to pay full compensation in the amount determined by the Arbitration Body or Tribunal. Such money has to be recovered as the arrear of land revenue.
Minimums Wages Law, 2013	
The Minimum Wages Law, No. 07/2013 was enacted on 22nd March 2013 (The Minimum Wages Rules, 2013). Section 12 (d) of the law provides that the project proponent has to pay the minimum wage to the workers working in the commercial, production business and service in cash.	
Section 12	The project proponent: (a) has to not pay wage to the worker less than the minimum wage stipulated under this Law; (b) may pay more than the minimum wage stipulated under this Law; (c) has to not have the right to deduct any other wage except the wage for which it has the right to deduct as stipulated in the notification issued under this Law; (d) has to pay the minimum wage to the workers working in the commercial, production and service business in cash. Moreover, if the specific benefits, interests or opportunities are to be paid, it may be paid in cash or partly in cash and partly in property, with prevailing regional price, jointly according to the desire of the worker;
Section 13	The project proponent: (b) Has to prepare and maintain the lists, schedules, documents and wages of the workers correctly; (c) Has to report the lists, schedules and documents prepared and maintained under sub- section(b) to the relevant department in accord with the stipulations; (d) Has to accept the inspection when summoned by the inspection officer. Moreover, he has to produce the said lists and documents upon asking to submit;
The Minimum Wages Rules, 2013 include: Chapter 9 - The power and obligations of the project proponent	
Section 43	The project proponent: (e) before fixing of the minimum wage by the National Committee under this rule, if his remuneration is less than the prescribed amount, he should be paid up to the full amount; (f) part time, hourly job employees has to be paid the prescribed minimum wage for the working hours; (g) for the salary employees one day day-off has to be allowed in a week. If he has to work on the off day, overtime wage has to be paid in accord with the existing law;
Payment of Wages Law, 2016	
Payment of Wages Law (No 17/2016) covers the following requirements:	
Chapter 2	
Section 3 Section 4 Section 5	Section 3 The project proponent has to pay for salary either Myanmar Kyats or Foreign Cash permitted by National Bank of Myanmar. When delivery the salary (b) If the project proponent needs to pay the other opportunities or advantages, they can pay cash together with other materials according employee's attitude. Section 4 When the contract finish, the project proponent has to to pay the salary (not more than one month) to employees. For the permanent worker, has to pay per monthly. If more than 100 employees, has to pay within the 5 days from the end of month. If fire the employees, has to pay salary within two days after fire. When employee dies due to the accident, has to pay money as an insurance to employee's family within two days.
Chapter 3	
Section 7 Section 13 Section 14	Project proponent has to comply with all sections covering all the issue of deducted salary based on different categories. According to Chapter 3, Section 7, the project proponent can deduct: (a) Can deduct from wages for absences except when such absence is during a public holiday or entitled leave, according to the law. (b) Accommodation charges and transportation charges, meal allowances, charges for water and electricity, taxes and errors in payment shall be allowed for deduction. (c) Can deduct from pre-issued, expensed and saved (or) contributed amount according to the law upon the employee contract. (d) The Employer can deduct with the judgment of the Court of Arbitrator Jury Council.

	According to Chapter 3, Section 11, the project proponent can also deduct for: (a) Direct damage which is either intentional or due to negligence or due to the failure of the employee concerned with company property to take proper care. (b) A breach of the employment contract or breech of any rules for which a fine had been previously set. No other deductions are allowed, except those covered above by Sections 7 and 11 of Chapter 3. Furthermore, according to Chapter 3, Section 10, no deductions shall ever be allowed for any workers under the age of 16. Section 14. If an Employee carries out overtime work, the project proponent has to ensure he/she is allowed the presiding overtime rate as set by the Law.
Social Security Law, 2012	
The objectives of the Social Welfare Law (2012) and accompanying Social Welfare Rules (2014) include providing workers with the right to draw back some of the contributions paid by employers and workers as savings in accordance with the stipulations, and to obtain the right to continue medical treatment, family assistance benefit, superannuation benefit, survivors' benefit, unemployment benefit, the right to residency and ownership of housing after retirement in addition to health care and pecuniary benefit for sickness, maternity, death, employment injury of the workers. PTTEP SA will comply with all social security requirements for drilling worker including foreign experts.	
Section 11	The Social Welfare Law (2012) requires the project proponent establishments to comply with the provisions for compulsory registration with the social security system and benefits (indicated in the Social Welfare Law) if they employ a minimum number of workers as determined by the Ministry of Labour in co-ordination with the Social Security Board: Industries which carry out business whether or not they utilize mechanical power or a certain kind of power; businesses of manufacturing, repairing and servicing; or engineering businesses, factories, warehouses and establishments.
Section 15	The project proponent has to ensure it meets the requirements of the social security funds
Section 18	(b) The project proponent has to deduct contributions to be paid by worker from his remuneration and pay to the social security fund together with contribution to be paid by him. The employer shall also bear the expenses for such contribution.
Section 48 (b)	(b) The employers may effect insurance by registering voluntarily for insurance of the workers who are not applied to provisions of compulsory registration for employment injury benefit insurance system, by paying stipulated contribution to employment injury benefit insurance fund.
Section 49	(a) The project proponent and insured persons of establishments where the project proponent had registered compulsorily in accordance with sub-section (a) of section 48 or where the project proponent had registered voluntarily in accord with sub-section (b) of section 48 who have paid contribution to employment injury benefit fund has to not apply to the provisions contained in the Workmen's Compensation Act as regards the employment injury benefit; (b) The insured persons who has effected insurance for employment injury benefit in accord with sub-sections (a) and (b) of section 48 has to be entitled only to the employment injury insurance benefits contained in this Law.
Section 75	The propoject proponent: (a) has to prepare and keep the following records and lists correctly and submit to the relevant township social security office in accord with the stipulations: (i) records and lists of workers' daily attendance; (ii) records on appointment of new workers, employing worker by changing of work, termination, dismissal and resignation; (iii) records on promotion and paying remuneration ; (iv) records and lists of employer, manager, and administrator and records on change of them; (b) has to inform the relevant township social security office if the following matters arise: (i) changes in number of workers and address of establishment; (ii) change of employer, change of business, suspension of work, and close-down of work; (iii) employment injury, decease and contracting diseases; (c) has to submit records of work and lists if requested by inspectorate or official assigned by the Social Security Head Office and various levels of Regional Social Security Office under this Law.
Leaves and Holidays Act, 1951	
The Leave and Public Holiday Act, 1951 Amended by Law No. 06/2006 and No. 30/2014 . The project proponent has to allow the leaves and holidays defined by the national governments.	

•The Protection of Rights of National Race Law, 2015	
This law has provisions for equal treatment and considerations for various ethnicities and races within Myanmar. If the project impacts Indigenous Peoples the proponent must provide complete, accurate and precise information about the Project proposed for their areas as per Section 5 of The Protection of Rights of National Race Law, 2015.	
Industrial Use Explosive Substance, 2018	
Section 6 (c) Project Proponent has to apply to the Ministry to build a munitions dump. Section 7: Project Proponent has to receive permission for importing, transfer and transport, storage, using and possessing of occupational explosive substances. Section 12: The License is valid for 1 year from manufacturing date. Section 13: If the project proponent wants to extend the license for storage of occupational explosive substances, he/ she has to apply to chief inspector 30 days before expired date. Section 15: The Project proponent: (a) Has to store the occupational explosive substances in defined limited amount systematically (b) Has to be monitored by chief inspector or inspector occasionally. (c) Has to inform to both nearest police station and chief inspector in line with the time, if there were missing, burning, blowing out, breaking down, injury or death of people. (d) Has to pay license fees to Ministry. Section 16: The project proponentwho gets permission- (a) Has to store the occupational explosive substances in munitions dump that have license. (b) Has to perform prior the required protection for transfer and transport, usage, possessing of occupational explosive substances. Section 18: The project proponent who gets permission cannot deny for inspection and monitoring by chief inspector or inspector.	
Fresh Water Fisheries Law, 1991	
Section 40	The project proponent will not cause harassment of fish and other aquatic organisms or pollution of the water in a freshwater fisheries water.
The Motor Vehicles Law, 2015 and Rule, 1987 and Rule 1987	
The project proponent has to comply with the noise, traffic and exhaust sections of the Motor Vehicle Law No. 55/15	
Myanmar Insurance Law, 1993	
Requires any business which may pollute the environment to effect compulsory general liability insurance.	
Section 15	The project proponent has to ensure all motor vehicles effect compulsory Third Party Liability Insurance with the Myanmar Insurance.
Section 16	The project proponent operating an enterprise which may cause loss to State-owned property or which may cause damage to the life and property of the public or which may cause pollution to the environment has to effect compulsory General Liability Insurance with the Myanmar Insurance.
Forest Law, 2018	
Section 12: The project proponent has to within a forest land and forest covered land at the disposal Government if: (a) is desirous of carrying out any development work or economic scheme has to obtain the prior approval of Ministry;	
Biodiversity & Protected Area Law. 2018	
Section 39. If the propjet proponent commits any of the following acts, on conviction be punished with imprisonment for a term which may extend to maximum 3 years or with fine which may extend to minimum Kyats 200,000 or maximum Kyats 500,000 or with both- (d) Causing water and air pollution, causing damage to a water-course or putting poison in the water in a natural area, passing through the electric current, and using chemicals and explosive substances. (e) Possessing or disposing of pollutants or mineral pollutants in a natural area. Section 41. If the project proponent commits any of the following acts shall, on conviction be punished with imprisonment for a term which may extend to minimum 3 years to maximum 10 years or with fine- (a) Killing, hunting or wounding, collecting, selling a completely protected wild animal or animals controlled in national trade without permission, possessing or transporting or transferring such wild animal or any	

part thereof or blood of such animals or product deriving from the parts of such animals without permission; (b) Extracting, collecting a completely protected natural plants or plants controlled in national trade or destroying, collecting, possessing, selling, transferring and transporting such plant or any parts thereof or product deriving from the parts of such plant without permission.	
The Underground Water Act, 1930	
The Underground Water Act, 1930 provides measures for systematic and sustainable use of underground water and prohibitions on accessing and using underground water without a license Whereas it is expedient to conserve and protect underground sources of water supply in the Union of Burma; it is hereby enacted as follows:	
Section 3	Project proponent has to not sink a tube for the purpose of obtaining underground water except under and in accordance with the terms of a licence granted by the water officer.
Section 6	(a) The project proponent has to comply with the President of the Union rules in regard to: a) prescribing the conditions subject to which licences may be granted by the water officer under section 3;
The Farmland Law, 2012 (Section 30)	
Section 30	In respect of the application to utilize the farmland for other purposes in the interest of the public: (a) The Central Farmland Management Body shall give permission to utilize the paddy land for other purposes, with the recommendation of the Region or State Farmland Management Body; (b) The respective Region or State Government shall give permission to utilize the farmland for other purposes except paddy land, with the recommendation of the Region or State Farmland Management Body
Land Acquisition Act, 1894	
	Land acquisition for a company may be carried out where it is "likely to prove useful to the public." In these cases the Government has the responsibility for carrying out the acquisition and distributing the compensation; however, the company acquiring the land has to provide the compensation. Compensation is based on the market value of the land and also possible damage incurred by the private landowner, such as loss of crops and firewood or the cost of changing residence and place of business. Land in-kind can also be provided in place of monetary compensation (Section 6). These losses should take place "in consideration of the compulsory nature of the acquisition" (Section 23). The Law sets out basic procedures governing land acquisition, including a preliminary investigation, and a procedure for notification of persons interested in the land. The Law also includes provision for objections to the land acquisition, in which the objector is granted the 'opportunity of being heard', where the objections raised may be further explained. However, the President's decision on the objection is final, in practice giving him/her wide discretionary powers (Section 5).
The Vacant, Fallow and Virgin Lands Management Law, 2012	
Section 16, The project proponent who has the right to cultivate or utilize vacant, fallow and virgin lands shall; (a) carry out only the type of business permitted and affiliated economic enterprises. (b) reclaim and carry out the permitted land until the completion of business according to the stipulation within 4 years starting from the day of permission. For the lapse of the prescribed period due to natural disasters or unstable situation, central committee may revise the stipulated term. c) not mortgage, gift, sell, lease or transfer by other means or divide the permitted Vacant, Fallow and Virgin Lands without the permission of the Union Government. (d) pay up the land revenue for vacant, fallow and virgin lands, which he has the right to cultivate or utilize . (e) comply with the conditions relating to the right to cultivate or utilize the vacant, fallow and virgin lands prescribed by the Central Committee. (f) not extract other natural resources above or below the ground except the permitted business. (g) when acquiring the required land area from the land permitted in the event of finding the natural resources within the permitted land and the Government is desirous to extract commercially, shall return as directed by the Union Government. 19. The project proponent has to comply with the Central Committee right to acquire the required minimum land area from the permitted vacant, fallow and virgin lands if one of the following conditions arises: (a) if the ancient cultural heritages are found in the permitted vacant, fallow and virgin lands; (b) if infrastructure project or special project is required to be implemented for the interest of the State; (c) if different resources other than the permitted type of metal is found in the permitted vacant, fallow and virgin lands for the mineral production business; (d) if the mineral resources are found in the vacant, fallow and virgin lands permitted to carry out the business contained in Section 4, Sub- section(a), (b) and (c).	

<table>
<tr><th colspan="2">The Protection and Prevention of Cultural Heritage Area, 2015</th></tr>
<tr><td colspan="2">The Protection and Preservation of Cultural Heritage Region Law, 1998 Amended by Law. No.1/2009
Provisions to protect ancient sites and regions and cultural heritage areas from any adverse impacts due to industrialization, tourism and urbanization.</td></tr>
<tr><td>Section 20</td><td>The project proponent can not carry out any of the following in the cultural heritage region:
(a) destroying an ancient monument;
(b) willfully altering the original ancient form and structure or original ancient workmanship of an ancient monument;
(c) excavating to search for antiquities;
(d) exploring for petroleum, natural gas, precious stones or minerals.</td></tr>
<tr><td>Section 23</td><td>The project proponent can not plough and cultivate or carry out any activity which may cause damage to the cultural heritage within the boundary notified by the Department in the cultural heritage region.</td></tr>
<tr><td>Section 29</td><td>(b) If any circumstance arises for the drilling of petroleum or natural gas and mining of precious stones or minerals in the cultural heritage region for the benefit of the State, the project proponent the request has to submitted to the Government and permission has to be requested and obtained.</td></tr>
<tr><th colspan="2">The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27)</th></tr>
<tr><td colspan="2">The Prevention of Hazard from Chemicals and Related Substances Law was enacted on 26th August 2013. The objectives of this Law include: protecting natural resources from decrease and loss, and safeguarding living things from endangerment caused by chemical and chemical related substances; and systematically controlling safety in carrying out approved chemical and associated materials businesses. The Law requires continuous development of worksite safety, health and environmental conservation.
The Prevention of Hazard from Chemicals and Related Substances Law (2013) defines Chemical as: imposing danger to the health or life of man or animal or chemical element, chemical compound and chemical mixture which cause bad consequences to the environment naturally or appearing after created by man. This definition includes the vapour, liquid, waste materials of oily and solid which act chemically and technically.</td></tr>
<tr><td>Section 16</td><td>The project proponet who has obtained a licence:-
(a) has to abide the licence regulations;
(b) has to perform to abide strictly the instructions for being safety in using the chemical and related substances by himself and also the persons who serve the work;
(c) has to keep the required safety equipment enough in the chemical and related substances businesses, furthermore has togrant the personal protection equipment and dresses free of charge to the working persons;
(d) has to make the course of training and study and instruction if necessary to the working persons for using the occupational safety equipment, the personal protection equipment and the dresses systematically in the chemical and related substances business;
(e) has to be inspected by the respective Supervisory Board and Boards of Inspection in respect of whether or not the hazard may impact on the Human Being and Animals' health and the environment;
(f) has to make medical check up the working persons who will work in the chemical and related substances business and has to permit to serve in that work after obtaining the recommendation that his health is suitable for that work. This medical check up records have to be kept systematically;
(g) has to send the copy of informative letter of the permission to the respective Department of Township Administration, if the hazardous chemical or related substances are permitted to store;
(h) has to acquire in advance the guidance and agreement of the respective Department of Fire Brigade, if the business that is worried to fire hazard is operated by using the fire hazard substances or the explosive substances;
(i) has to transport only the permitted amount of the chemical and related substances in accordance with the prescriptive stipulations, if they are transported in local;
(j) has to take the permission from the Central Supervisory Board if the chemical and related substance is altered and transferred from one place to any other place which contained in the license;
(k) has to abide and perform in accordance with the related environmental laws not to impact and damage to the environment in operating the chemical and related substances business.</td></tr>
<tr><td>Section 17</td><td>The project proponent who has obtained a licence, has to put the insurance in accordance with the prescriptive stipulations to be able to pay the compensation, if the impact and damage is occurred on the Human Being and Animals or the environment in respect of the chemical and related substances businesses.</td></tr>
<tr><td>Section 23</td><td>The project proponent who has obtained the registration certificate:-
(a) has to apply to register again, to the Central Supervisory Board if the chemical and related substances, which are not contained in the registered list, are used;</td></tr>
</table>

	(b) has to inform and submit the unused chemical and related substances list to the Central Supervisory Board, although which are contained in the registered list.
Section 27	The project proponent who has obtained the licence to be complied the following matters to control and decrease the hazard of the chemical and related substances:- (a) classifying the hazard level to protect in advance the hazard according to the properties of the chemical and related substances; (b) expressing the Material Safety Data Sheet and Pictogram; (c) providing the safety equipments, the personal protection equipments to protect and decrease the accident and attending to the training to be used systematically; (d) performing in accordance with the stipulations in respect of transporting, possessing, storing, using, discharging the chemical and related substances; (e) not being imported or exported the chemical and related substances banned by the Central Supervisory Board and the machinery and equipments which are used them.
Import and Export Law, 2012	
Chapter IV Prohibitions	
Section 7	Project Proponent who obtained any license has to not violate the conditions contained in the license.
Myanmar Engineering Council Law, 2013	
The objectives of this Law are as follows: (a) to uphold and upgrade the dignity, ethics and quality of the Myanmar citizen engineers, graduate technicians and technicians who are practising engineering works; (b) to explore using engineering technology and information technology combined the good methods, research and development activities by which the natural resources and human resources of the State may be beneficially applied with least impact on environment; (c) to carry out guidance and supervision, and to take necessary actions for fulfillment of the requirements of stipulated technical standard, proper method, free from danger, keeping ethic and being dutiful in the fields of engineering and technology education, researches and services; (d) to service engineering and technology ielated functions and duties beneficial for the State assigned by the relevant Ministry and relevant organizations The project proponent has to ensure the employment of the person who has certificate related with the project activities under the requirements of Myanmar Engineering Council Law (2013).	
The Conservation of Water Resources and Rivers Law, 2006	
The Conservation of Water Resources and Rivers Law (2006) was promulgated on 2nd October 2006. The aims of this Law are as follows: • To conserve and protect the water resources and rivers system for beneficial utilisation by the public; • To ensure smooth and safe waterways navigation along rivers and creeks; • To contribute to State economic development through improving water resources and river systems; and • To protect environmental impact.	
Section 8	The project proponent has to ensure no person: (a) carry out any act or channel shifting with the aim to ruin the water resources and rivers and creeks. (b) cause the wastage of water resources wilfully.
Section 11	The project proponent has to ensure no person: (c) dispose of engine oil, chemical, poisonous material and other materials which may cause environmental damage, or dispose of explosives from the bank or from a vessel which is plying, vessel which has berthed, anchored, stranded or sunk. (d) catch aquatic creatures within river-creek boundary, bank boundary or waterfront boundary with poisonous materials or explosives.
Section 19	The project proponent has to ensure no person dispose of any substance into the river-creek that may cause damage to waterway or change of watercourse from the bank or vessel which is plying, vessel which has berthed, anchored, stranded or sunk.
Section 24	The project proponent has to ensure no person: (a) violate the conditions relating to navigation of vessels in rivers and creeks prescribed by the Directorate for conservation of water resources, rivers and creeks. (b) violate the conditions prescribed by the Directorate so as not to cause water pollution and change of watercourse in rivers and creeks.
Ward and Village Tract Administration Law, 2012	
Project proponent has to comply with the Ward and Village Tract Administration Law and inform the lists of person that live in exploration and campsite to the relevant ward/village offices.	
Health the Care Waste Management Guideline	
Project Proponent has to manage all medical wastes / clinical wastes management in compliance with the Health the Care Waste Management Guideline once stipulated by Ministry of Health and Sports	

3.4 Institutional Framework

The aim of this Chapter is to describe the Administrative and political divisions of Myanmar.

3.4.1 Administrative Divisions

Myanmar is a multi-ethnic country composed of over 130 ethnic groups, and viewing macroscopically, in the central part of the country from north to south along Ayeyarwady River resides the largest group covering 70% of the total population, Bamar, and in mountainous area in east and west reside most of the minorities.

Myanmar has a three levels administrative structure, as described below.

The first level subdivision includes:

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

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

Each region and state has a Regional/State Government, consisting of a Chief Minister, Ministers and an Advocate General. Legislative authority resides with the State/Regional “Hluttaw” (a parliament or legislative body), which are made up of elected civilian members and representatives of the military.

The Constitution states that Naypyidaw is a Union Territory under the direct administration of the President. The Naypyidaw Council, led by a Chairperson, carries out general functions on behalf of the President. The Chairpersons of the Naypyidaw Council are appointed by the President, and include civilians and representatives of the military.

Self-Administered Zones and Self-Administered Divisions are administered by a Leading Body, which is headed by a Chairperson, and has executive and legislative powers. The Leading Body consists of elected State/Regional Hlutttaw members and military personnel.

In August 2014, PTTEP South Asia Limited (PTTEP SA), a subsidiary company of PTTEP was granted a Production Sharing Contract (PSC) for Myanmar Onshore Block MOGE 3, owned by Myanmar Oil and Gas Enterprise (MOGE), the block encompasses 1,217 square kilometers (km^2) and is located in the Southern part of Magway region in the dry, central zone of the Myanmar lowlands. PTTEP SA plans to drill four (4) exploration drilling wells in Block MOGE-3 located in Thayet Township, Magway Region, Myanmar.

The Thayet District has the following Townships:

- Aunglan Township
- Kamma Township
- Mindon Township
- Minhla Township
- Sinbaungwe Township
- Thayet Township

3.5 Project's Environmental, Social and Health Standards

MONREC has established environmental and health quality standards, the National Environmental Quality (Emission) (NEQG) Guidelines [Legal Reference: ECL 2012 (Section 2c) and NEQG 2015] were promulgated on December 29th, 2015. The Guidelines are largely based on International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, and contain regulations and control of various environmental parameters, including noise and vibration, air emissions, and effluent discharges, from various sources and activities. ECD / MONREC have indicated that the discharge standards shown in **Table 3-4** are applicable for Onshore Oil and Gas activities.

These are in accordance with international standards.

Table 3-4: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced sand	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9 – Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements
Air emissions	Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and: – Hydrogen sulfide 5 mg/Nm^3

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to provide relevant industry background and technical information. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new

facilities by existing technology at reasonable costs (Environmental Health and Social Guidelines, IFC 2007).

Table 3-5: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Air quality	Section 1.1 provides guideline applies for facilities or projects that generate emissions to air at any stage of the project life-cycle. It presents information about common techniques for emissions management. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. Additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards are included. These Guidelines include the following key recommendations: • facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air; • impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations; • the dispersion model applied should be internationally recognized, or comparable (examples of acceptable emission estimation and dispersion modelling approaches for point and fugitive sources are reported in these guidelines); • emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls (examples are provided in these guidelines); • a monitoring system should be implemented. For ambient air quality IFC refers to WHO Guidelines (Air Quality Guidelines Global Update, 2005.)
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed facility or for verifying operational phase noise levels. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

Environmental topic	Applicable EHS Guidelines
Drill Cuttings	Section 1.1 Drilling Fluids and Drilled Cuttings Feasible alternatives for the treatment and disposal of drilling fluids and drilled cuttings should be evaluated and included in the planning for the drilling program. Alternative options may include one, or a combination of, the following: • Injection of the fluid and cuttings mixture into a dedicated disposal well; • Injection into the annular space of a well; • Storage in dedicated storage tanks or lined pits prior to treatment, recycling, and / or final treatment and disposal; • On-site or off-site biological or physical treatment to render the fluid and cuttings non-hazardous prior to final disposal using established methods such as thermal desorption in an internal thermal desorption unit to remove NADF for re- use, bioremediation, landfarming, or solidification with cement and / or concrete. Final disposal routes for the non- hazardous cuttings solid material should be established, and may include use in road construction material, construction fill, or disposal through landfill including landfill cover and capping material where appropriate. In the case of landfarming it should be demonstrated that subsoil chemical, biological, and physical properties are preserved and water resources are protected; • Recycling of spent fluids back to the vendors for treatment and re-use. Consider minimizing volumes of drilling fluids and drilled cuttings requiring disposal by: • Use of high efficiency solids control equipment to reduce the need for fluid change out and minimizing the amount of residual fluid on drilled cuttings; • Use of slim-hole multilateral wells and coiled tubing drilling techniques, when feasible, to reduce the amount of fluids and cuttings generated. Pollution prevention and control measures for spent drilling fluids and drilled cuttings should include: • Minimizing environmental hazards related to residual chemicals additives on discharged cuttings by careful selection of the fluid system. • Careful selection of fluid additives taking into account technical requirements, chemical additive concentration, toxicity, bioavailability and bioaccumulation potential; • Monitoring and minimizing the concentration of heavy metal impurities (mainly mercury and cadmium) in barite stock used in the fluid formulation.

4. PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4.1 Project Background

4.1.1 Introduction

In August 2014, PTTEP South Asia Limited (PTTEP SA) has been granted the petroleum concession of onshore Block MOGE-3, owned by Myanmar Oil & Gas Enterprise (MOGE). PTTEP SA has completed 2D and 3D Seismic Acquisition in Block MOGE-3 and vicinity area during 2016-2017. Regarding the Production Sharing Contract (PSC), PTTEP SA will conduct an exploration drilling campaign in Block MOGE-3. The EIA will be investigating eight (8) locations with four (4) wells being selected for exploration well drilling in 2018-2019. PTTEP SA is planning to spud the first well in December 2018. The exploration well will be drilled as a standard well with conventional drilling methods. The exploration drilling will be conducted with a typical land-drilling rig.

4.1.2 Purpose and Objectives of Project

PTTEP SA plans to drill four (4) exploration drilling wells in Block MOGE-3 located in Thayet Township, Magway Region, Myanmar. The primary objectives of the onshore exploration drilling project in Block MOGE-3 are to:

1. Explore the hydrocarbon potential in Block MOGE-3;
2. Fulfill the PSC commitments.

4.1.3 Geological Prognosis

The main reservoir targets of exploration wells are mainly Sandstone/Siltstone from intermediate to deep level (**Figure 4-1**). Target depth of each candidate well location is summarized in **Table 4-2**.

If reservoirs are discovered, further studies on chemical and physical properties of petroleum, age of reservoirs, rock characteristics, porosity, permeability in the formation and others will be conducted. If oil/gas is found then the economics of the potential reservoirs will be evaluated with an appraisal well for assessment/evaluation of the reservoir size.

If oil/gas reserves are economically feasible then a production well will be developed in the area.

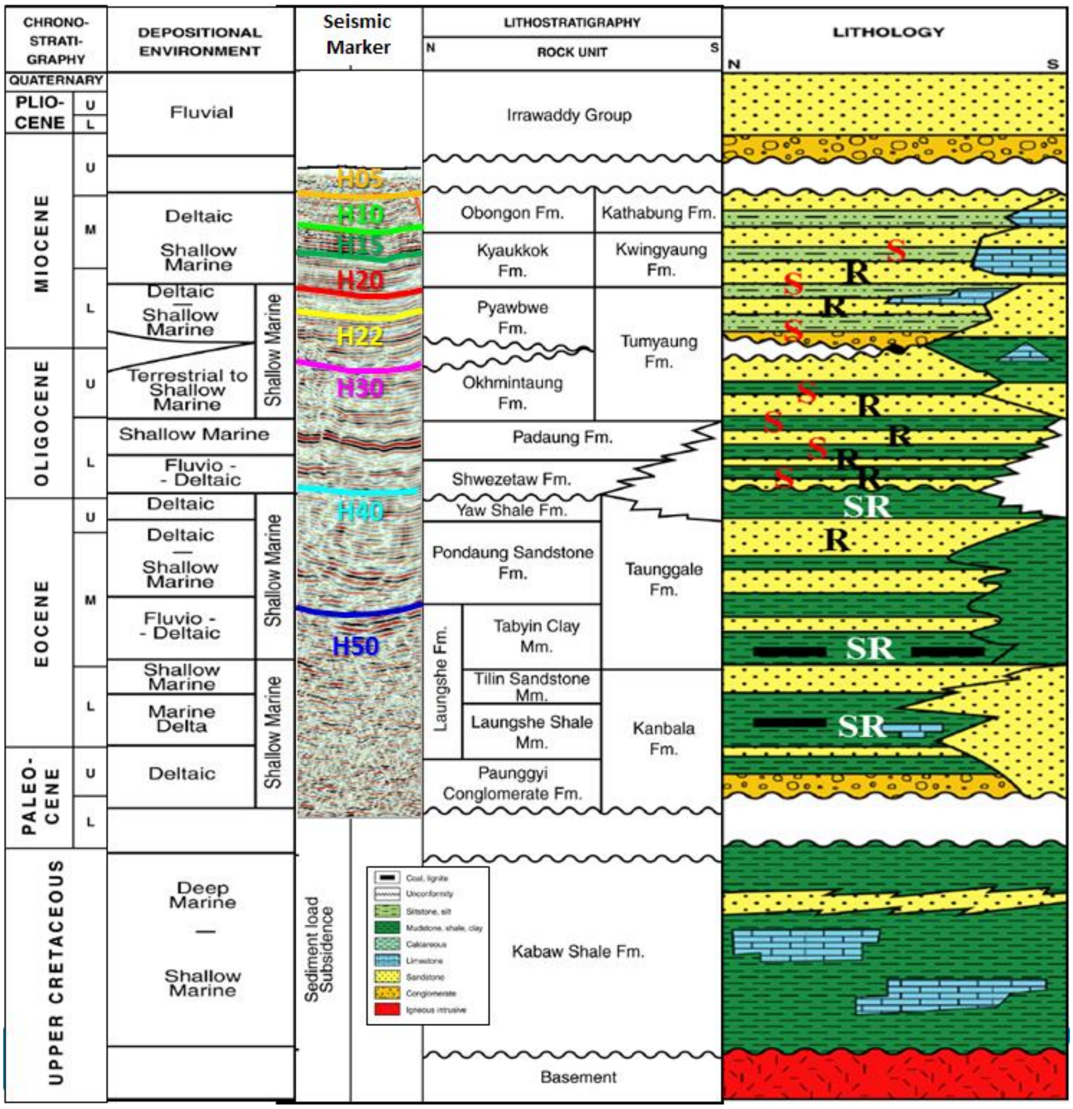


Figure 4-1: Stratigraphic Succession of Block MOGE-3

Table 4-1: Information of the proposed wells

Candidate Location	Padaukpin	Sakangyi	Monatkon	Ngabetkya	Banbyin	Tazi gauk	Natmi	Talaba
Reservoir	Sandstone/Siltstone							
Formation	PY/OK		Lower PY/OK/PA		PY/OK		KK/PY	
Target Zone (mMSL)	600-2575	600-2800	600-2600	600-2800	600-2800	600-2700	600-1650	600-2860
TD Depth (mMSL)	2575	2800	2600	2800	2800	2700	1650	2860
GL. Elevation (m)	125	100	150	150	100	215	115	130

4.1.4 History and Petroleum Activity within Block MOGE-3

4.1.4.1 Seismic Acquisition History

Previous operators (MOGE and Exspan Myanmar (L) Inc. Indonesia), have collected the following geophysical survey data for Block MOGE-3:

- Seismic – VAX Single Coverage (1960), Seismograph Service Ltd.;
- Gravity (1966), MOGE, 502.48 km;
- Seismic (1994, DFS-V), MOGE, 242.30 km;
- Seismic (1998, SN 368), EXSPAN, 174.58 km; and
- Seismic (2011, SN 428), MOGE, 75.45 km.

PTTEP SA acquired new seismic data including 930 sq.km. of 3D seismic data and 222 line km. of regional 2D seismic data during November, 2016 to May, 2017.

4.1.4.2 Exploration Drilling History

In 1920, Burmah Oil Company (BOC) drilled shallow wells (<2500 ft) in Padaukpin area, with crude production of 40 Barrels of Oil per Day (BOPD), declining to 4 BOPD in 1926. In this same period, British Burma Petroleum Company (BBPC) drilled four wells in Sakangyi area, with the first well producing 100 BOPD.

During 1910- 1939, BOC drilled 5 wells in Monatkon area with average depth of 4300 ft. Trace of oil and gas were discovered in Well1 to 4 and Well-5 produced 89000 cu. ft. per day.

During 1922 – 1926, IBOF drilled 3 wells in Okpon area with average depth of 2000 ft. Trace of oil was discovered.

During 1904 – 1906, BOC drilled 4 wells in Banbyin area with average depth of 850 ft. Trace of oil and gas were discovered.

MOGE has also drilled more than 25 wells in Block MOGE-3, as follows:

- 20 wells in Pyaye area in 1954-2007, with average depth of 3200 ft. Total gas produced from Pyaye area was 25.10 BCF.
- 1 well in Padaukpin area in 1995, with average depth of 7400 ft. Well was dry;
- 2 wells in Thayetkon area in 1990, with average depth of 4700 ft. Trace of condensate and gas were discovered.
- 2 wells in Sakangyi area in 1972, with average depth of 4500 ft. Trace oil was found in one well; and
- 3 wells in Natmi area in 1972-1974, with average depth of 7457 ft. Total gas produced from Natmi Well-3 was 1.24 Billion Cubic Feet (BCF).

4.1.4.3 Production History

Block MOGE-3 has three existing fields in the block including; Padaukpin Oil Field, Pyaye Gas Field and Natmi Gas field. There are also a variety of hand-dug state owned enterprise areas within the block.

4.1.4.4 Previous Environmental Impact Assessments in Block MOGE-3

The Myanmar Onshore Block MOGE-3 2D and 3D seismic Exploration ESHIA completed in February 2015 and Myanmar Onshore Block MOGE-3 Regional Seismic IEE completed in April 2017 are the previous IEE/EIA/SIA conducted in Block MOGE-3.

4.1.5 Project Need and Justification

In May 2017, PTTEP SA successfully completed 2D and 3D Seismic Acquisition that was located in Thayet and Kanma Township, Magway Region, Myanmar. PTTEP SA is planning to conduct a drilling campaign in order to explore petroleum potential in Block MOGE-3 in order to fulfill its PSC commitments.

Myanmar has proven natural gas reserves of 7.8 trillion cubic feet.[1] Gas production in 2014 was over 2 billion cubic feet per day and oil production onshore reached 8,300 barrels per day in 2014, in addition to offshore gas fields that produced 8,000 barrels per day of condensate. As of 2014, the country operated three refineries with a combined capacity of 55,000 barrels per day of petroleum products, the vast majority of natural gas production, about 95 percent, came from the two offshore fields at Yadana and Yetagun in the Andaman Sea. There is some domestic offtake, but the majority of this gas is exported via pipeline to Thailand.[2] Since then, the Shwe field in the Bay of Bengal and the Zawtika field in the Andaman Sea have been commissioned and put into production (2013 and 2014 respectively). The majority of the gas from the Shwe field is exported to China via a newly built pipeline and the Zawtika gas is mainly exported to Thailand also via pipeline.

As of 1 December 2014[3] oil and gas production in Myanmar was as follows:

Production	Onshore	Offshore
Gas mmcfd	70	2,000
Oil and condensate bpd	8,300	8,000

Gas sales were as follows:

Sales	Thailand	China	Domestic
Gas mmcfd	1,400	400	300

Myanmar faces energy access and security challenges. The International Energy Agency has calculated that Myanmar has the poorest level of energy access in all of the Asia-Pacific, and Myanmar is the least developed economy in Southeast Asia. Only 13 percent of the country's population have access to the national electricity grid, approx. 26 per cent have access to electricity, and almost 95 percent of its people depend on solid fuels such as wood and rice husks for cooking and heating.[4]

Secure energy supplies will be important to Myanmar's future development. The Ministry of Electric and Energy has set the basis of Myanmar's energy policy framework —

- (i) fulfilling domestic energy requirement
- (ii) implementing sustainable energy development;
- (iii) promoting the wider use of new and renewable sources of energy;
- (iv) promoting energy efficiency and conservation;
- (v) promoting use of alternative fuels;
- (vi) implementing effective utilization of discovered crude oil and natural gas resources in the interest of the entire nation; and (vii) promoting more private participation.[5]

PTTEP SA, as the operator of the Myanmar onshore petroleum PSC, is striving to develop and produce oil from its potential reservoirs located within Block MOGE-3.

[1] BP, "BP Statistical Review of World Energy" (June 2011).
[2] Asian Development Bank, Interim Country Partnership Strategy: Myanmar, 2012–2014 (Manila: October, 2012).
[3] MOGE 1 December 2014
[4] UNDP, "Accelerating Energy Access for All in Myanmar" (2013), Executive Summary.
[5] Myanmar Ministry of Electric and Energy, "Regional Energy Cooperation" (accessed 15 July 2014).

4.2 Project Location

4.2.1 Block MOGE-3

Block MOGE-3 lies within Thayet and Kamma Townships in Thayet District of Magway Region. The block encompasses 1,217 square kilometers (km^2) and is located in the Southern part of Magway region in the dry, central zone of the Myanmar lowlands. The block boundaries are shown in **Table 4-2**.

Table 4-2: Coordinates of Block MOGE-3 Boundary

	Point	X	Y
MOGE-3	A	390736.44	2163862.50
	B	414338.81	2163734.25
	C	415839.94	2110240.25
	D	394798.38	2110348.25
	E	394038.91	2130641.75
	A	390736.44	2163862.50

Note: Datum – UTM WGS84 Zone 46N

The location of Block MOGE-3 (yellow area) in Myanmar is shown in **Figure 4-2**.

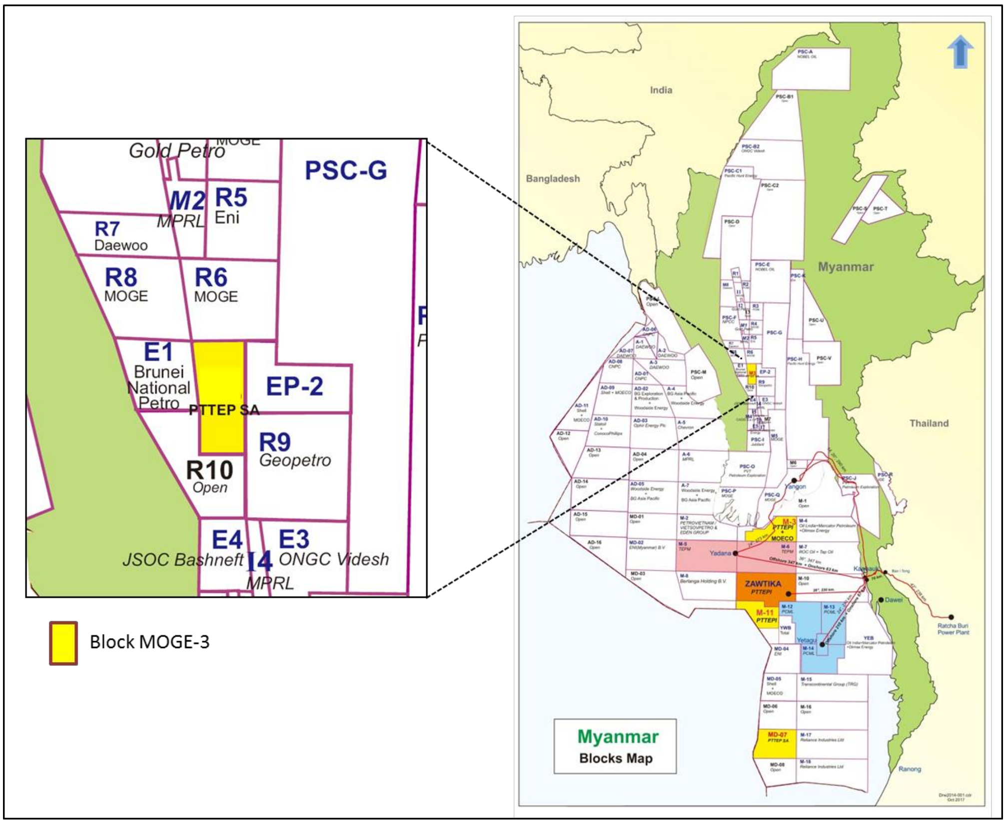


Figure 4-2: Location of Block MOGE-3

4.2.2 Drilling Location

Four (4) drilling locations will be selected based on eight (8) potential EIA study locations for the 2018-2019 drilling campaign which shown in **Table 4-3**.

Table 4-3: Locations of the potential wells

Location	Lat	Long	X	Y
Tazigauk	19°33'38.60"N	95° 0'28.31"E	395928.46	2163173.72
Monatkon	19°30'41.12"N	94°59'38.90"E	394456.61	2157726.21
Ngabetkya	19°25'58.09"N	94°59'14.95"E	393707.23	2149029.74
Banbyin	19°24'55.98"N	95° 1'17.48"E	397269.74	2147099.80
Padaukpin	19°22'26.34"N	95° 4'40.02"E	403152.41	2142467.30
Sakangyi	19°22'20.51"N	95° 6'16.96"E	405979.52	2142273.20
Talaba	19° 21' 47.05"	95° 00' 30.29"	395860.02	2141299.88
Natmi	19°13'7.12"N	95° 1'11.83"E	396981.65	2125310.31

Note: Datum – UTM WGS84 Zone 46N

The coordinates and map of proposed EIA survey locations are found in **Figure 4-3**.

NO.	Name	Point	Site locations	
			X	Y
1	Monatkon (1.5x1.0)	A	394709.19	2158286.50
		B	393203.56	2158036.25
		C	393366.63	2157041.50
		D	394858.75	2157310.50
		A	394709.19	2158286.50
2	Ngabetkya (1.5x2.9)	A	393414.31	2151523.25
		B	393388.00	2148628.00
		C	394924.53	2148614.25
		D	394941.78	2151524.50
		A	393414.31	2151523.25
3	Padaukpin (1.5x2.4)	A	402207.16	2142989.00
		B	403472.00	2143755.25
		C	404363.38	2142242.25
		D	404061.78	2141230.50
		E	403427.91	2140887.00
		A	402207.16	2142989.00
4	Sakangyi (1.5x2.0)	A	405637.53	2142382.00
		B	406476.13	2140568.00
		C	407846.34	2141208.50
		D	406979.91	2143009.50
		A	405637.53	2142382.00
5	Banbyin (2.5x1.5)	A	395217.00	2148262.00
		B	395059.88	2146797.50
		C	397584.28	2146552.50
		D	397705.88	2148044.25
		A	395217.00	2148262.00
6	Tazigauk (1.0x1.5)	A	395505.84	2163660.25
		B	396457.84	2163292.00
		C	395874.16	2161881.00
		D	394910.84	2162277.50
		A	395505.84	2163660.25
7	Natmi-North (1.5x2.0)	A	394925.84	2126137.50
		B	396166.38	2127034.00
		C	397445.50	2125354.00
		D	396269.91	2124437.50
		A	394925.84	2126137.50
8	Talaba (1.0x2.5)	A	394504.31	2142758.50
		B	395402.31	2143255.25
		C	396643.63	2141031.75
		D	395685.53	2140537.50
		A	394504.31	2142758.50

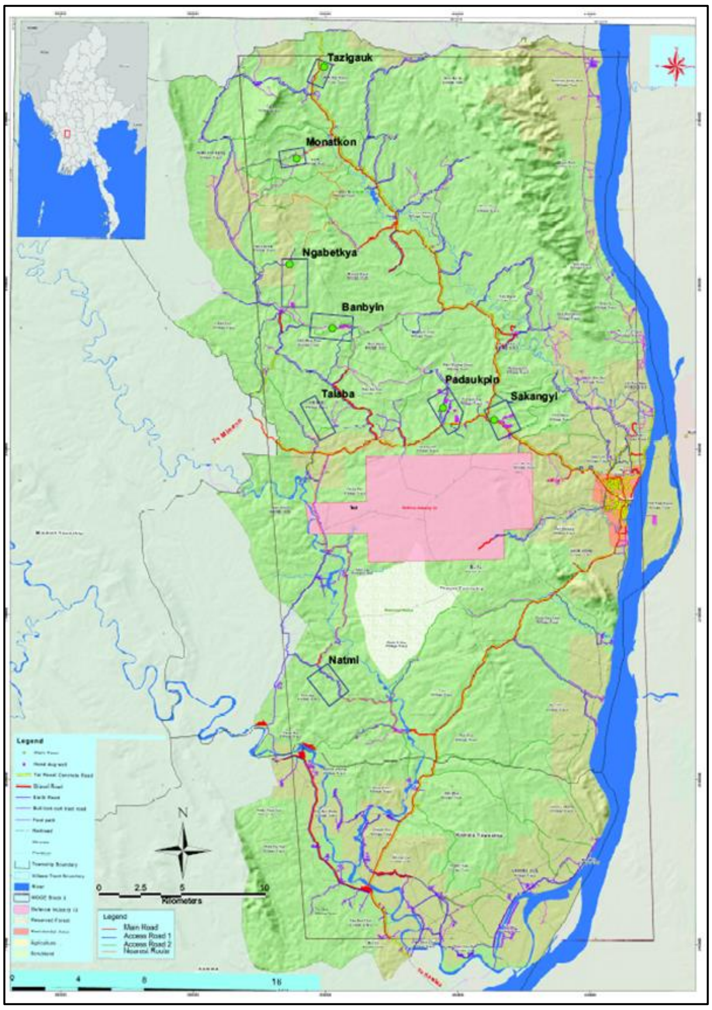


Figure 4-3: EIA Survey Locations

4.3 Project Schedule

PTTEP SA is planning to spud the first well in December 2018. Each well will have similar drilling schedule which can be divided into 3 phases.

- Construction Phase: ± 150 days (60 days for road and 90 days for well site)
- Drilling and Testing Operations Phase: ± 60 days (30 days for drilling and 22 days max. for testing)
- Well Suspension/Abandonment Phase and Site Restoration: ± 30 day

The overall schedule of the exploration drilling campaign for block MOGE-3 is provided in **Table 4-4**.

The project schedule with well site construction planned for Q3 of 2018, with the spud the first well in December 2018. The estimated duration for drilling 4 wells is 6-8 months. Well testing is estimated to take place over a 5-month period.

Table 4-4: Project Timeline of MOGE-3 Exploration Drilling Campaign

Well	Duration																														
	2018							2019												2020											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Well#1 PDP																															
Well#2 MNK																															
Well#3 NBK																															
Well#4 SKG																															

Remark: Construction Phase; Drilling Phase; Well Testing Phase; Site Restoration Phase

4.4 Project Alternatives

4.4.1 No Project

If the proposed exploration project is not implemented, economic benefits generated by the project would not occur (**Section 4.1.5**). Benefits lost would include the following:

- Employment generation and project expenditures during exploration drilling;
- Potential loss/delay of petroleum production from the site;
- Loss of revenue for the Myanmar and local governments through Production Sharing Contracts (PSC);
- The future contribution of crude oil from this area would need to be replaced with an equivalent amount sourced from overseas. Importing crude oil from outside Myanmar has associated impacts from transportation (emissions, potentials for spills) as well as cost implications;

4.4.2 Project

4.4.2.1 Site Selection Process

The final location of well sites and access roads in Block MOGE-3 will be selected based on the data from 2D and 3D seismic acquisition, general site criteria, engineering criteria, economic criteria, and environmental, social and health criteria as summarized in **Table 4-5**.

4.4.2.1.1 General Criteria

The general criteria include an evaluation of Geology, Location, Topography, Land Use and Significant sensitive areas and Infrastructure for the project. The exploration drilling project will explore the location, extent and characteristics of petroleum reservoirs. This project will select the location to drill exploration wells based on geological data and seismic interpretation data in the area. The most promising location to find petroleum reservoirs based on geological and seismic information will be defined as the ideal location, most suitable for understanding the target petroleum reservoir and most likely to find promising petroleum reservoirs. The ideal location is then evaluated for other constraints, such as steep terrain, land use, sensitive areas and distance from roads.

4.4.2.1.2 Engineering Criteria

Engineering criteria for well site selection regard the following factors: Minimize difficult terrain (such as drilling in steep topography, rocky areas, etc.), Maximize use of existing local access road, Minimize logistical issues (including engineering safety concerns), Minimize drilling distance to reservoir (preferably conventional straight hole) and Minimize overall length of access road construction if needed.

4.4.2.1.3 Economic Criteria

The site selection process incorporates the assessment of the economic value of a potential petroleum hydrocarbon reservoir and its commercial worth against the cost of the investment (including Land Cost Compensation for land, Renting Rig, Construction, Operation and Maintenance costs) for alternate well locations.

4.4.2.1.4 Environment, Social and Health Criteria

Environmental, social and health criteria evaluated to select well site locations are: location as far away as possible from environmental and social sensitive areas. An "ideal" well site location should be located at least 1 km from any large community and near a transportation network or access route

that can accommodate transport of the drilling rig. The shortest distance for access road construction must be considered and well site must not be located within reserved area such as national park, wildlife sanctuary, watershed area, reserved forest, historical park, etc. In case it is necessary to use such an area, the project proponent must operate strictly in accordance with applicable laws and regulations of the relevant government agencies.

Table 4-5: Well Site Selection Criteria

Environmental, Social and Health Considerations	**Physical Resources**
	Minimize use of sensitive terrain/soil (e.g. wetland/erosive soil)
	Maximize use of existing highways and access roads
	Minimize number of river, waterway, and canal crossings
	Minimize use of existing river, waterway and canal crossings
	Ecological Resources
	Minimize impact on natural sensitive terrestrial environment
	Minimize impact on natural sensitive aquatic environment
	Minimize impact on national parks, forest reserves, wildlife sanctuaries
	Human Use Values
	Minimize impact on transportation
	Minimize impact on water resources structure (river, waterway and canal crossing)
	Minimize impact on water resources structure
	Minimize impact on low level row crops (e.g., vegetable, sesame, beans and pulses)
	Minimize impact on paddy fields
	Minimize impact on orchards and forest plantations (e.g., mango, coconut, mixed orchard)
	Minimize impact on aquaculture
	Minimize impact on livestock operations (e.g., swine)
	Quality-of-Life Values
	Minimize impact on population centres, settlements
	Minimize impact on individual buildings and residences in ROW
	Minimize visual impacts
	Minimize impact on cultural/religious resources
	Health
	Minimize potential for construction accidents
	Minimize potential for operation accidents (settlements)
	Minimize anxiety of local people
	Minimize impact on water resources structure (river, waterway and canal crossing)
Engineering Design Considerations	Minimize waterway crossings
	Minimize difficult terrain (steep, rocky, etc.)
	Maximize use of existing ROW access
	Minimize logistical issues
	Engineering design (minimize drilling distance to reservoir)
	Minimize overall length of access road construction
	Subsurface hazard evaluation (formation pressure prediction, shallow gas, etc.)
Economic Factors	Land compensation cost
	Construction cost
	Operation and Maintenance cost

4.4.2.2 Drilling Phase Alternatives

4.4.2.2.1 Camp Site Selection

The camp site selections is based on the land availability and the workers requirements. Typically the camp site can be established next to the well pad area or at a central location. Since the program will drill multiple well site locations (4 well sites) a central camp site location will be developed next to the Thayet Township. This will allow for the easy access to camp site support materials and limit the land impact from establishing the camp site next to each well pad area.

4.4.2.2.2 Type of Rig

PTTEP SA intends to use a land drilling rig for this drilling campaign. The land drilling rig is the only type of rig suitable for onshore drilling.

The selection criteria for the land drilling rigs are:

- Availability
- Cost
- Rig Capability
    - Rig criteria are mostly related to the well depth requirements which consider:
        - Derrick
        - Drawworks
        - Mud Pumps
        - Drillstring
        - Mud System
        - Surface Equipment Limitation (BOP, Wellhead etc)
        - SSHE MS
        - Track records
        - Experience

4.4.2.2.3 Type of Drilling Method

The wells will be drilled with a conventional hole size. A conventional hole sizes are required because of the depths being drilled, the type of formations being drilled, the kinds of pressures expected, and for hole stability.

4.4.2.2.4 Type of Flaring

Associated gas brought to the surface with crude oil during oil production is sometimes disposed of at onshore facilities by venting or flaring to the atmosphere. Flaring or venting are also important safety measures used on onshore oil and gas facilities to ensure gas and other hydrocarbons are safely disposed of in the event of an emergency, power or equipment failure, or other plant upset condition.

Continuous venting of associated gas is not considered current good practice and should be avoided. The associated gas stream should be routed to an efficient flare system, although continuous flaring of gas should be avoided if feasible alternatives are available. Before flaring is adopted, feasible alternatives for the use of the gas include gas utilization for on-site energy needs, export of the gas to a neighbouring facility or to market, gas injection for reservoir pressure maintenance, enhanced recovery using gas lift, or gas for instrumentation. Due to the remote location of the proposed well sites the alternative options are currently not feasible, therefore the project will implement measures to minimize flare volumes, with the elimination of continuous production- associated gas flaring as the preferred goal.

The flare system will be a horizontal burner into an earth berm pit to reduce the visual and noise impact from the flaring operations.

4.4.2.2.5 Type of Mud

Many types of drilling fluids are used on a day-to-day basis worldwide. Some wells require that different types be used at different parts in the hole, or that some types be used in combination with others. The various types of fluid generally fall into a few broad categories:

- Air: Compressed air is pumped either down the borehole's annular space or down the drill string itself. Drilling depth with this fluid is limited.
- Air/water: The same as above, with water added to increase viscosity, flush the hole, provide more cooling, and/or to control dust. Drilling depth with this fluid is limited.
- Air/polymer: A specially formulated chemical, most often referred to as a type of polymer, is added to the water & air mixture to create specific conditions. A foaming agent is a good example of a polymer. Drilling depth with this fluid is limited.
- Water: Water by itself is sometimes used.
- Water-based mud (WBM): A most basic water-based mud system begins with water, and then clays and other chemicals are incorporated into the water to create a homogenous blend resembling something between chocolate milk and a malt (depending on viscosity). The clay (called "shale" in its rock form) is usually a combination of native clays that are suspended in the fluid while drilling, or specific types of clay that are processed and sold as additives for the WBM system. The most common of these is bentonite, frequently referred to in the oilfield as "gel". Gel likely makes reference to the fact that while the fluid is being pumped, it can be very thin and free-flowing (like chocolate milk), though when pumping is stopped, the static fluid builds a "gel" structure that resists flow. When an adequate pumping force is applied to "break the gel", flow resumes and the fluid returns to its previously free-flowing state. Many other chemicals (e.g. potassium formate) are added to a WBM system to achieve various effects, including: viscosity control, shale stability, enhance drilling rate of penetration, cooling and lubricating of equipment.
- Oil-based mud (OBM): Oil-based mud can be a mud where the base fluid is a petroleum product such as diesel fuel. Oil-based muds are used for many reasons, some being increased lubricity, enhanced shale inhibition, and greater cleaning abilities with less viscosity. Oil-based muds also withstand greater heat without breaking down. The use of oil-based muds has special considerations. These include cost and environmental considerations.
- Synthetic-based fluid (SBM): Synthetic-based fluid is a mud where the base fluid is synthetic oil. This is often used on both onshore and offshore rigs because it has the properties of an oil-based mud, but the toxicity of the SBM fluid is much less than an oil-based fluid. The synthetic-based fluid provides good drilling performance for high formation pressure but has less toxicity and is more environmentally friendly than OBMs.

PTTEP SA drilling program is currently expecting to use either Water-based mud (WBM) or Synthetic based mud (SBM) depending on results of subsurface and seismic interpretation result. WBM is the preferred option to be used first and SBM will be used if there are any problematic formations to drill.

4.4.2.2.6 Type of Drilling Cuttings Treatment

The largest waste stream from the exploration drilling program are the drilled cuttings removed from the wellbore and spent drilling fluids. Drilling fluids are circulated downhole and routed to a solids control system at the surface facilities where fluids can be separated from the cuttings so that they may be recirculated downhole leaving the cuttings behind for disposal. These cuttings contain a proportion of residual drilling fluid. According to the IFC On-shore Oil and Gas Guidelines, the feasible alternatives for the treatment and disposal of drilling fluids and drilled cuttings include:

- Injection of the fluid and cuttings mixture into a dedicated disposal well;
- Injection into the annular space of a well;
- Storage in dedicated storage tanks or lined pits prior to treatment, recycling, and / or final treatment and disposal;
- On-site or off-site biological or physical treatment to render the fluid and cuttings non-hazardous prior to final disposal using established methods such bioremediation, land farming, or solidification with cement and / or concrete. Final disposal routes for the non-hazardous cuttings solid material should be established, and may include use in road construction material, construction fill, or disposal through landfill including landfill cover and capping material where appropriate. In the case of land farming it should be demonstrated that subsoil chemical, biological, and physical properties are preserved and water resources are protected;
- Recycling of spent fluids back to the vendors for treatment and re-use.

The treated cuttings will be deposited into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at DOWA waste management facility for disposal.

4.5 Exploration Drilling

4.5.1 Layout and Facilities in Well Site Area

4.5.1.1 Drilling Rig

PTTEP SA intends to use a typical land-drilling rig for this drilling campaign. The typical specifications of the rig are:

- Weight: 600 MT
- Mast Height: 45 m
- Support Equipment: Sub-base, Mast, Drawwork, Top Drive, Mud pumps, Generators, Mud Tanks, Shaker, BOP, V-door, Cat-walk, Pipe rack.

The rig's Drawworks has a power rating of 1,800 HP. The rig is powered by four diesel driven generator sets and each rated 600 KVA to supply the rig site with power. An example of a land drilling rig and auxiliary equipment are shown in **Figure 4-4** to **Figure 4-9**.

Figure 4-4: Land Drilling Rig

Figure 4-5: Top Drive

Figure 4-6: Mud Pumps

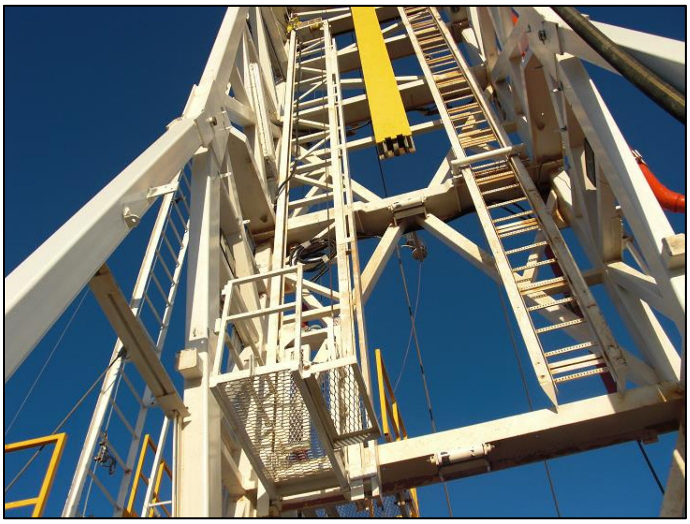


Figure 4-7: Mast

Figure 4-8: Mud Tanks

Figure 4-9: Shaker

4.5.1.2 Cellar and Well Pad

Within the drill pad, a hole will be dug and lined with 200 mm thick concrete to form the inline cellar with dimensions of 3.0 m x 3.0 m x 3.0 m deep. This forms the rig "cellar", into which is fitted a short length of 30 inch steel pipe, extending 12 to 24 metres into the ground; this is the "conductor pipe" that acts as a guide to the drill bit and drill string while drilling the uppermost portion of the well. The cellar also houses the well-head and the blow out preventers.

A reinforced concrete rig pad, measuring approximately 30 m by 57 m will be constructed around the cellar. This acts as the foundation upon which the drilling rig, generators and fuel tanks sit on. An additional shaker concrete pad will be constructed for the mud tanks and shakers. All concrete areas will drain into the cuttings pit. To avoid the cutting pits contaminated with oil from any emergency spill on the drill pad, the engineering team will add the oil separator unit on both sides of gutter to trap oil before flowing down to the cutting pit.

4.5.1.3 Concrete Lined Cuttings Pit

A concrete lined cuttings pit will be installed onsite. The cuttings from the shale shakers will be placed in the concrete lined cuttings pit. The possibly contaminated runoff water from concrete drill pad and shaker area will drain to the cuttings pit. The concrete lined cuttings pit size is approximately 20m x 25m x 1.5m. To avoid the cutting pits contaminated with oil from any emergency spill on the drill pad, the engineering team will add the oil separator unit on both sides of drain gutter to trap oil before flowing down to the cutting pit.

The estimated typical amount of runoff during a rain storm varies according to the month of the year. Runoff from the rig pad enters the cuttings pit. The pit is sufficient in size to contain any runoff from storms. It is not expected that discharge of water will be required unless there is unusually prolonged storm activity. The cuttings pit has a maximum holding capacity of 560 m3. The cuttings pit can therefore contain much more rainfall than the rainfall intensity of a ½-hr duration storm.

The Concrete Class used for this project is 210 (i.e. compressive strength can withstand 210 kg/sqcm or 3000 psi), 30 cm thick on the rig pad. After the cement is poured it is allowed to cure for a minimum of 3 weeks. The pad will also be inspected by a PTTEP SA and Rig engineers to ensure no leakage through the concrete before acceptance and use.

Nothing hazardous is stored in the cuttings pit; however, the pit level is monitored to ensure it does not overflow. The reverse situation (a rapid decrease in the water level in the pit) would indicate a leak in the pit and action would be taken to fix it.

4.5.1.4 Mud Tanks

Mud tanks are used to hold the drilling mud system. These above ground tanks are 3 m x 10 m steel tanks which are used for holding and pumping the mud system in a closed loop. The mud tanks are preferred to mud pits to ensure a closed system. After the cuttings pass through the shale shakers the cuttings are placed in the concrete lined cuttings pit and the mud system is recalculated in the mud tanks and closed drilling mud system.

4.5.1.5 Top Hole Cutting Pit

A high-density poly ethylene (HDPE) lined earth pit will be constructed to accommodate the cuttings in the event that the level in the concrete lined cutting pit will be overflowed. The top hole cutting pit has capacity of 2,300 m^3.

4.5.1.6 Hazardous Pit

A Hazardous pit will be constructed on site to hold any hazardous materials. This pit will be 400 m^3 and lined with high-density poly ethylene (HDPE) to stored SBM cutting. All hazardous material will be removed at the end of drilling and will do either bioremediation or disposed of at DOWA waste management facility.

4.5.1.7 Well Site Drainage and Flood Prevention System

4.5.1.7.1 During Civil Works

During construction, a civil engineering contractor will be required to survey the road to be upgraded and the driveway to be constructed. The contracted civil engineer will determine and recommend if culverts or additional ditches are necessary to manage surface water runoff.

4.5.1.7.2 During Drilling in Well Pad (drilling) area

The well site layouts are designed by a Registered Engineer to control the surface water drainage and flood prevention systems. The concrete drill pad and shaker area made of concrete, which prevents leakage of contaminated water to the surrounding area. Machines within the drilling pad area that could potentially release contaminated water include skip tank, cuttings pit, cement mixer, and drilling rig. Runoff within the drilling area will be drained via drainage gutter into the cuttings pit, which will accumulate all of the runoff and contaminated water generated within the drilling area. Therefore, contaminated water from this area will go through a large oil trap and end up in the cuttings pit and won't escape to contaminate surrounding areas.

The cuttings pit will be constructed at the drilling area and is lined with a concrete liner to keep all the water used/released within the drilling area. The cuttings pit has volume of 560 m^3.

The volume of runoff from the well site will be calculated from the volume of the heaviest rainfall within 30 minutes with a month's equivalent rainfall in one hour. The volume of the cuttings pit (560 m^3) is much more than the volume of the extremely heavy runoff. Therefore, the cuttings pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the cuttings pit will be monitored regularly. If water level in the cuttings pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit.

4.5.1.8 Chemical and Equipment Storage Areas

Mud and cementing chemicals will be stored with tarpaulin covers or roof to protect the mud and cementing chemicals from rain. Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers. The area will have a berm to protect from accidental spills. However, the drilling chemicals are mostly dry powder materials, so the risk of spill is low. All Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers as per the manufactures recommendations. Spill Kits will be provided onsite to ensure the readiness of preparation in case of spills. Other storage areas such as parts, equipment and repair shops will be contained in converted portable 40 foot containers or the steel baskets.

4.5.1.9 Fuel Storage Area

The fuel tanks (2 fuel tanks approximate 40 m^3 capacity each) will be stored above ground in tanks set on the concrete rig pad within the rig pad. The fuel tanks will be completely surrounded with a bund to contain any spillage in accordance with Good International Industry Practice included in Environmental, Health and Safety General Guideline of IFC.

- Secondary containment, constructed of impervious and chemically resistant material, shall be provided that is capable of containing the larger of 110% of the largest tank or 25% of the combined tank volumes.
- Fuel shall not be stored in underground tanks.
- Fuel shall be transferred between vehicles and storage tanks on an impervious surface sloped to a collection structure.

The fuel storage area will have spill kits and absorbent material to contain any potential fuel spills during re-fuelling.

The fuel storage permit or license will be obtained from the concerned authorities as needed.

4.5.1.10 Water Supply

It is estimated that a total of 300 bbls/day of industrial grade fresh (non-potable) water will be required during the drilling operation (to be used as makeup water for the drilling mud, cement mixing and losses). Water will be supplied to each well site from deep tube wells at the well site. If tube type wells are not successful or water supply rate not suitable, PTTEP SA will contact local water resource from Tote Kaing Village or Ye Myat Village and transported by tanker to Drilling well site. Local authorities will be consulted prior water hauling begins.

The industrial water will be stored on the well site in an in ground storage pit 30 m x 15 m x 3 m deep for a maximum capacity of 1,200 m^3.

4.5.1.11 Power Supply

Estimated fuel consumption is 8 m^3 per day during drilling. All electrical power for the well site, drilling rig and associated equipment will be provided by four diesel fuelled generator sets.

All electrical power for the well site, drilling rig and associated equipment will be provided by four diesel fuelled generator sets. Estimated total fuel usage is 480 m^3 (based on 60 days of drilling). During well testing phase, power consumption is minimal (i.e., only power for instruments and lights is required which can be powered from the work camp generators).

4.5.1.12 Flare Stack

The flare stack will be horizontal burner directed to an earth berm flare pit to ensure the safety of workers at the well site. The nearest community will be located over 300 m away (for all the proposed well sites); thus, impact from light and sound from the flare stack is designed to be minimal.

No waste fluids will be discharged to the flare pit. The reservoir fluids will be burned. The produced water will be separated and directed into the wastewater pit. The flare pit is only used for the emergency burning of high-pressure hydrocarbons.

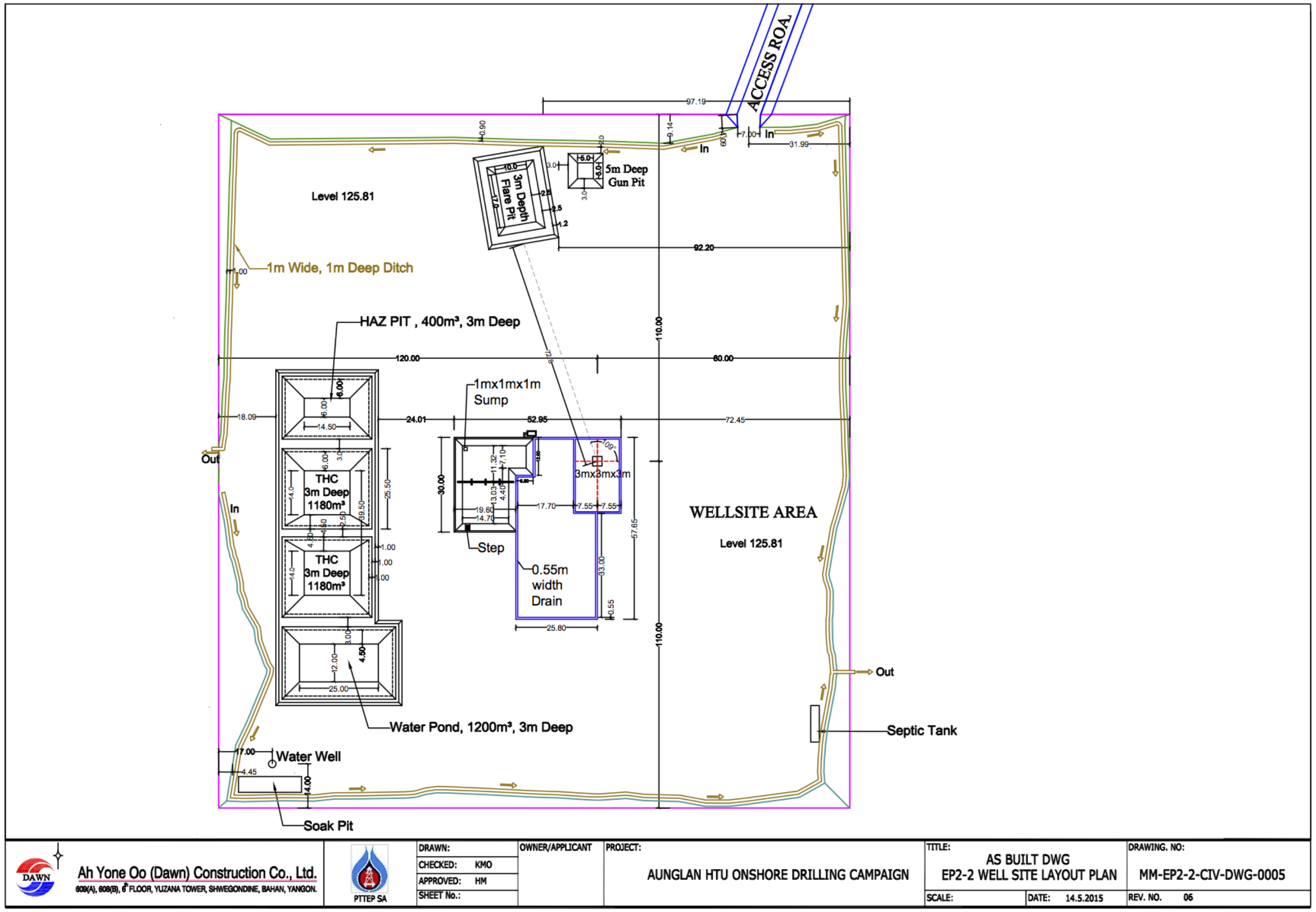
The flare pit soil will tested upon completion of well testing and if contaminated will be disposed as per the Waste Management Plan. The safety zone was considered during construction phase and it is within the boundary of fence. (approx.: 80 meters).

4.5.1.13 Field Office

A field office will be located at the rig site. The field office will consists of container units located in a safe area outside the main well pad working area.

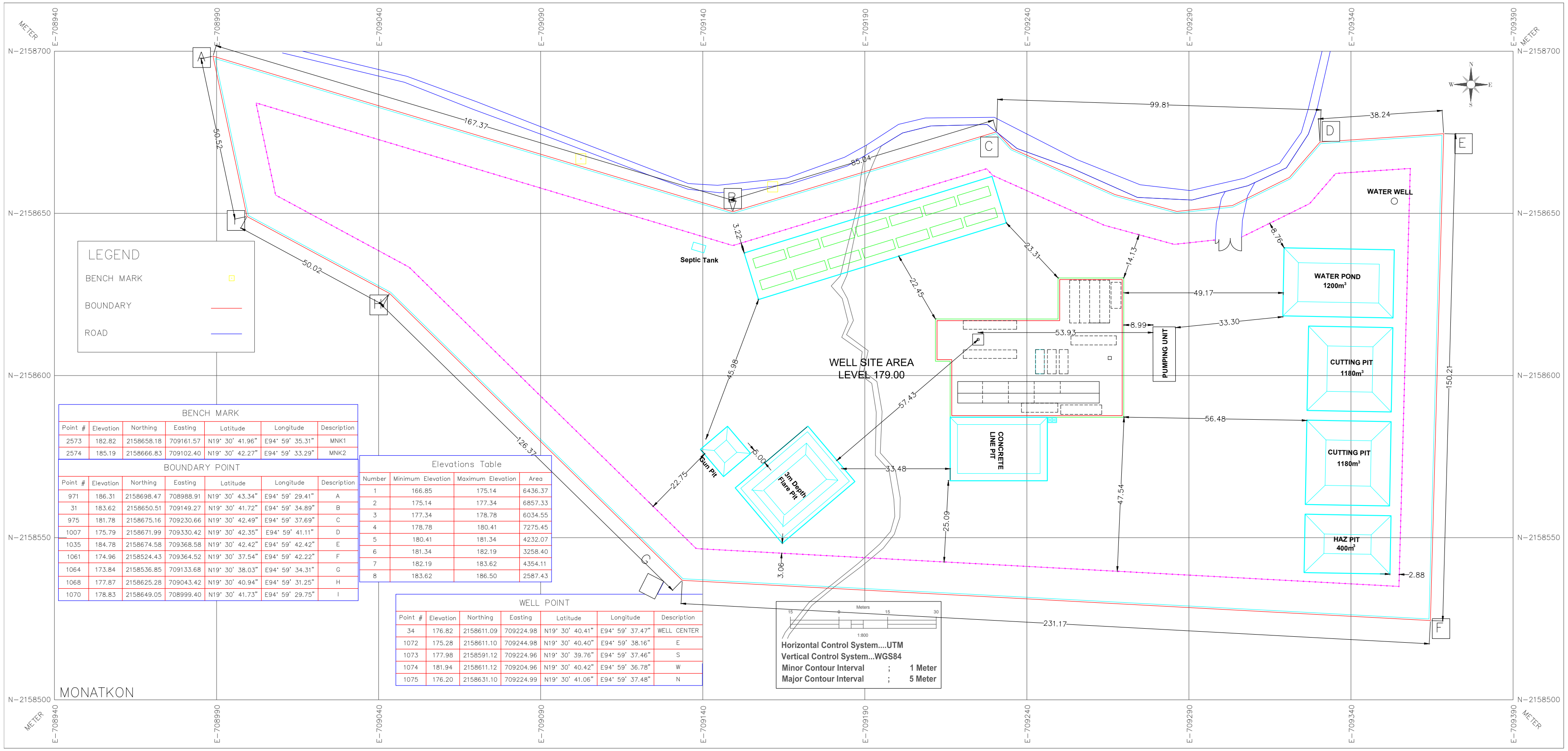
4.5.1.14 Layouts

The typical well site layout is shown in **Figure 4-10**. The well site layout for Monatkon (MNK) is shown in **Figure 4-11**. The well site layout for Ngabetkya (NBK) is shown in **Figure 4-12**. The well site layout for Padaukpin (PDP) is shown in **Figure 4-13**. The well site layout for Sakangyi (SKG) is shown in **Figure 4-14**.



Source: PTTEP SA, 2018

Figure 4-10: Typical PTTEP SA Drilling Well Site Layouts



BENCH MARK

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
2573	182.82	2158658.18	709161.57	N19° 30' 41.96"	E94° 59' 35.31"	MNK1
2574	185.19	2158666.83	709102.40	N19° 30' 42.27"	E94° 59' 33.29"	MNK2

BOUNDARY POINT

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
971	186.31	2158698.47	708988.91	N19° 30' 43.34"	E94° 59' 29.41"	A
31	183.62	2158650.51	709149.27	N19° 30' 41.72"	E94° 59' 34.89"	B
975	181.78	2158675.16	709230.66	N19° 30' 42.49"	E94° 59' 37.69"	C
1007	175.79	2158671.99	709330.42	N19° 30' 42.35"	E94° 59' 41.11"	D
1035	184.78	2158674.58	709368.58	N19° 30' 42.42"	E94° 59' 42.42"	E
1061	174.96	2158524.43	709364.52	N19° 30' 37.54"	E94° 59' 42.22"	F
1064	173.84	2158536.85	709133.68	N19° 30' 38.03"	E94° 59' 34.31"	G
1068	177.87	2158625.28	709043.42	N19° 30' 40.94"	E94° 59' 31.25"	H
1070	178.83	2158649.05	708999.40	N19° 30' 41.73"	E94° 59' 29.75"	I

Elevations Table

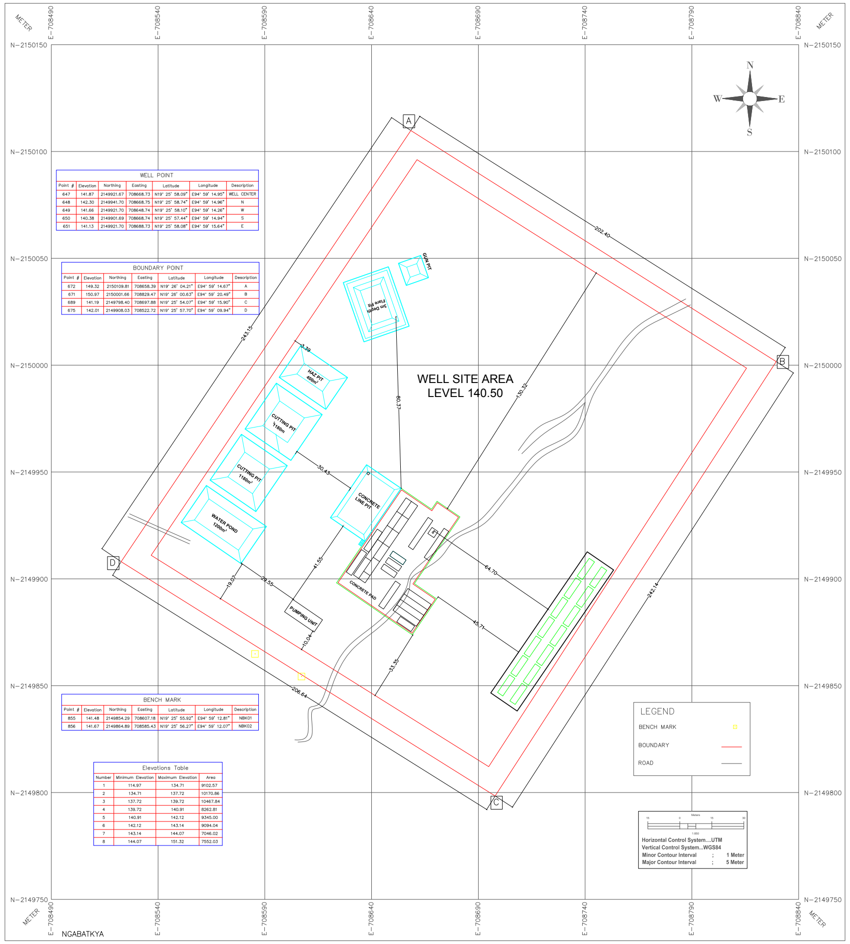
Number	Minimum Elevation	Maximum Elevation	Area
1	166.85	175.14	6436.37
2	175.14	177.34	6857.33
3	177.34	178.78	6034.55
4	178.78	180.41	7275.45
5	180.41	181.34	4232.07
6	181.34	182.19	3258.40
7	182.19	183.62	4354.11
8	183.62	186.50	2587.43

WELL POINT

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
34	176.82	2158611.09	709224.98	N19° 30' 40.41"	E94° 59' 37.47"	WELL CENTER
1072	175.28	2158611.10	709244.98	N19° 30' 40.40"	E94° 59' 38.16"	E
1073	177.98	2158591.12	709224.96	N19° 30' 39.76"	E94° 59' 37.46"	S
1074	181.94	2158611.12	709204.96	N19° 30' 40.42"	E94° 59' 36.78"	W
1075	176.20	2158631.10	709224.99	N19° 30' 41.06"	E94° 59' 37.48"	N

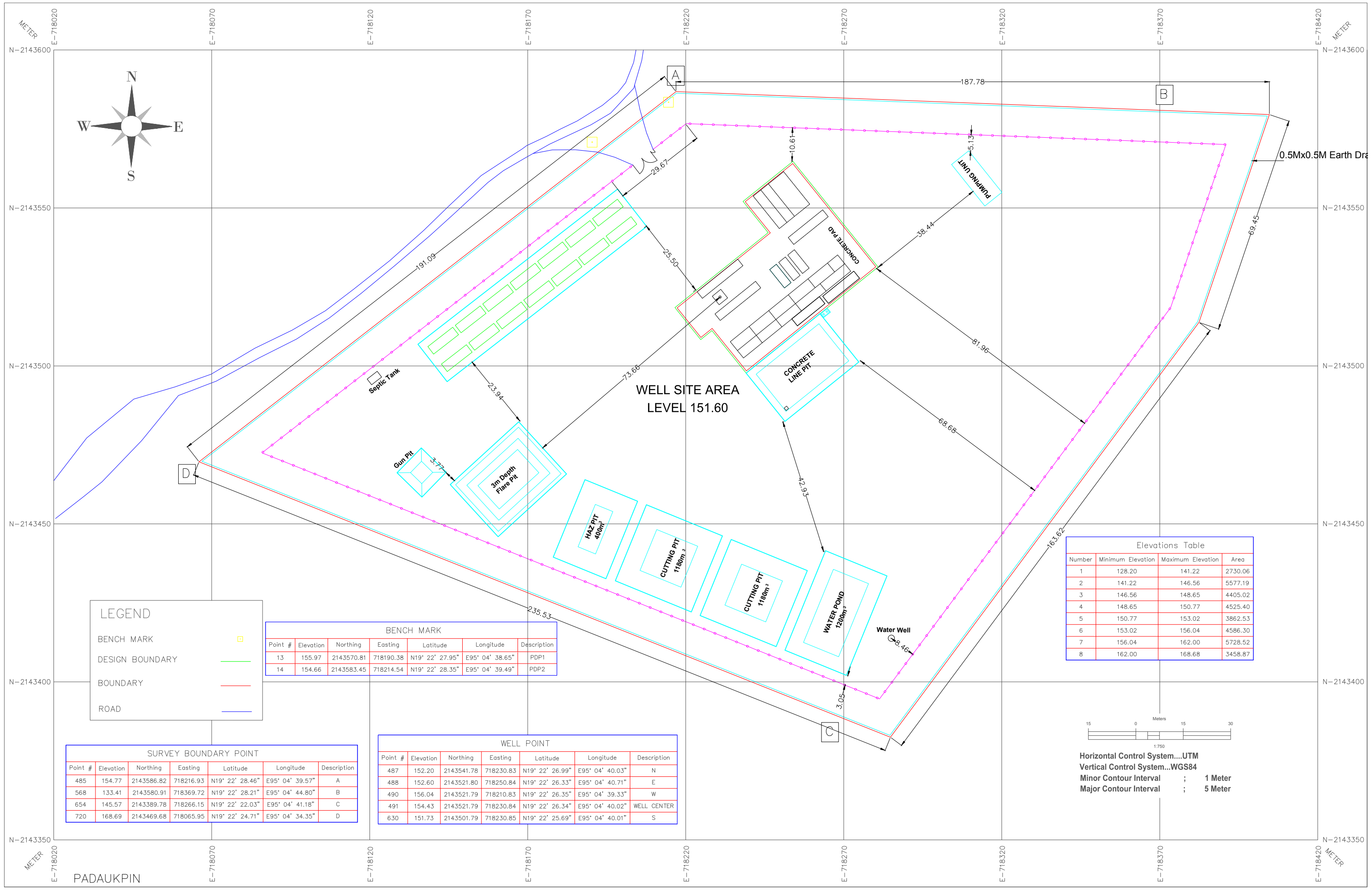
Source: PTTEP SA, 2018

Figure 4-11: Monatkon (MNK) Well Site Layout



Source: PTTEP SA, 2018

Figure 4-12: Ngabetkya (NBK) Well Site Layout



BENCH MARK

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
13	155.97	2143570.81	718190.38	N19° 22' 27.95"	E95° 04' 38.65"	PDP1
14	154.66	2143583.45	718214.54	N19° 22' 28.35"	E95° 04' 39.49"	PDP2

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area
1	128.20	141.22	2730.06
2	141.22	146.56	5577.19
3	146.56	148.65	4405.02
4	148.65	150.77	4525.40
5	150.77	153.02	3862.53
6	153.02	156.04	4586.30
7	156.04	162.00	5728.52
8	162.00	168.68	3458.87

SURVEY BOUNDARY POINT

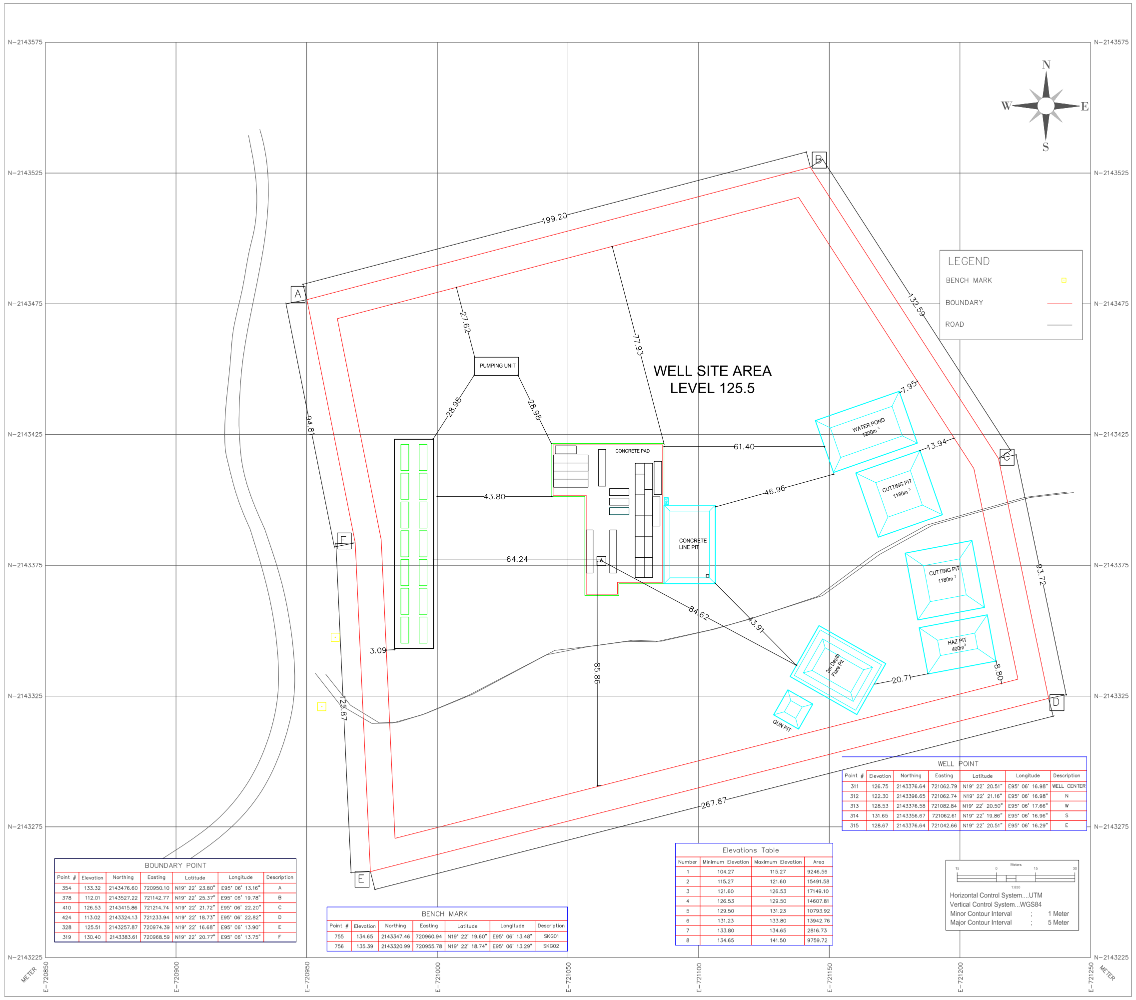
Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
485	154.77	2143586.82	718216.93	N19° 22' 28.46"	E95° 04' 39.57"	A
568	133.41	2143580.91	718369.72	N19° 22' 28.21"	E95° 04' 44.80"	B
654	145.57	2143389.78	718266.15	N19° 22' 22.03"	E95° 04' 41.18"	C
720	168.69	2143469.68	718065.95	N19° 22' 24.71"	E95° 04' 34.35"	D

WELL POINT

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
487	152.20	2143541.78	718230.83	N19° 22' 26.99"	E95° 04' 40.03"	N
488	152.60	2143521.80	718250.84	N19° 22' 26.33"	E95° 04' 40.71"	E
490	156.04	2143521.79	718210.83	N19° 22' 26.35"	E95° 04' 39.33"	W
491	154.43	2143521.79	718230.84	N19° 22' 26.34"	E95° 04' 40.02"	WELL CENTER
630	151.73	2143501.79	718230.85	N19° 22' 25.69"	E95° 04' 40.01"	S

Source: PTTEP SA, 2018

Figure 4-13: Padaukpin (PDP) Well Site Layout



BOUNDARY POINT

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
354	133.32	2143476.60	720950.10	N19° 22' 23.80"	E95° 06' 13.16"	A
378	112.01	2143527.22	721142.77	N19° 22' 25.37"	E95° 06' 19.78"	B
410	126.53	2143415.86	721214.74	N19° 22' 21.72"	E95° 06' 22.20"	C
424	113.02	2143324.13	721233.94	N19° 22' 18.73"	E95° 06' 22.82"	D
328	125.51	2143257.87	720974.39	N19° 22' 16.68"	E95° 06' 13.90"	E
319	130.40	2143383.61	720968.59	N19° 22' 20.77"	E95° 06' 13.75"	F

BENCH MARK

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
755	134.65	2143347.46	720960.94	N19° 22' 19.60"	E95° 06' 13.48"	SKG01
756	135.39	2143320.99	720955.78	N19° 22' 18.74"	E95° 06' 13.29"	SKG02

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area
1	104.27	115.27	9246.56
2	115.27	121.60	15491.58
3	121.60	126.53	17149.10
4	126.53	129.50	14607.81
5	129.50	131.23	10793.92
6	131.23	133.80	13942.76
7	133.80	134.65	2816.73
8	134.65	141.50	9759.72

WELL POINT

Point #	Elevation	Northing	Easting	Latitude	Longitude	Description
311	126.75	2143376.64	721062.79	N19° 22' 20.51"	E95° 06' 16.98"	WELL CENTER
312	122.30	2143396.65	721062.74	N19° 22' 21.16"	E95° 06' 16.98"	N
313	128.53	2143376.58	721082.84	N19° 22' 20.50"	E95° 06' 17.66"	W
314	131.65	2143356.67	721062.61	N19° 22' 19.86"	E95° 06' 16.96"	S
315	128.67	2143376.64	721042.66	N19° 22' 20.51"	E95° 06' 16.29"	E

Source: PTTEP SA, 2018

Figure 4-14: Sakangyi (SKG) Well Site Layout

4.5.1.15 Access Roads

PTTEP SA will use existing local roads for transportation as much as possible to each well site. However, due to the well sites being located in an agricultural area, PTTEP SA will need to construct new access roads to connect the well sites to the existing main roads for transportation of drilling rig and drilling equipment. PTTEP SA will consider the impact to the nearby villages and design the road accordingly. The land required for the access roads will follow land acquisition committee consideration and decision for compensation and access route. PTTEP SA will consider the final access road route depending on the land compensation committee consideration and approval.

PTTEP SA will obtain permission from the relevant local authorities and land owners prior to construction of the access roads. The land acquisition will mainly focus on the registered farmland/ paddy land. The land acquisition for the well sites and access roads will be according to MOGE's official formation order for Land Acquisition / Rental for drilling a Land Compensation committee will be established.

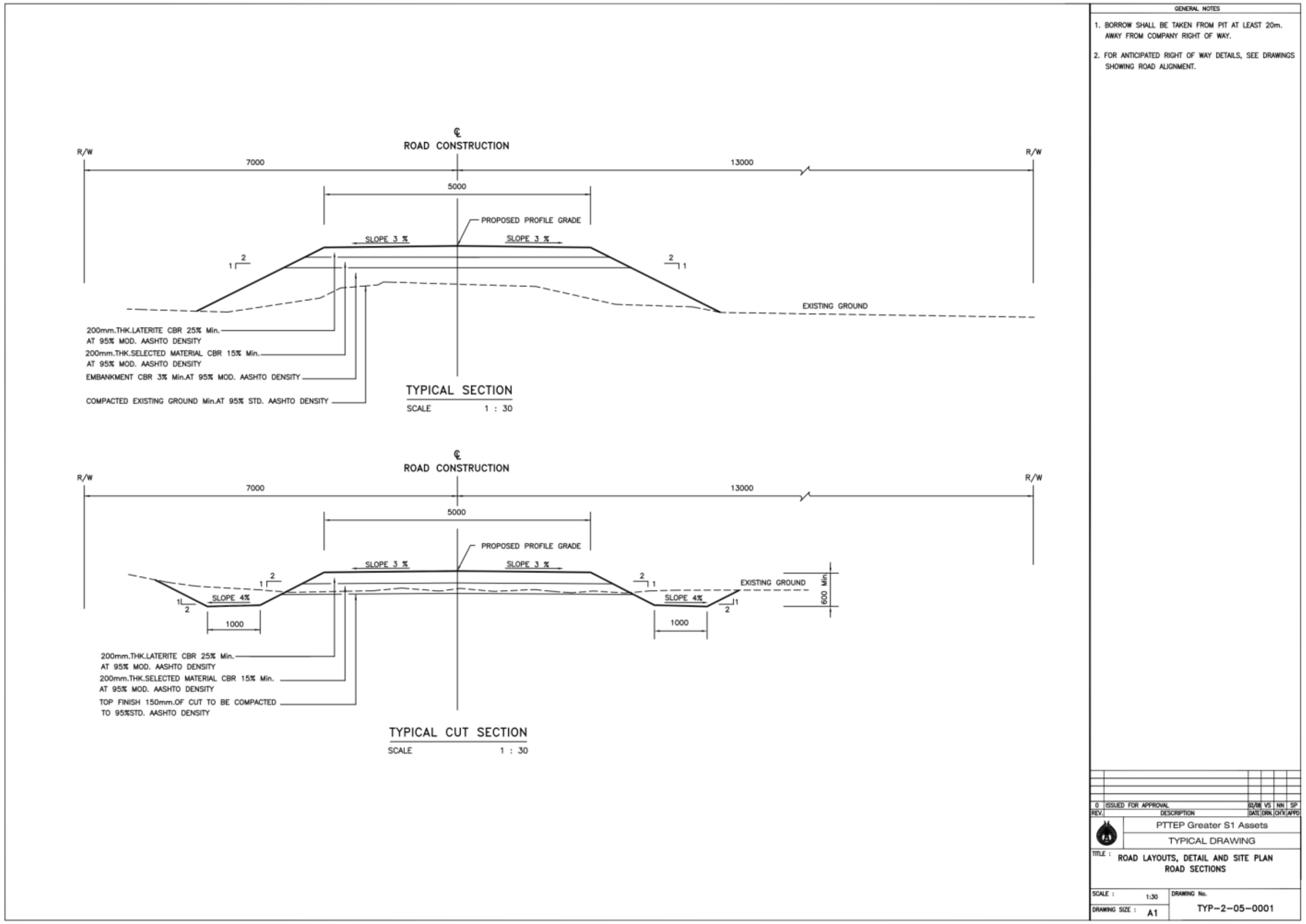
The distances of constructed access road to the Central Camp Site and the proposed well locations are provided in **Table 4-6**.

Table 4-6: The Road Locations and Access Road Distance to the Central Camp Site (CCS) and Proposed Well Locations

Work site	Start point	End point	Distance (km)
Central Campsite (CCS)	19°20'27.7"N 95°09'46.6"E	19°20'33.0"N 95°09'45.8"E	0.250
Padaukpin (PDP)	19°21'54.5"N 95°04'39.3"E	19°22'27.9"N 95°04'38.3"E	1.4
Monatkon (MNK)	19°31'21.4"N 95°00'50.0"E	19°30'41.7"N 94°59'36.2"E	3.1
Ngabetkya (NBK)	19°21'24.8"N 95°02'19.4"E	19°25'56.5"N 94°59'13.9"E	14
Sakangyi (SKG)	19°22'19.3"N 95°06'13.1"E	19°22'18.9"N 95°06'15.4"E	0.25
Tazigauk (TZG)	19°33'55.0"N 95°00'18.4"E	19°33'33.0"N 95°00'30.1"E	1.6
Natmi (NTM)	19°14'37.2"N 95°06'18.2"E	19°13'01.0"N 95°00'59.7"E	10

The proposed well locations can be accessed by car from Thayet. But most of the earth road cannot be used in the rainy season. Therefore, new access roads will be designed as single lane, un-surfaced roads, constructed of compacted laterite and selected material. The roads will be 5 m with side slopes of 2:1, constructed with 200 mm of compacted laterite and 200 selected materials as shown in **Figure 4-15**.

The maps of the proposed of access roads has been surveyed for 6 of the proposed well site. (**Figure 4-16** to **Figure 4-21**) The survey has only been completed for 6 wellsites, therefore the remaining two wellsites (**Figure 4-22** and **Figure 4-23**) have multiple options for access road.



Source: PTTEP SA, 2018

Figure 4-15: Longitudinal-Section of Proposed Access Road

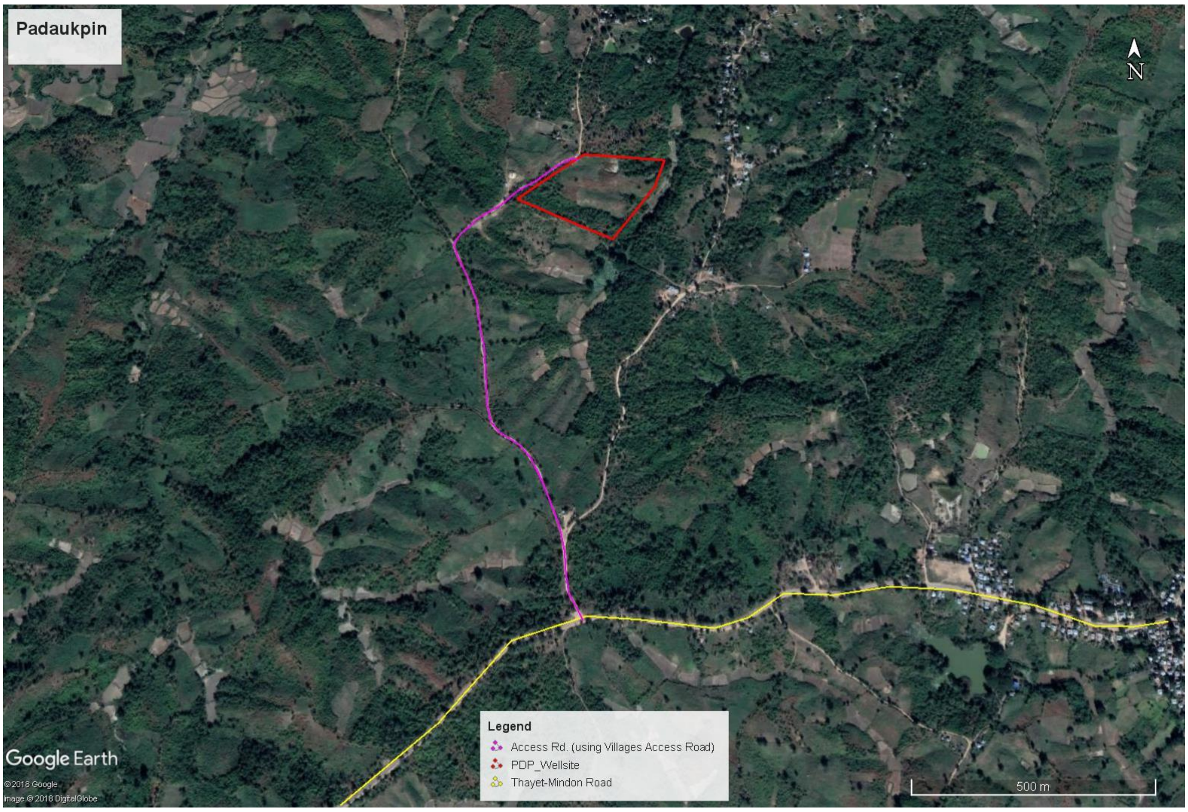


Figure 4-16: Proposed Access Road for Padaukpin Wellsite

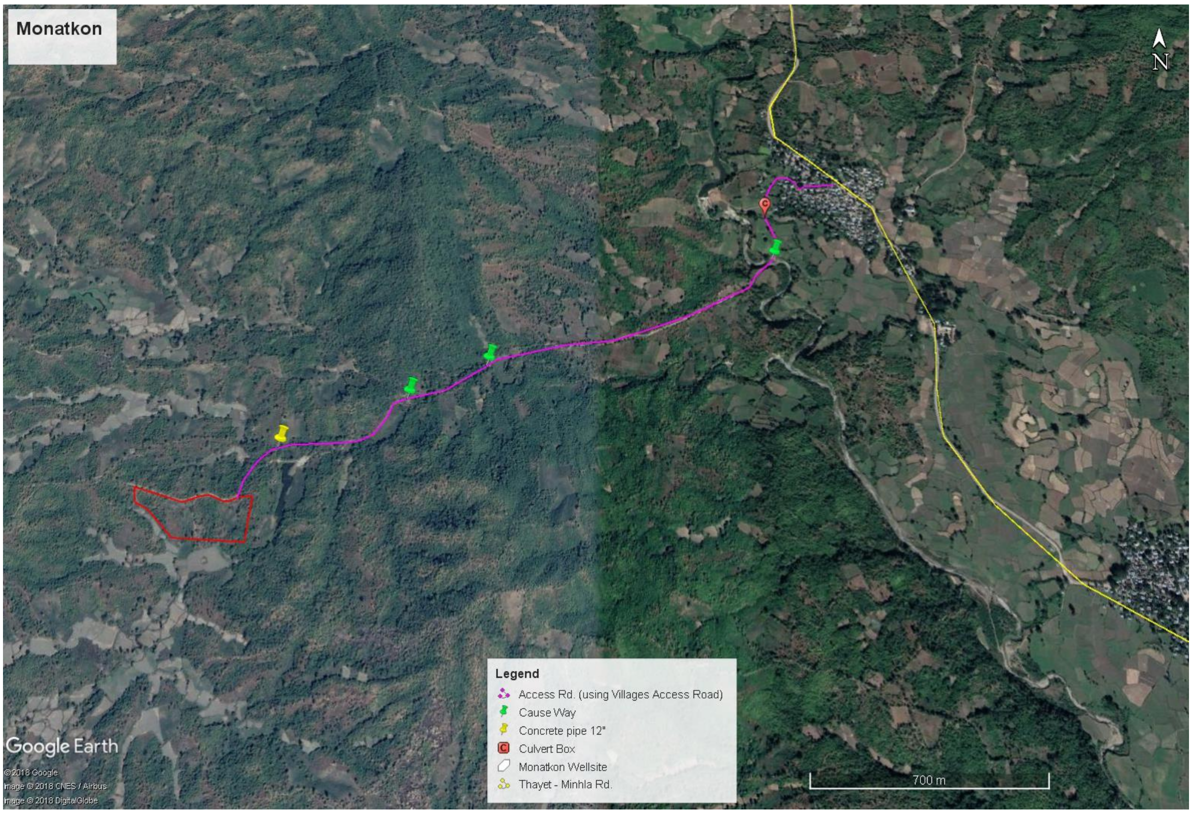


Figure 4-17: Proposed Access Road for Monakton Wellsite

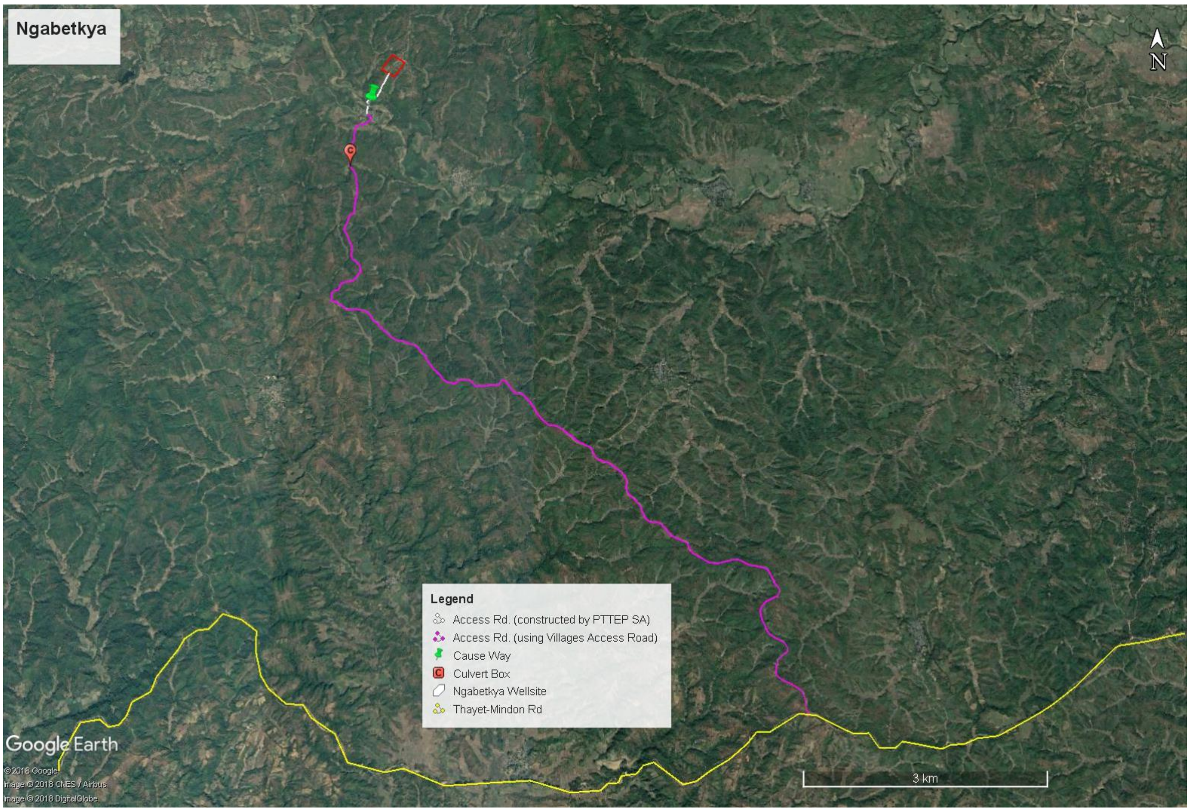


Figure 4-18: Proposed Access Road for Ngabetkya Wellsite

Figure 4-19: Proposed Access Road for Sakangyi Wellsite

Figure 4-20: Proposed Access Road for Tazigauk Wellsite

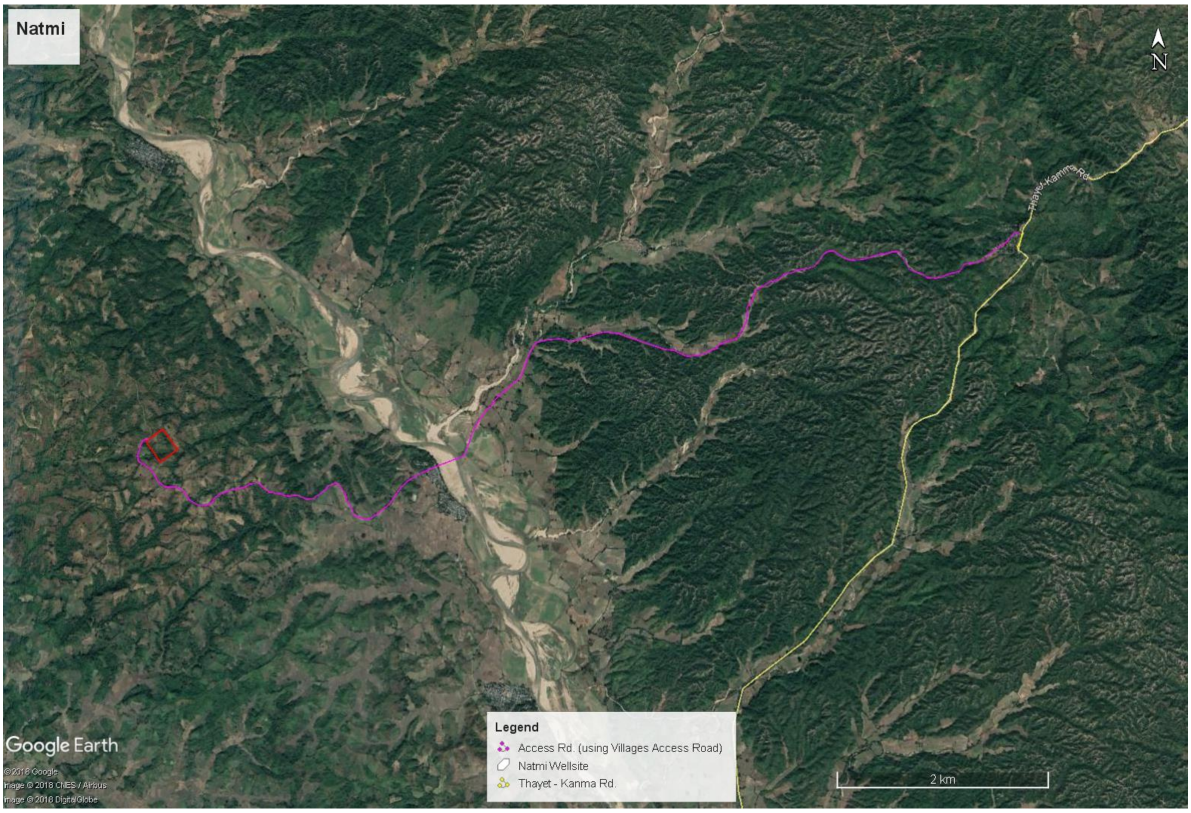


Figure 4-21: Proposed Access Road for Natmi Wellsite

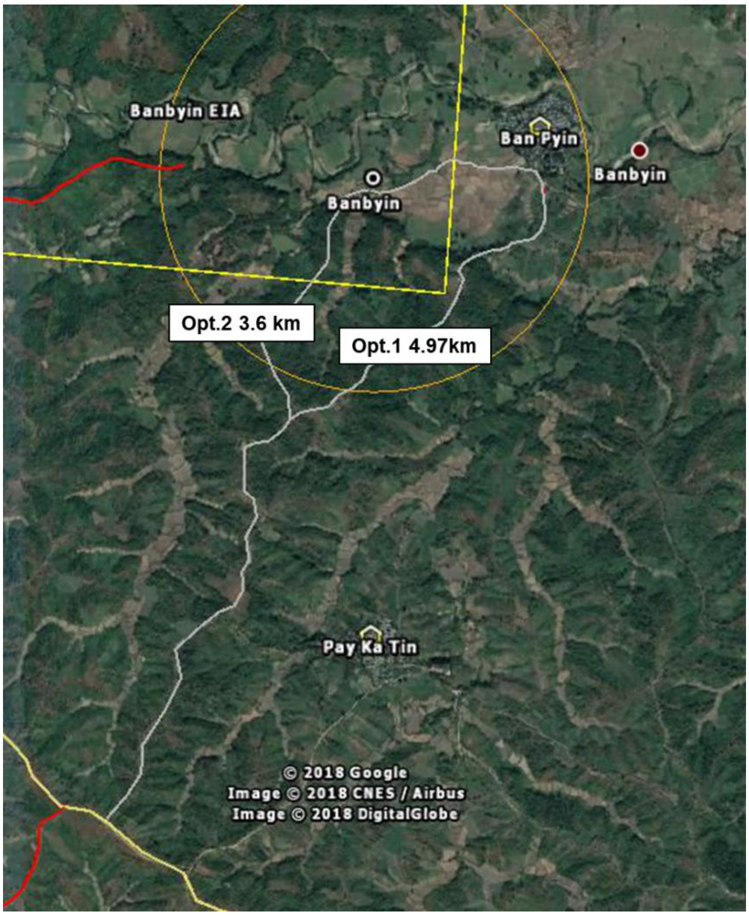


Figure 4-22: Potential Access Road Options to Banbyin Well site

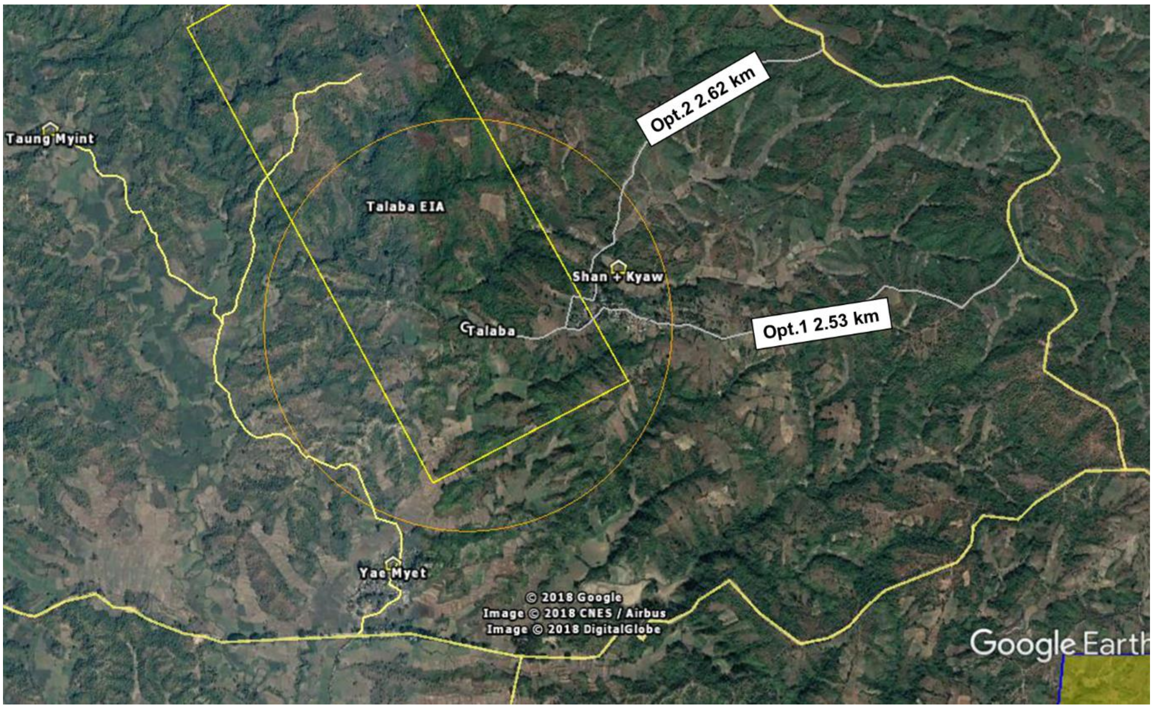


Figure 4-23: Potential Access Road Options to Tabala Well site.

4.5.1.16 Stream Crossings

The proposed access roads will require some stream crossings. The stream crossings have been designed based on the expected water volume. The crossing types and locations are described in **Table 4-7**.

The typical engineered schematics for the causeway is detailed in **Figure 4-24** and **Figure 4-25**. The schematic of the box culver is detailed in Figure 4-26. The Natmi wellsite will require a river crossing, however due to the size of the stream no permanent installation will be constructed and vehicles and equipment will complete a shallow river crossing to access the well site.

Table 4-7: Crossing the stream for Proposed Access Road

Description	**Coordinate**
MNK	
1. Culvert box	19°31'16.7"N 95°00'41.1"E
2. Causeway#4	19°31'11.2"N 95°00'41.6"E
3. Causeway#3	19°30'57.4"N 95°00'07.4"E
4. Causeway#2	19°30'53.4"N 94°59'58.5"E
5. Concrete pipe 12"	19°30'47.8"N 94°59'44.4"E
NBK	
1. Culvert box	19°25'13.5"N 94°58'56.7"E
2. Cause way	19°25'41.5"N 94°59'03.5"E
Natmi	
1. River Crossing	No installation required. Shallow River crossing will be carried out by equipment only.

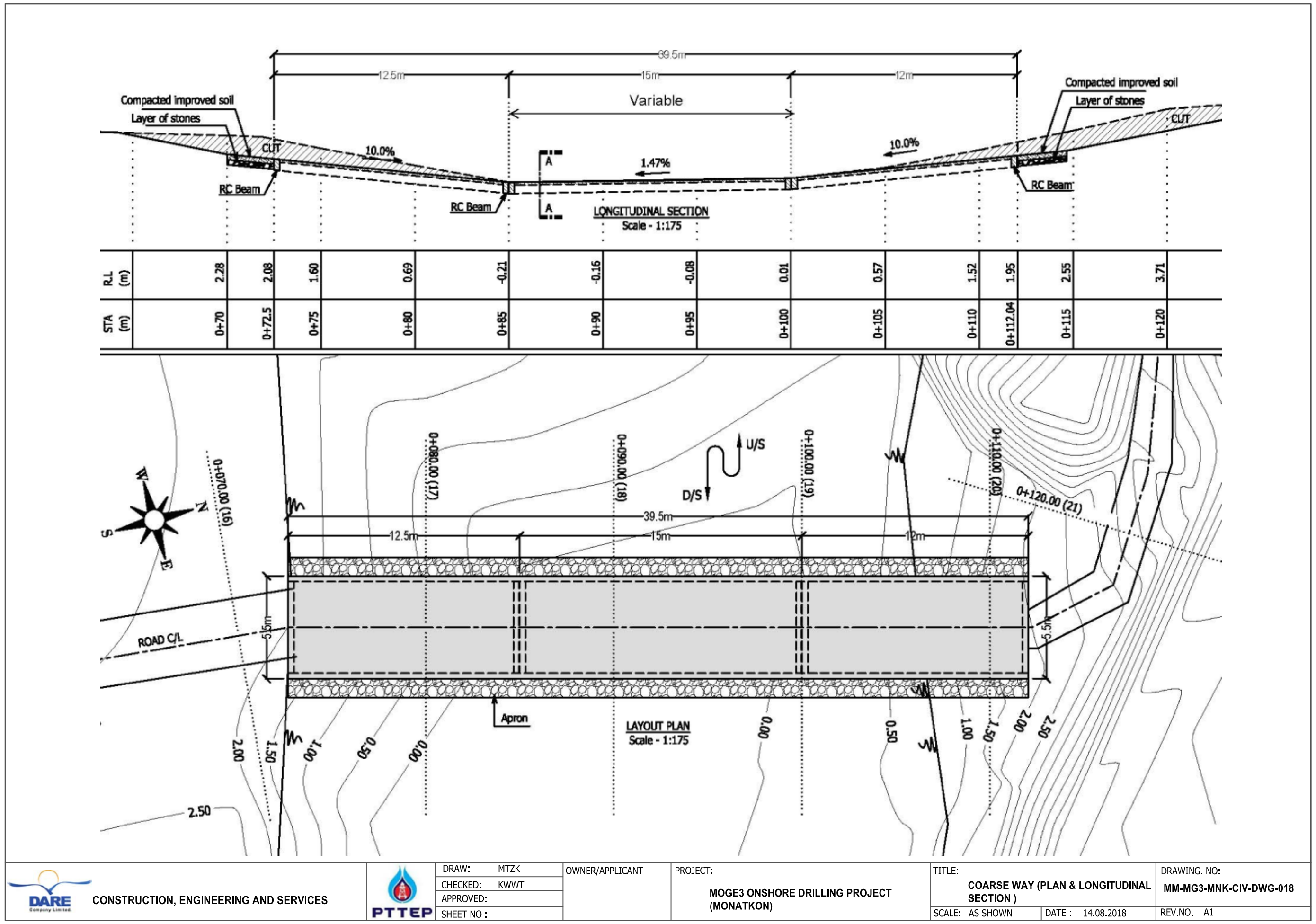


Figure 4-24: Schematic of Causeway Crossings

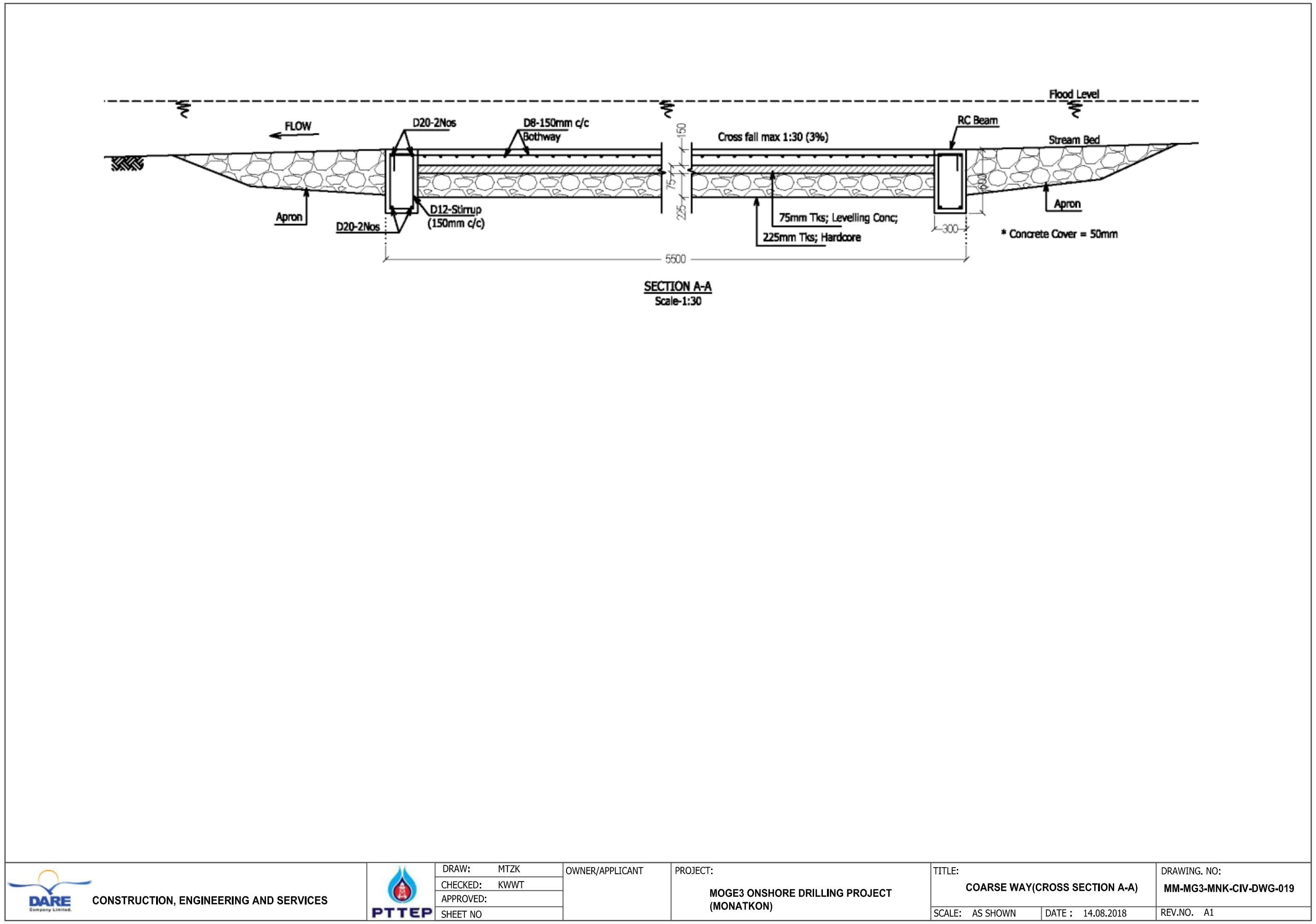


Figure 4-25: Cross-section Schematic of Causeway Crossings

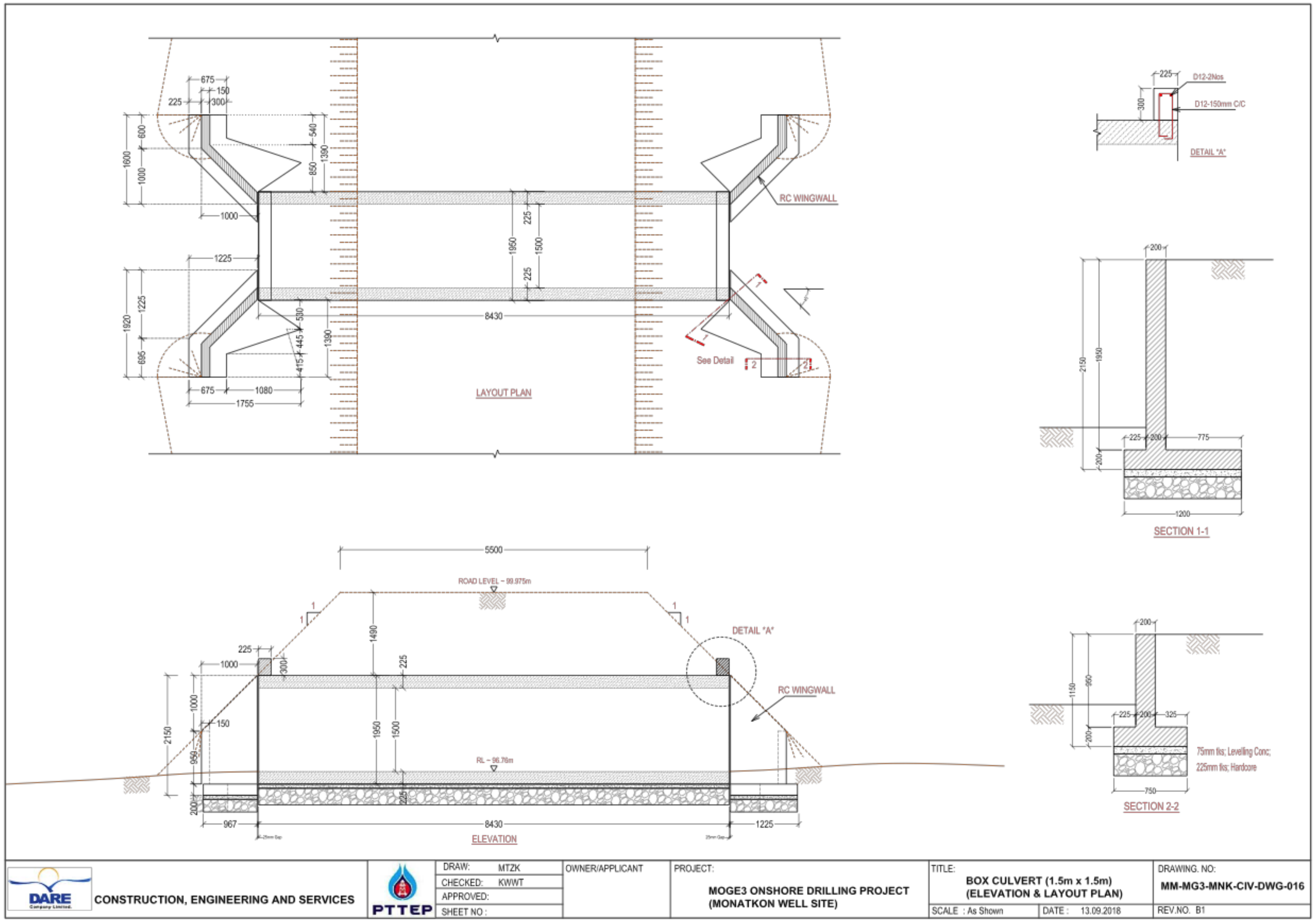


Figure 4-26: Schematic of Box Culvert

4.5.2 Layout and Facilities in Basecamp, Central Campsite and Accommodation Areas

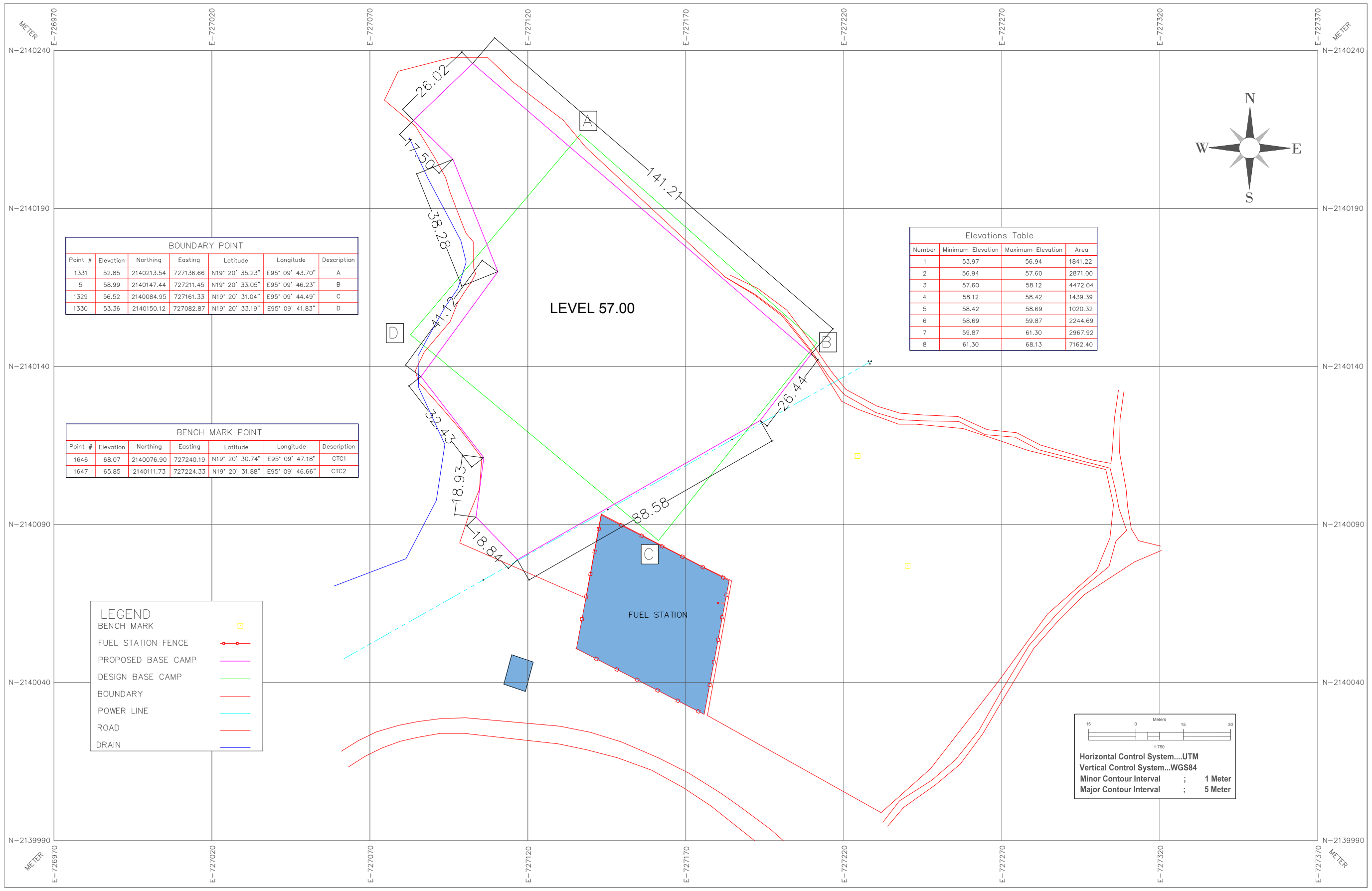
There is no suitable existing accommodation, such as hotels or guest houses, within a reasonable distance of the proposed well sites, so a temporary camp site will be established near to the well sites.

The planned central camp site will be located 3 km outside of Thayet town by the main road. The area of the camp site is about 100 m x 100 m. (Coordinate WGS84 = X: 412004.39, Y: 21388942.42). The basecamp will be designed and built to international standard and comply with IFC Workers' accommodation Guidelines. The layout of the campsite is shown in **Figure 4-27**. The location of the camp site and proposed access road is shown in **Figure 4-28**.

During the civil work phase, there will be a temporary basecamp built to place all the workers with basic requirement such as beds, food, clean water and hygienic facilities.

During the drilling phase, there will be a central campsite. There will also small container to be placed at the rig site to accommodate the essential crew such as company man, rig tool pusher and minimum crew. The camp accommodation will be a container types with the power being generated from a portable diesel engine generator. The campsite will be industry-standard, consisting of container-based sleeping and living quarters, messing and recreation facilities, with a capacity to accommodate up to 140 personnel. Of these personnel, PTTEP SA plans to hire 15-20 locally. It will have its own cooking, freezer food storage, laundry and sanitation facilities as well as its own power generation by diesel powered generators.

The rig crew and service personnel work 12-hour shifts and are rotated from duty on a maximum 28-day schedule, as is standard industry practice. PTTEP SA will also ensure that a full time doctor will stay at the site 24 hours a day, 7 days a week during the drilling phase. MOGE provides at its discretion an on-site representative, who observes operations and provides advice on compliance with Myanmar regulations.



Source: PTTEP SA, 2018

Figure 4-27: Layout of Central Camp Site

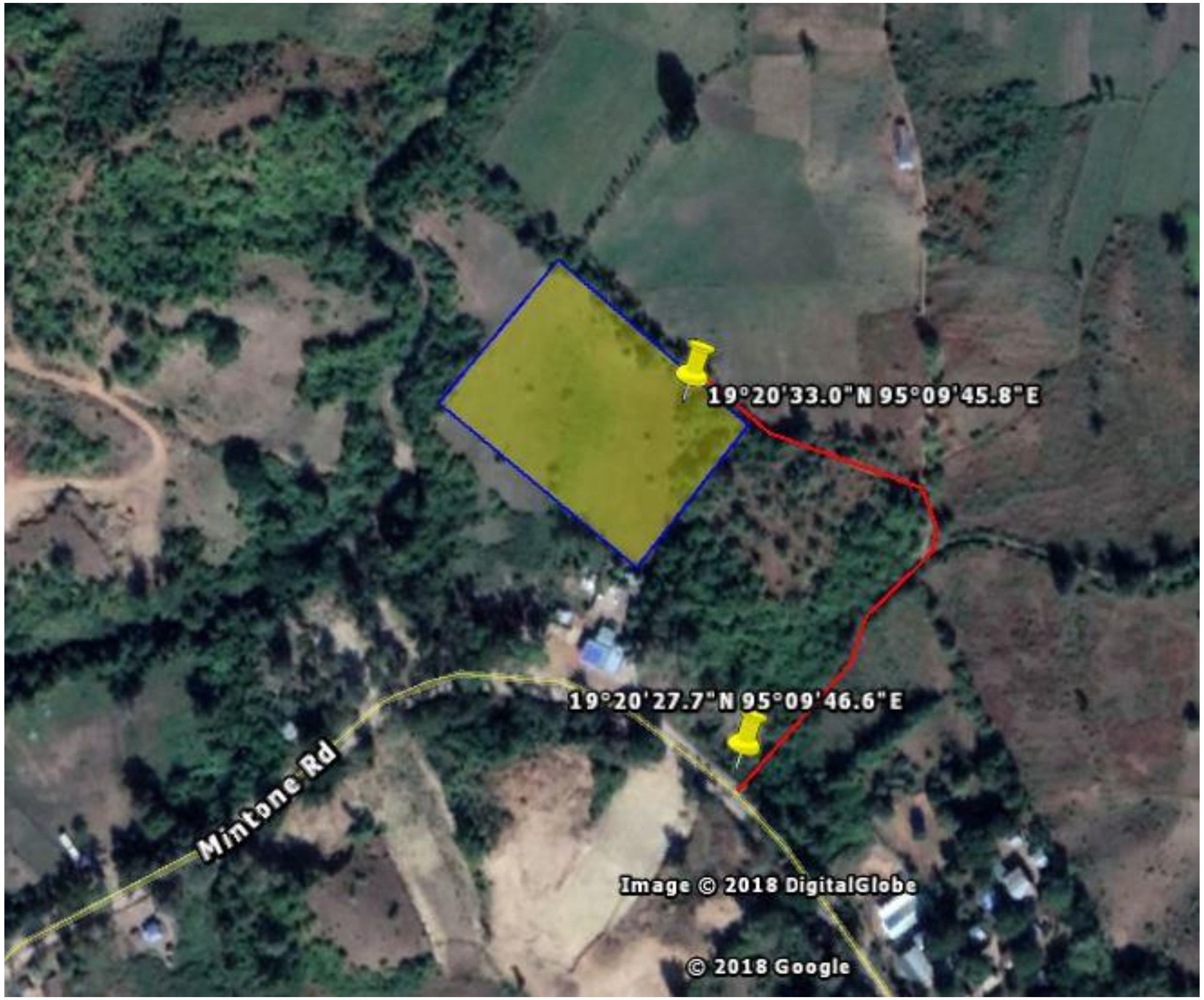


Figure 4-28: Location of Central Camp Site & Proposed Access Road

4.5.2.1 Potable Water

During the civil works phase, the drinking/consumption water (~300 liters daily bottled) will be trucked to the camp and another 200 liters to be used for hygienic purposes either to be sourced from water well or to be trucked.

During the exploration drilling phase, the drinking/consumption water (~600 litres of water bottled) will be required daily and another 600 liters to be used for hygienic purposes either to be sourced from water well or to be trucked as well.

The under-ground water well will be constructed at well sites. During civil works or exploration drilling phase, the under-ground water well will be used if it is sufficient. If tube type wells are not successful or water not suitable, water will be sourced and transported by tanker from nearby reservoirs/rivers. Local authorities will be consulted before water hauling.

4.5.2.2 Drainage Control within Central Campsite

There are no potentially harmful chemicals stored at the central campsite that could drain offsite. The fuel tank for the camp generator will be placed on an impermeable membrane and bunded to contain potential fuel leaks. There will be spill kits and absorbents at the central campsite site to clean up any potential fuel or oil spills during vehicle maintenance or use.

4.5.2.3 Central Camp Site Sewage System

A set of concrete septic tanks will be built into the work camp pad at the outer edges. They will have a combined capacity of 8000 litres (8 m^3). No pump out of septic sludge is required as the concrete septic tanks and any sewage sludge will be left in ground onsite at the end of the drilling campaign.

Wastewater from the campsite, including both grey water and black water, will be treated separately. Grey water will be treated in a soak pit and Black water will be treated in septic tank and soak pit.

A waste management plan will be prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations.

4.5.2.4 Central Campsite Power

The central campsite will be as a container types with the power being generated from portable diesel engine generator. The engine will be running 24 hours a day to power up the lighting, equipment and other necessity. For cooking, cylinder gas also to be considered.

All power for the base camp site will be provided by the camp’s 100 KVA diesel-fueled generators. Expected fuel consumption is 0.5 m^3 per day during full accommodation. On-site fuel storage capacity will consist of one 25 m^3 tank. Estimated total fuel usage is about 30 m^3 (based on 60 days of drilling).

4.5.3 Stages of Operation

Major activities of project consist of Construction Phase, Drilling Phase, Well Testing Phase and Well Completion, Suspension, Abandonment or Contingency Well. The activity chart of the project is shown in **Figure 4-29**.

1. **Construction Phase**

   Details are preparation and construction of the drilling area, access road construction, rig and equipment installation and elements of the drill area.

2. **Drilling Phase**

   Details are hole and casing design, drilling exploration methodology, types and components of drilling mud, drilling mud volume, volume of cutting from drilling and wire line logging.

3. **Well Testing Phase**

   Details are well testing equipment installation, well testing operation, waste management from well testing operation.

4. **Well Completion, Suspension, Abandonment or Contingency Well**

5. **Reinstatement Phase**

   After completion of all activities, the work site will be made ready to handback to MOGE or villager or communities in the agreed condition.

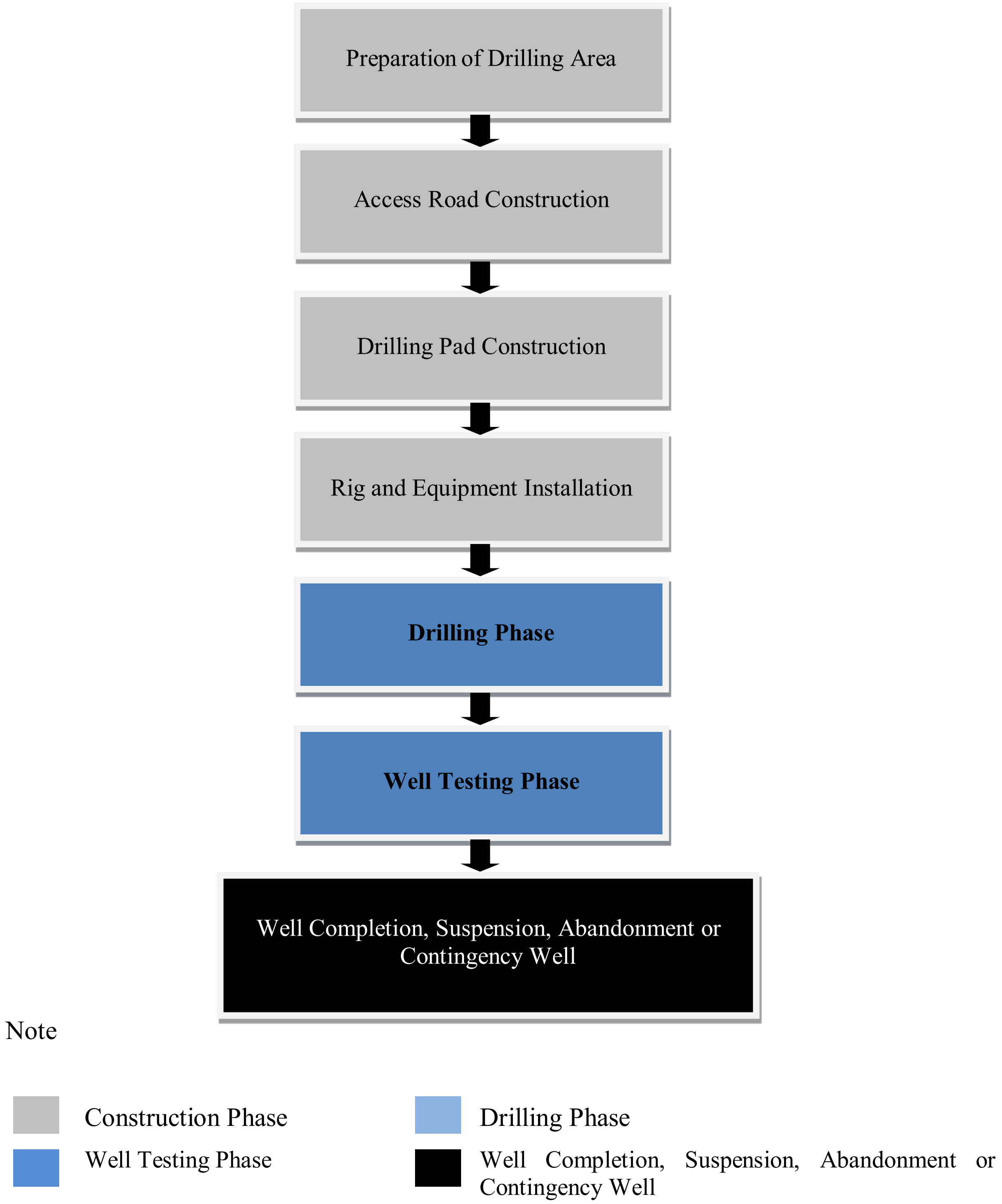


Figure 4-29: Activity chart of project

4.5.3.1 Construction and Rig Installation Phase

4.5.3.1.1 Well Site and Central Camp Site and Access Road

Each well site will have a similar construction plan. The well sites and central campsite will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted pad will be approximately 500 mm thick.

A barbed wire fence to keep animals and unauthorized persons from entering the site will surround the well pad and central campsite pad areas. Security guards will also be employed and stay on each site 24 hours per day, 7 days per week throughout rig mobilization, set up, drilling and well testing until the site is abandoned

Dimensions of the well site and accommodation camp site to be constructed are summarised in **Table 4-8**.

Table 4-8: Dimensions of Well Pad, Work Camp Pad

Item	Dimensions	Area	Estimated Fill
Each Site			
Well site	240 m x 200 m x (500 mm thick)	48,000 m^2	24,000 m^3 (1)
Central Campsite	100 m x 100 m x 500 mm thick	10,000 m^2	5,000 m^3

(1) Estimate based on an average of 500 mm thick

All of the materials to be used for constructing the well site and facilities are to be provided by the civil engineering contractor. This contract will be issued to a local construction company as per MOGE and PTTEP SA's policy of ensuring that the economic benefits of the project are concentrated within the Province. The civil engineering contractor will obtain fill materials from local extraction sites operating under permit from the relevant local authorities.

It will be the responsibility of the civil engineering contractor to source the fill materials and the materials must also be of a high quality grade for use as un-surfaced road building material and acceptable to PTTEP SA for construction of the well pad.

4.5.3.1.2 Rig Installation

PTTEP SA intends to use a typical land rig for this drilling campaign. One drilling rig will be used for the entire campaign. The drilling rig will be mobilized onsite overland or the rig will be moved along the Ayerwaddy river to Thayet Cement Factory Jetty by the barges then mobilized overland to central camp site or site. Approximately 130 truck loads are required to mobilize the drilling rig. The following rig components will be mobilized and installed on site:

1) Hoisting system consists a derrick and platform or derrick floor used for clinging and installing the drilling equipment to the tower. The drilling equipment include crown block handed on a cable which use to raise and lower a drill string in the well.

2) Rotating system consists of a hydraulic top drive to spin, raise and lower the drill string equipped with a drill bit.

3) Mud & Cuttings circulating system

During drilling operation, drilled cuttings and fluids are removed from the well. Mud is added to the pipe and flows out at the hole of drill bit to: carry cuttings to the surface, transmit power and lubrication to the drill bit; exert a hydrostatic head to help prevent caving or sloughing of the formation; prevent flow of formation fluids into the borehole; and maintain dense materials

such as cuttings and barite in suspension in the borehole to maintain downward pressure in the well.

4) Mud mixing unit consist of mud mixing tank and mud pump. The equipment functions as chemical mixing unit for mud.

5) Cementing unit consists of cement mixing tank, cement storage tank and cement pump. The equipment functions as chemical mixing unit for cement. Cement will be used to prevent fluid infiltration to borehole.

6) Power system

Rig may be located far from main power supply (Electric Transmission Line). Therefore, three units of diesel electric generator must be installed in the rig to supply electricity.

7) Wireline logger

A mobile truck-mounted wireline logging unit will be used for geophysical tests. (Wireline logging)

8) Mud Logging

Mud Logging will continuously monitor the drilled well by determining inner borehole condition and surface parameters.

9) Drilling mud laboratory

Drilling mud laboratory will be equipped with drilling mud testing equipment.

For rig installation, cranes will be used and the process will take approximately 7 days.

4.5.3.2 Drilling Operations Phase

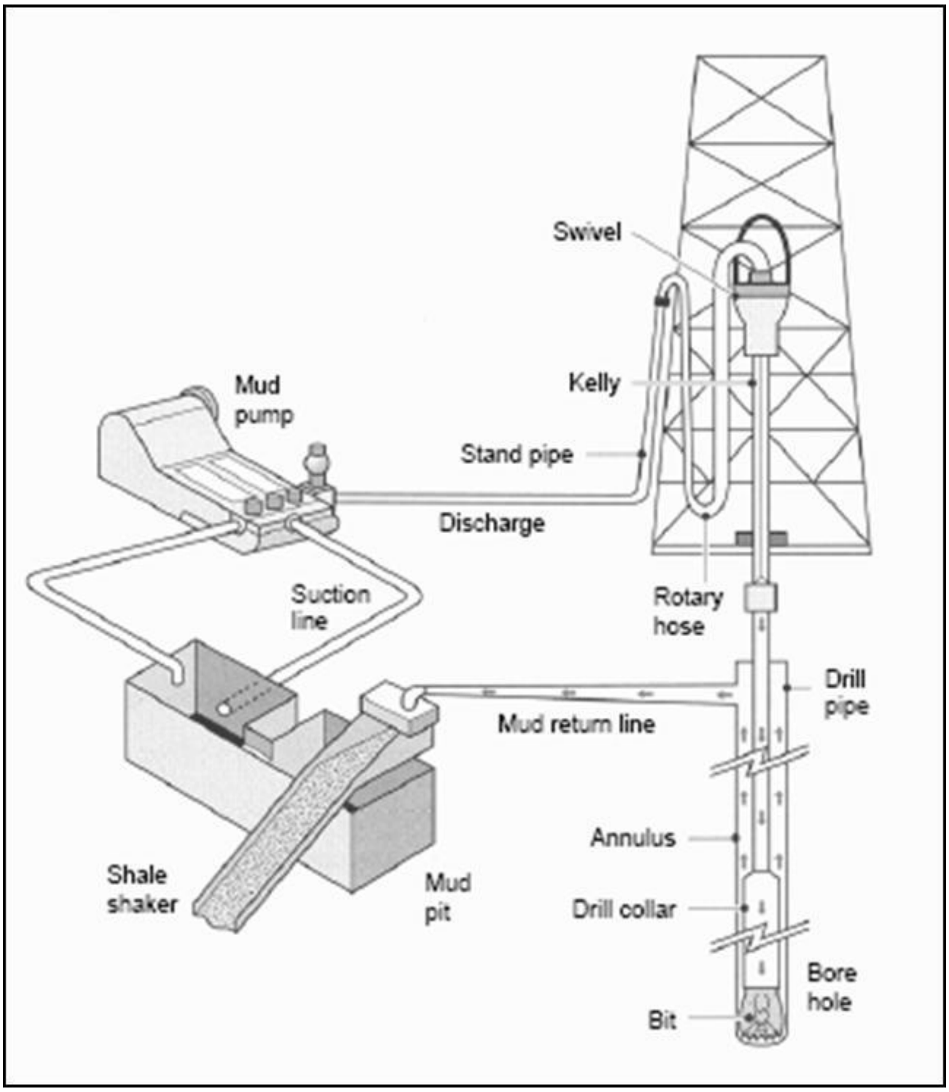
All operations on these wells will be carried out in accordance with the appropriate international API standards, PTTEP SA Drilling Management System, copies of which will be at the rig site and must be read and understood by everyone involved in these well operations.

Drilling operations and associated services will be conducted on a 24-hour basis. Drill crews will work alternate 12-hour shifts rotated from duty on a maximum 28-day schedule, as is standard industry practice.

The basic steps of drilling an exploration well are summarized below.

- Drilling the Hole - The drill string is a series of long, hollow steel pipes, which can be screwed together. The drill bit, which has a larger diameter than the drill string, is the cutting tool and is screwed to the end of the drill string. A hoist system within a derrick over the well allows the drill string to be assembled and broken down into manageable sections.
- Drilling Fluids System - The drill string and bit are lubricated and cooled by a drilling fluid, commonly referred to as mud. This mud is stored in large steel tanks beside the rig, from where it is pumped down through the drill string.
- Mud Cleaning Equipment - When the drilled cuttings are brought to the surface with the drilling fluids, they will first pass through a mud treatment system commonly consisting of shale shakers. This comprises of a vibrating frame fitted with a series of fine mesh screens, which separate the vast majority of the drill cuttings from the drilling mud. A typical drilling schematic is provided in **Figure 4-30**.
- Casing and Cementing - Various sections of the hole will be drilled at different diameters, with the size of the borehole decreasing with depth. Each section of the hole will be lined with thick steel tubing, known as casing, which will be fully cemented in place. This ensures

that the hole remains stable and that the surrounding geological formations, in particular those that may act as fresh water aquifers, are not contaminated. This casing also helps in the process of controlling the pressure of any gas that the well might penetrate, as it is prevented from flowing into shallower, less pressurised formations.



Source: PTTEP SA, 2018

Figure 4-30: Typical Drilling Rig and Mud System

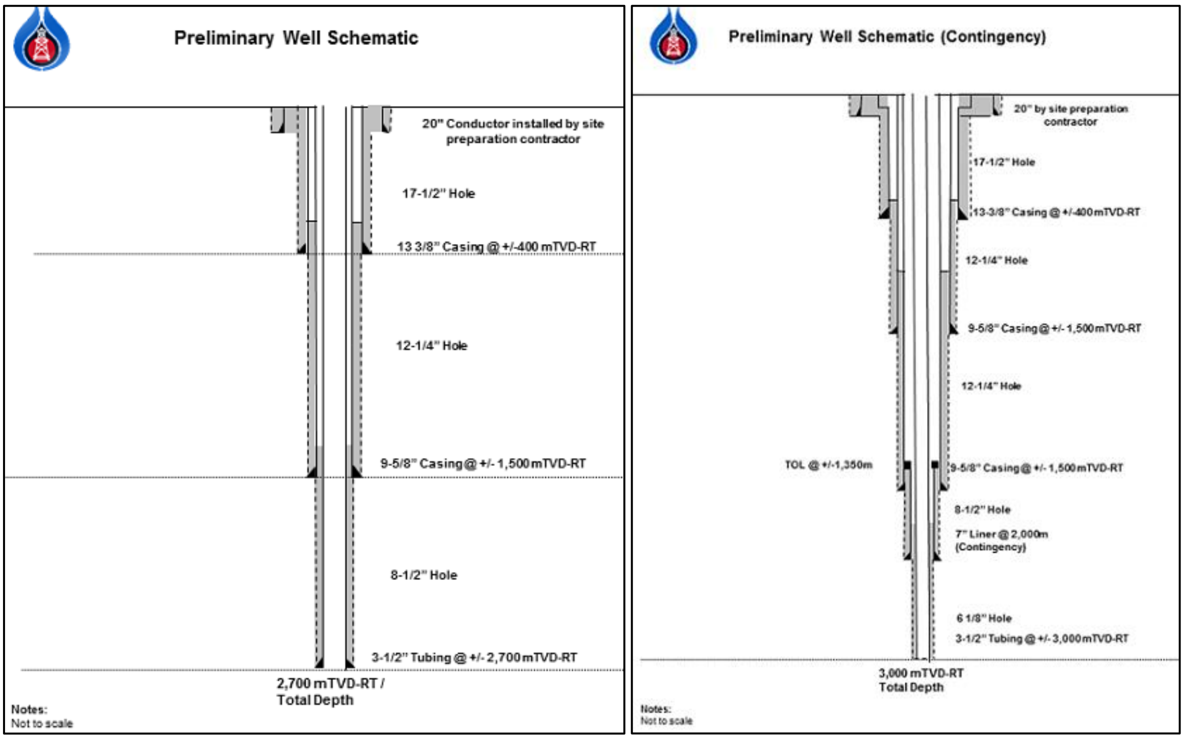
4.5.3.2.1 Hole and Casing Design

The well design for each well will have 4 bore hole sizes of 26-inch (0.660 m), 17½-inch (0.445 m), 12 ¼-inch (0.311 m) and 8 ½-inch (0.216 m). The general hole and casing dimensions are summarized in **Table 4-9**. The preliminary hole and casing schematic diagrams for MOGE-3 wells are shown in **Figure 4-31**. However, these are subject to change slightly based on the operational criteria and geological requirements.

Table 4-9: Hole and Casing Design for each Well

Well sites	Interval	Hole Diameter (inches)	Casing Size (inches) External	True Vertical Depth (m)
Wells	Conductor	35-45"	30"	24
	Surface	26	20	400-500
	Intermediate	17.5	13 3/8	400-1200
	Production	12.25	9 5/8	1000-1800
	Production	8.50 and/or 6.125	7" and/or 4-1/2"	2600-3200

Source: PTTEP SA, 2018



Source: PTTEP SA, 2018

Figure 4-31: Preliminary casing schematics

4.5.3.2.2 Drill Exploration Process

Drilling and Casing

- **26-inch Hole-** The well drilling operations will begin by drilling a 26-inch (0.660 m) hole from surface to the designated depth. This section will be drilled with a basic water-based mud system. Hi-viscosity mud sweeps will be pumped to clean the hole during connections. A 20-inch surface casing will be run and cemented to surface. A surface blowout prevention (BOP) stack will be installed before drilling the next section. No shallow gas is expected in this project.
- **17 ½-inch Hole** - A 17 ½ -inch hole will then be drilled to the designated depth. This section will be drilled with a low toxicity Water Based Mud (WBM) or Synthetic-based fluid (SBM). The 13 3/8" casing string will be run and set to the designated depth.
- **12 ¼-inch Hole** - The 8 ½ -inch hole will then be drilled to the designated depth. This section will be drilled with a low toxicity Water Based Mud (WBM) or Synthetic-based fluid (SBM) system as the previous section. The 9 5/8" casing string will be run and set to the designated depth.
- **8 ½ and/or 6-1/8 -inch Hole** - The 8 ½-inch hole (the reservoir section) will be drilled with Water Based Mud (WBM) or Synthetic-based fluid (SBM). A 7-inch production line will be used as a contingency.

Technical or operational constraints

Technical/operational constraints would be pipe stuck, lost circulation, clay swelling, hole pack-off, well kick, hole wash out and hole ballooning. However high temperature and high pressure are not expected on these wells.

Drill Cuttings

Drill cuttings are formation particles generated by the drill bit during the drilling process and vary in size from small slivers (less than 10 mm in length) to dispersed clays and ultra fine particulates (less than 0.002 mm). The exact nature of the cuttings will depend on the geological formations drilled though. After being processed by the Solids Removal Equipment (shale shakers) the drill cuttings are sent to the cuttings pit. The estimated cuttings volume is about 1500 m^3 per well. However this could vary according to each hole section TD.

Drilling Mud

Mud performs a number of functions. Apart from carrying cuttings to the surface, it: transmits power and lubrication to the drill bit; exerts a hydrostatic head to help prevent caving or sloughing of the formation; prevents flow of formation fluids into the borehole (which could lead to a blowout); and maintains dense materials such as cuttings and barite in suspension in the borehole to maintain downward pressure in the well, when circulation is interrupted (as when adding a new joint of drill-pipe).

Many types of drilling fluids are used on a day-to-day basis world wide. Some wells require that different types be used at different parts in the hole, or that some types be used in combination with others. The PTTEP campaign is planning to use Water Based Mud (WBM) to drill the wells, however Synthetic-based fluid (SBM) will be an option if encounter hole problem. The estimated mud volume is about 5000 bbls per well. However this could vary according to each hole section TD. (**Table 4-10 and Table 4-11**)

The mud and cutting disposal options will depend on the type of mud system used. The main disposal options include: (1) sending wastes to DOWA waste facility for landfill and disposal; or (2) onsite

bioremediation and burial. PTTEP will propose both options to MOGE for approval before final disposal.

Drilling fluids will be circulated in a closed loop system to recycle the drilling mud and contain all wastes. A summary of MSDS for the drilling muds are included in **Table 4-12**. Full MSDS sheets are to be provided at the work site.

Table 4-10: Size and depth of exploration wells

Well sites	Interval	Hole Diameter (inches)	Casing Size (inches)	True Vertical Depth
			External	(m)
Wells	Conductor	35-45”	30”	24
	Surface	26	20	400-500
	Reservoir Section	17.5	13 3/8	400-1200
	Reservoir Section	12.25	9 5/8	1000-1800
	Reservoir Section	8.50 and/or 6.125	7” and/or 4-1/2”	2600-3200

Table 4-11: SBM Drilling mud concentrations and consumption

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m^3)	(kg)	(kg/m^3)	(kg)
26” x 20”	WBM	Barium Sulphate			253	88000
		Bentonite	42.75	4200	22.84	5700
		Starch			7.125	2900
		Caustic Soda	0.3	27	0.3	120
		Sodium Bicarbonate	0.7	67	0.3	290
17-1/2” x 13-3/8”	SBM	Base Fluid			593.98	20688.45
		Primary Emulsifier			8.48	295.36
		Secondary Emulsifier			16.01	557.63
		Organophilic Clay			17.95	625.20
		Gilsonite			19.47	678.14
		Calcium Hydroxide			24.42	850.55
		Polymeric Blend			2.64	91.95
		Fresh Water			140	4876.23
		Calcium Chloride			37.71	1313.45
		CaCo3 Fine			40.5	1410
		CaCo3 Medium			40.5	1410.62
		CaCo3 Coarse			15.37	535.34
		Barite			259.46	9037.05

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m^3)	(kg)	(kg/m^3)	(kg)
12 ¼” x 9-5/8”	SBM	Base Fluid			593.98	20688.45
		Primary Emulsifier			8.48	295.36
		Secondary Emulsifier			16.01	557.63
		Organophilic Clay			17.95	625.20
		Gilsonite			19.47	678.14
		Calcium Hydroxide			24.42	850.55
		Polymeric Blend			2.64	91.95
		Fresh Water			140	4876.23
		Calcium Chloride			37.71	1313.45
		CaCo3 Fine			40.5	0.00
		CaCo3 Medium			40.5	1410.62
		CaCo3 Coarse			15.37	535.34
		Barite			259.46	9037.05
8 ½” x 7” and/or 6-1/8” x 4-1/2”	SBM	Base Fluid			593.98	87492.0
		Primary Emulsifier			8.48	1249.1
		Secondary Emulsifier			16.01	2358.2
		Organophilic Clay			17.95	2644.0
		Gilsonite			19.47	2867.9
		Calcium Hydroxide			24.42	3597.0
		Polymeric Blend			2.64	388.9
		Fresh Water			37.71	20621.7
		Calcium Chloride			40.5	5554.6
		CaCo3 Fine			40.5	0.0
		CaCo3 Medium			15.37	5965.6
		CaCo3 Coarse			259.46	2264.0
		Barite			0.53	38217.9
8 ½” x 7” and/or 6-1/8” x 4-1/2”	Brine	Potassium Chloride Salt			164.2	154000
		Corrosion inhibitor (liquid)			8.55	281
		Oxygen Scavenger (sulfer free)			0.43	141
		Biocide			0.71	233

Table 4-12: Health and Safety Information for the Additives to the Water-Based & Synthetic-Based Drilling Mud

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
Barium Sulphate	• Not regarded as a health or environmental hazard under current legislation. • Contains a small quantity of quartz. IARC Monographs, Vol.68, 1997 concludes that there is sufficient evidence that inhaled crystalline silica (quartz or crystobalite) from occupational sources causes cancer in humans. IARC classification group 1.	• Dust may irritate respiratory system or lungs. Harmful: danger of serious damage to health by prolonged exposure through inhalation. • May cause discomfort if swallowed. • Powder may irritate skin. • Particles in the eyes may cause irritation. • Contains small quantity of quartz. Prolonged inhalation of high concentration may damage respiratory system. Because of quantity and composition, the health hazard is small.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Shovel into dry containers. Cover and move the containers. Flush the area with water. May be slippery when wet.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Bentonite (clay)	• Not regarded as a health or environmental hazard under current legislation. • Contains a small quantity of quartz. IARC Monographs, Vol.68, 1997 concludes that there is sufficient evidence that inhaled crystalline silica (quartz or crystobalite) from occupational sources causes cancer in humans. IARC classification group 1.	• Dust may irritate respiratory system or lungs. Harmful: danger of serious damage to health by prolonged exposure through inhalation. • May cause discomfort if swallowed. • Powder may irritate skin. • Particles in the eyes may cause irritation. • Contains small quantity of quartz. Prolonged inhalation of high concentration may damage respiratory system. Because of quantity and composition, the health hazard is small.	• Do not allow to enter drains, sewers or watercourses.	• Observe manufacturer's storing and handling recommendations.	• Shovel into dry containers. Cover and move the containers. Flush the area with water. May be slippery when wet.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
Starch	• NON-HAZARDOUS SUBSTANCE and NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code.	• The material may produce mild skin irritation; limited evidence or practical experience suggests.	• Prevent dust cloud. • Prevent, by any means available, spillage from entering drains or water course.	• Store in an indoor fireproof cabinet or in a room of noncombustible construction. • Provide adequate portable fire-extinguishers in or near the storage area	• Remove all ignition sources • Clean up all spills immediately • With clean shovel (preferably non-sparking) place material into clean, dry container and cover loosely. • Move containers from spill area. • Control personal contact by using protective equipment.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Caustic Soda (sodium hydroxide)	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS. • Reacts violently with water. • Causes severe burns. • Risk of serious damage to eyes. • Classification: R14/34/41	• The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion. • The material can produce severe chemical burns to the eye following direct contact. • Vapours or mists may be extremely irritating. • The material can produce severe chemical burns following direct contact with the skin.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations. • DO NOT store near acids, or oxidising agents. • No smoking, naked lights, heat or ignition sources.	• Remove all ignition sources. • Avoid contact with skin and eyes with personal protective equipment. • Use dry clean up procedures and avoid generating dust. • Place in a suitable labelled container for waste disposal.	• CORROSIVE • ICAO/IATA, ADR/RID, IMDG Class: 8

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
Sodium Bicarbonate	• Not regarded as a health hazard.	• Toxic dose 1-LD50: 4220 mg/kg (oral rat). • Dust may irritate respiratory system or lungs. • May cause gastric distress, nausea and vomiting if ingested. • Powder may irritate skin. • Particles in the eyes may cause irritation and smarting.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry area protected from environmental extremes. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storage and handling recommendations contained within this SDS.	• Shovel up and place in a labelled sealable container for subsequent safe disposal. Flush the area with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Primary Emulsifier	• Hazardous substance, Non-dangerous goods • May cause of lung damage if swallowed.	• Discomforting to the gastro-intestinal tract and maybe harmful if swallowed in quantity. • Disconforting to the upper respiratory tract. • Inhalation hazard is increased at higher temperatures. • Acute effects from inhalation of high concentrations of vapour are pulmonary irritation.	• Prevent spillage from entering drains or water course.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Clean up all spills immediately. • Contain and absorb spill with sand, earth, inert material or vermiculite. • Place in a suitable labelled container for waste disposal.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
Secondary Emulsifier	• Considered a dangerous substance according to directive 1999/45/EC and its amendments. • Can become highly flammable in use. • Irritating to eyes and skin.	• This is caused of irritant effects range from minimal to severe depended on the surfactant characteristic, concentration and contact time. • Entry into the blood-stream may produce systemic injury with harmful effects.	-	• Store in original containers. • Keep containers securely sealed.	• Remove all ignition sources • Clean up all spills immediately. • Clear area of personnel and move upwind.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Organophilic Clay	• NON-HAZARDOUS SUBSTANCE and NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code.	• The dust may produce eye discomfort and abrasive eye inflammation.	• Avoid generating dust. • Prevent spillage from entering drains, sewers, or water courses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Clean up all spills immediately. • Use dry clean up and avoid generating dust. • Place in clean drum then flush area with water.	• Not regulated for transport of dangerous goods: UN, IATA, IMDG
Gilsonite	• Hazardous substance, Non-dangerous goods	-	-	• Keep dry. • Store in a cool, dry place. • Protect containers against physical damage. • Keep containers securely sealed. • Check regularly for spills and leaks.	• Clean up all spills immediately. • Place in suitable containers for disposal.	• Not regulated for transport of dangerous goods: UN, IATA, IMDG

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
Calcium Hydroxide	• May be corrosive to metals. • Causes severe skin burns and eye damage. • Causes serious eye damage.	• Vapours or mists may be extremely irritating. • Eye contact with calcium hydroxide may result in severe irritation and pain.	• Prevent spillage from entering drains or water courses. • DO NOT discharge into sewer or waterways.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storage and handling recommendations contained within this SDS. • DO NOT store near acids, or oxidising agents • No smoking, naked lights, heat or ignition sources.	• Check regularly for spills and leaks. • Clean up all spills immediately. • Use dry clean up procedures and avoid generating dust. • Place in a suitable, labelled container for waste disposal.	• CORROSIVE • ICAO/IATA, ADR/RID, IMDG Class: 8
Polymeric Blend	• NON-HAZARDOUS SUBSTANCE and NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code.	• Not normally a hazard due to non-volatile nature of product.	• Prevent runoff into drains.	• Store in original containers. • Keep containers securely sealed. • No smoking, naked lights or ignition sources. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for	• Clean up all spills immediately. • Contain and absorb spill with sand, earth, inert material or vermiculite. • Wipe up. • Place in a suitable labelled container for waste disposal.	• Not regulated for transport of dangerous goods: UN, IATA, IMDG

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirement	Spill Clean Up Methods	Transport Information
				leaks. • Observe manufacturer's storing and handling recommendations		
Calcium Chloride	• May cause eye, skin and respiratory tract irritation. • May cause gastric distress, nausea and vomiting if ingested.	• May produce severe irritation to the eye causing pronounced inflammation. • Repeated or prolonged exposure to irritants may produce conjunctivitis. • May cause skin irritation after prolonged or repeated exposure	• Prevent large spills from entering into soil, ditches, sewers, waterways and/or groundwater.	• Store at moderate temperatures in dry, well-ventilated area. • Keep in original container.	• Avoid generating and spreading of dusts. • Shovel into dry containers. • Cover and move the containers. • Flush the area with water. • Do not contaminate drainage or waterways.	• Not regulated for transport of dangerous goods: UN, IATA, IMDG
Calcium Carbonate	• Not regarded as a health or environmental hazard	• Dust may irritate respiratory system or lungs. • May cause discomfort if swallowed. • Powder may irritate skin. • Particles in the eyes may cause irritation. • Contains a small quantity of quartz. Prolonged and repeated exposure by inhalation to concentrations of crystalline silica exceeding the maximum exposure limit may lead to chronic lung disease such as silicosis. Because of quantity and composition, the health hazard is small.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed.	• Avoid generation and spreading of dust. Shovel up and place in a labelled sealable container for subsequent safe disposal	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Cementing Chemicals

The composition and volume of cementing chemicals to be used for the MOGE-3 drilling campaign are detailed in **Table 4-13**.

Table 4-13: Composition and volume of Cement Chemicals used for MOGE 3 Drilling

Section (inch)	Casing size (inch)	Cement chemical	Function	Volume (m^3/well)
		Normal well		
26”	20”	PC-X60L	Defoamer	0.284
		PC-A97L	Accelerator	2.992
		PC-P81L	Extender	3.487
17.5”	13-3/8”	PC-X60L	Defoamer	0.24
		PC-J62L	Anti-settling agent	0.67
		PC-G712L	Fluid loss agent	7.56
		PC-GS12L	Gas migration	25.18
		PC-P81L	Extender	2.89
		PC-H21L	Retarder	0.46
12-1/4”	9-5/8”	PC-X60L	Defoamer	0.06
		PC-J62L	Anti-settling agent	0.16
		PC-G712L	Fluid loss agent	1.83
		PC-GS12L	Gas migration	6.11
		PC-P81L	Extender	0.70
		PC-H21L	Retarder	0.11
8-1/2”	3-1/2”	PC-X60L	Defoamer	0.157
		PC-J62L	Anti-settling agent	0.444
		PC-G712L	Fluid loss agent	5.041
		PC-GS12L	Gas migration	16.786
		PC-P81L	Extender	1.928
		PC-H21L	Retarder	0.307
		Deep well		
26”	20”	PC-X60L	Defoamer	0.284
		PC-A97L	Accelerator	2.992
		PC-P81L	Extender	3.487
17.5”	13-3/8”	PC-X60L	Defoamer	0.24
		PC-J62L	Anti-settling agent	0.67
		PC-G712L	Fluid loss agent	7.56
		PC-GS12L	Gas migration	25.18
		PC-P81L	Extender	2.89
		PC-H21L	Retarder	0.46
12-1/4”	9-5/8”	PC-X60L	Defoamer	0.06
		PC-J62L	Anti-settling agent	0.16
		PC-G712L	Fluid loss agent	1.83
		PC-GS12L	Gas migration	6.11
		PC-P81L	Extender	0.70
		PC-H21L	Retarder	0.11
8-1/2”	7”	PC-X60L	Defoamer	0.041
		PC-J62L	Anti-settling agent	0.116
		PC-G712L	Fluid loss agent	1.318
		PC-GS12L	Gas migration	4.390
		PC-P81L	Extender	0.504
		PC-H21L	Retarder	0.080
6.125”	4.5”	PC-X60L	Defoamer	0.037
		PC-J62L	Anti-settling agent	0.026
		PC-G712L	Fluid loss agent	0.814
		PC-GS12L	Gas migration	1.560
		PC-P81L	Extender	0.118
		PC-H21L	Retarder	0.033

4.5.3.2.3 Welll Testing

Oil and gas well testing (also known as drill stem testing) are performed at various stages of drilling, completion and production. Test objectives can be as simple as identification of produced fluids and reservoir productivity to the characterization of reservoir features. Current technology improvements in downhole sensors and better control of down-hole environment have significantly increase capabilities of well testing operation. A typical well testing arrangement is shown in **Table 4-14**.

Generally, well tests are conducted to:

- ✓ Identify produced fluids
- ✓ Measure reservoir pressure & temperature
- ✓ Obtain representative samples, surface and downhole for PVT analysis
- ✓ Determine well productivity and flow performance i.e. productivity index, skin
- ✓ Obtain hydrocarbon composition and impurities i.e. Mercury, CO2 and H_2S

Testing procedure has not been finalized yet, below is the tentative testing procedure and timing per one test.

Table 4-14: Tentative Testing Procedure

Option 2 - DST&TCP with FRAC			
Activity	Est. Duration	Cumulative Time	
	hrs	hrs	days
Well Preparation	**26.00**		
R/U E-Line / Run CBL	6.00	6.00	0.24
P/T Casing	1.00	7.00	0.28
RIH Bit & Scrapper / Condition Mud and Displace well to brine/ POOH Bit and Scrapper	18.00	25.00	1.03
M/U Flowhead Assembly	1.00	26.00	1.07
Run Test String - DST #1	**37.50**		
M/U TCP Guns	1.00	27.00	1.12
M/U Test Tools and BHA	6.00	33.00	1.37
R/U E-Line / Drift BHA and F/T SRO Running Tool	1.25	34.25	1.42
P/T BHA	1.25	35.50	1.47
RIH 300jts of 3-1/2" Test Tubing and fill up with base oil (20 jts/hr) and P/T	15.00	50.50	2.09
R/U E-Line / GR CCL Depth Correlation / Space out DST/TCP String	3.00	53.50	2.22
M/U Lubricator Valve and P/T	2.50	56.00	2.32
Change Bails/ M/U Flowhead / P/T Landing Joint	2.00	58.00	2.41
Set DST Packer	0.50	58.50	2.43
R/U Surface Lines / P/T Flowhead and Surface Lines / F/T ESD	4.50	63.00	2.62
Initialise Downhole Tools	0.50	63.50	2.64
Well Test - DST #1	**63.25**		
Wait on Daylight	0.00	63.50	2.64
Pre-Test Safety Meeting	0.25	63.75	2.65
Activate TCP Guns & Drop	1.00	64.75	2.69
Initial / Clean-up Flow	6.00	70.75	2.94
First Build-up	6.00	76.75	3.19
Main Flow Period	18.00	94.75	3.94
Main Build-Up Period	12.00	106.75	4.44
R/U E-Line PCE / RIH SRO tool / Monitor Main Pressure Build Up / R/D E-Line	12.00	118.75	4.94
R/U Slickline and BHS Toolstring	2.00	120.75	5.02
RIH and Collect Samples / POOH / R/D Slickline	6.00	126.75	5.27

R/U Frac head / Data Analysis / Perform Mini-Frac / Main Frac	30.00	156.75	6.52
Unload Frac Fluids (Clean up)	12.00	168.75	7.02
Post Frac Pressure Build-up	4.00	172.75	7.19
Post Frac Flow Period	18.00	190.75	7.94
Final Build-Up Period	12.00	202.75	8.44
R/U E-Line PCE / RIH SRO tool / Monitor Main Pressure Build Up / R/D E-Line	12.00	214.75	8.94
Recover DST Test String and Suspension	**27.50**		
Bleed off THP / Reverse Circulate Test String	3.00	217.75	9.06
Bullhead Rathole / Flow Check	0.50	218.25	9.08
Flush Surface Lines / R/D Surface Lines / R/D Hoses to Flowhead	1.50	219.75	9.15
Unseat Packer / Flow Check	0.50	220.25	9.17
Curculate Well to Kill Weight Mud	2.00	222.25	9.25
L/D Flowhead / L/D Lubricator Valve	1.50	223.75	9.31
POOH and L/D 3-1/2" Tubing 300jts (24 jts/hr)	12.50	236.25	9.83

4.5.3.2.4 Flaring

If it is decided to test the well (DST or LPT) a significant quantity of gas could be flared from the well. The actual flow rate of the reservoir at this location is a parameter that the drilling of the well is intended to determine.

The rate of gas production will range between 0-30 mmscfgd (30 mmscfgd being the maximum handling of the rig's processing equipment). If a DST found less than 5 mmscfgd an LTP test would unlikely proceed. The data gathered is used to establish reservoir characteristics. The maximum flow during tests generally never exceeds 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 22 days.

4.5.3.3 Blowout Preventative Measures

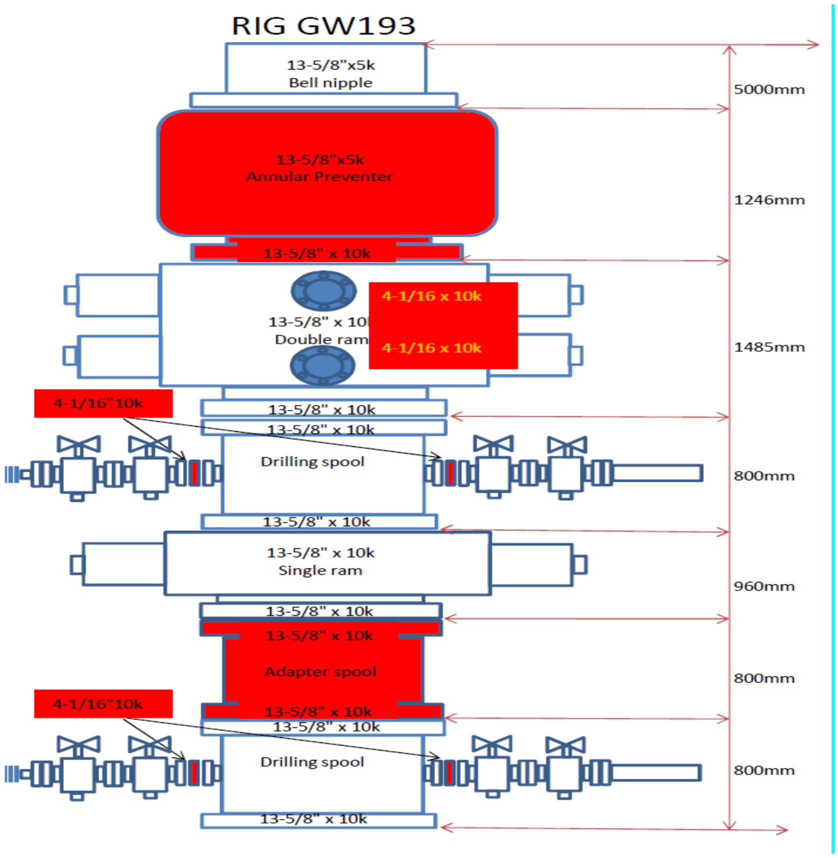
A complex series of valves, known as the "blowout preventer" (BOP), is attached to the top of the conductor below the derrick floor. All further casing strings are also attached into this blowout preventer. These are powerful hydraulically-activated valves and rams that can be closed around the drill pipe to isolate the well bore should unexpectedly high formation pressure be encountered. If formation pressure exceeds the hydrostatic head of the drilling mud, it may cause the well to flow strongly, referred to as a "kick". A kick can also occur if a highly permeable formation, such as a naturally fractured limestone, is encountered and a large volume of mud is suddenly lost into the formation.

The blowout preventer is the primary safety mechanism for well control. The series of valves act independently and when closed in an emergency form a series of increasingly secure barriers that isolate the well so that a plan of action can be developed to bring it back under control.

Maximum pressure for the project prospect wells is expected to be not exceeding 9,500psi. PTTEP SA will use a 5,000 psi rated 21-1/4" BOP and a 10,000 psi 13-5/8" BOP with double ram preventers in the 12-1/4", 8-1/2" and 6-1/8" section.

The 13-5/8" BOP is tested and certified as per API standards to 10,000 psi before installation. Once the BOP stack is installed it is pressure tested to API specification (API RP 53) to 10,000 psi. Once in service the BOP stack must be tested ever 3 weeks as per API specification. PTTEP SA's standard operation procedures require the BOP to be tested every 2 weeks, which is more stringent than API specification. Also, every time a connection is made (i.e. wellhead connection) the BOP must be pressure tested again to as per API specification. BOP unit will have separate generator which will use power supply to generate pressure in the accumulator to operate BOP that is always available.

PTTEP SA as part of its HSSE MS system which defines the procedures that are to be used in the event of a well control emergency occurring in their onshore exploration drilling.



Source: PTTEP SA, 2018

Figure 4-32: Blowout Diagram Used for Previous Campaign

4.5.3.4 Well Completion, Suspension, Abandonment or Contingency Well

If the well proves to be highly productive it is likely that the well will be completed and temporarily suspended rather than permanently abandoned, given the high cost of drilling a replacement well at a later date.

At the end of the drilling or the well completion operations, the rig and associated equipment will be broken down and loaded onto trucks to be moved to the next operator's drilling location.

4.5.3.4.1 Commercially Successful Well

Well Completion

A commercially successful well will be suspended for future completion. The well will be killed with clean brine at appropriate weight. (Calculated overbalance) Then a minimum of 1 mechanical retrievable or drillable bridge plug or minimum 30 m cement plug will be set above the perforated zone and pressure tested. A kill string will be run and landed in the well head with the tubing hanger and a BPV (Back Pressure Valve) The tubing hanger will be secured with the tie down screws. Then the BOP is removed and suspension cap installed.

Well Pad Suspension

If the well is completed as a future producer, the drilling rig, associated equipment, accommodation units and warehousing will be removed from the site. The entire site will be cleaned up and made ready for suspension. The waste pit will be emptied and cleaned out with any material extracted removed for treatment and disposal.

The concrete rig pad and other foundations will be left intact for future use. The internal and intermediate drains around the rig pad and well pad site will be cleaned and any material extracted removed for treatment and disposal offsite. The external flood water diversion drain around the well site will be cleaned out and put in a state of good repair.

An inspection will be made of the entire well pad by a civil engineer and any defects put right and any modifications made to ensure it will be able to withstand an entire rainy season without significant deterioration. The site will be inspected before and after each rainy season and any repair work conducted accordingly.

The well site will have 2 security guards on duty at all times 24/7.

4.5.3.4.2 Commercial Failure, Well Abandoned

It is considered unlikely that this well will be a commercial failure. However, if it is so decided then the well will be permanently abandoned and the well site restoration work commenced immediately. The requirements for the physical abandonment will follow best industry practices. The following procedure for plugging and abandoning the well bore will ensure that the land is returned to an agreeable condition with landowners.

The procedure for abandonment and restoration of such a well site is long established and is a relatively routine operation.

The well abandonment will follow normal industry practices and procedures, conforming to all International regulations. A reservoir section will be filled with heavy kill weight mud and a cement plug will be put in position, 30m below top of liner lap and 30m above as one 60m long plug. (Minimum length) After curing/thickening time, the position of the plug will be confirmed physically by tagging with the cementing string. It will then be pressure tested. Then a 30m (Minimum length) cement plug will be spotted at surface. Wellhead will then be removed and casing will be cut off at bottom of cellar. A steel plate will be welded on the top of the cut off casing. The cellar will then be removed and the cellar back filled with clean soil.

The well site will be cleared of all equipment and cleaned up. The well pipe will be cut approximately 3 m below grade and capped with a steel plate before the rig cellar is backfilled with soil. The concrete rig pad, other foundations and the cuttings pit will be left on site. Below is the preliminary P&A well schematic for MOGE-3 wells, however subject to change according to final well design and testing program.

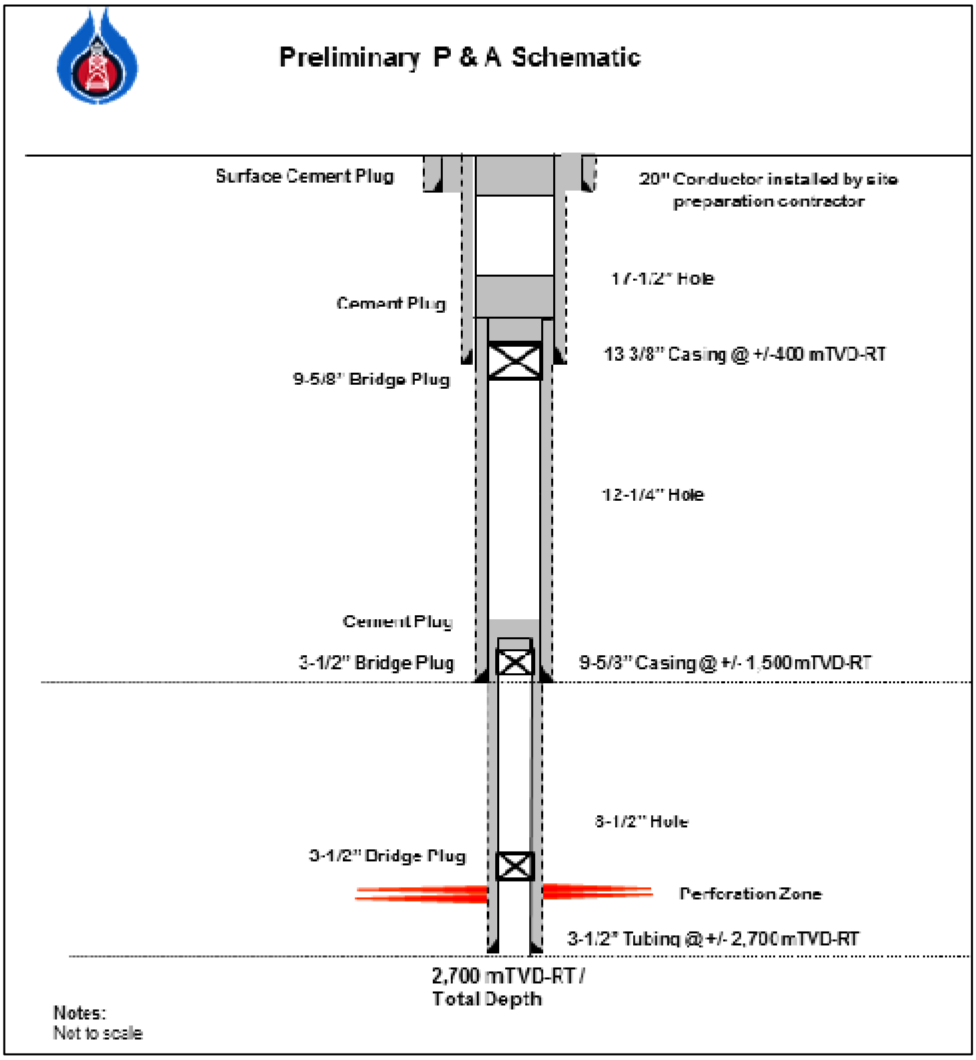


Figure 4-33: Preliminary P&A Schematic

4.5.3.4.3 Contingency Wells

During drilling of the well, technical issues may occur that require the exploration well to be re-drilled. A contingency well would be in the form of a side track or a new hole next to the first hole within the same pad built for the well. Examples of some technical issues that could require drilling of a contingency well are: tools or drill string lost down hole; surface casing collapse or weakened; unexpected hydrocarbon reservoir encountered shallower than objective; poor quality reservoir. Although these issues are unlikely to occur, a second or third contingency well may have to be drilled from the drill pad to meet the objectives of this project.

The technical issue encountered would be reviewed and PTTEP SA would evaluate the best option to overcome the issue. Drilling a contingency well is just one of many possible options but would be a worst case and last resort scenario.

4.5.4 Workforce

The workforce active on the project will vary with time, depending on the phase of the operation. All workers onsite will be on rotation, there is no permanent on site. Up to 100 rotation workers could be employed for this exploration drilling project. An estimate of the number of personnel active during each phase is provided in **Table 4-15**.

Table 4-15: Estimated Work Force

Project Phases	Number of Personnel
Construction Phase	30 - 50
Drilling Operations Phase	80-140
Well Testing Phase	50-100
Well Suspension or Abandonment Phase	50-100

The site construction and abandonment or restoration phases will be conducted using a civil engineering contractor and their local staff.

During drilling operations, the composition of the crew will depend on actual contracting companies, most of which will be local subsidiaries of international companies. Where possible it is PTTEP SA's company policy to encourage the hiring of local staff. Based on previous campaign, there will be about 15-20 persons for local hire.

4.5.5 Transportation

Drilling Rig - PTTEP SA plans to use a land rig for the drilling program. The rig will be moved along the Ayerwaddy River to Thayet Cement Factory Jetty by the barges and duration of rig move will be about 5-7 days. Then the rig will goes to temporary site by trucks near Thayet for re-activation and inspection. The rig mobilization will include around 100 truckloads to complete rig and support equipment. The maximum mobilization distance for the rig is estimated at about 5.5 km from Thayet jetty to temporary site and it will take about 10 days to move. After re-activation and inspection the rig will then move to first well location by trucks.

Drilling Materials will be transported from Yangon (Thaketa or MITT port) to the well sites. The estimated number of round trips for rig and support equipment is 130 truckloads during drilling activities.

The rig personnel will transported overland to the well locations from Yangon.

4.5.6 Emissions, Discharges and Waste Generation

Emissions, discharges and waste generation will conform to applicable government regulations in Myanmar such as Myanmar Environmental Conservation Law (2012).

All wastes produced will be assessed and classified by type prior to treatment, transport, disposal or recycling. Wastes are classified as:

- Drilling Mud and Cuttings
- Wastewater (effluent);
- Hazardous waste (e.g., chemical waste, waste oil etc.);
- Non-hazardous solid waste (e.g., wood, paper, steel, food waste etc
- Air emissions;
- Noise
- Fluids Produced from the Separators During Drilling and Testing

4.5.6.1 Waste Drilling Mud and Cuttings

The major waste products from the drilling operations are used drilling mud and cuttings. As described in earlier sections the drilling rig equipment contains a standard closed mud circulation and treatment system, that takes the drilling mud as it leaves the well bore, removes the cuttings and suspended fine solids, and returns the cleaned mud to the rig's holding tanks for reuse. The subsequent treatment and disposal of the cuttings and drilling mud are discussed below.

Estimated mud volume from previous projects is about 5000 bbls per well and the estimated cutting volume is about 1000 m^3 per well. However this could vary according to each hole section TD.

4.5.6.1.1 Waste Drilling Mud

Some of the drilling fluid portion will be lost to porous rocks, such as sandstones, and some of the additive solids will be lost to form a mud-cake along the wall of the hole. The volume of these "losses" cannot be calculated accurately as they depend on the local geology. The solid and liquid phases are separated on-site by industry standard physical and chemical means (shaking, centrifuging and flocculation).

At the end of the first well location, the left over drilling mud will be transferred and used at the next well location. At the end of drilling campaign the left over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP offshore drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs.

4.5.6.1.2 Waste Drilling Solids

There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the DOWA waste management facility.

There are a variety clean-up technologies available at the time and treatment of mud and cutting wastes based on the actual lab test results of the samples and the disposal / well locations to develop a "best practice disposal procedures". The waste will be sampled and tests on the samples to determine if bioremediation is recommended. The main purpose of testing is to ascertain the suitability of bioremediation (Composting) in Myanmar's climate. If testing shows that bioremediation

(Composting) is not a viable treatment for the mud and cuttings then the wastes will be removed from site and disposed at DOWA waste management facility.

If Bioremedation preliminary testing has been able to bring the Oil and Grease content with in the required disposal limits; bioremediation techniques will be used for a minimum treatment time of 6 months. However, additional time is required to bring the OOC content with in allowable limits treatment of cuttings as per National Environment Quality (Emission) Guidelines Myanmar **(NEQG)** standards.

After treatment, the final closure of the project (disposal of treated cuttings) is completed after receipt of testing results from an independent laboratory confirms the bioremediated wastes meet the NEQG standards.

The bioremediation process includes the following stages:

Bioremediation Site Construction & Design Features

- Site clearance (Clearing, Levelling)
- Compaction and Preparation of Bio pad depend on the Cutting volume (Bio-pad area was prepared in a manner that would mitigate against under-ground seepage (leaching), secured against potential spillage with containment (bonding) and promote micro-organism growth)
- Drainage and collection pits

Treatment Process

1. The SBM cuttings were moved to the Concrete pit for mixing where they were prepared for bioremediation
2. Preparation included mixing of drill cuttings with bulking agents, native soil and nutrients at a pre-determined ratio.
3. Blending the mixture with the remaining WBM cuttings with native soil.
4. After mixing the ingredients, it was expected that the total volume will increase four times due to the addition of bulking agents.
5. The Bioremediation process involved the spreading of hydrocarbon contaminated waste over the treatment area and then disking the waste into the soil using common farming equipment. Disking will be done to a depth of 30 to 45 centimetres to help homogenize the distribution of the waste. Additional water and nutrients will be added periodically as required and the area re-disked.
6. The entire process would take approx.4 – 6 months until completion
7. pH of the mixture were checked and brought within acceptable limits between 6 to 8.
8. Application of waste & soil to the treatment area in the shape of composting windrows (0.9 m x 0.9 m).
9. Tilling, Row up keep and Watering (**TRW**) were utilized every day to ensure that proper care was taken of the compost.
10. Moisture levels of between 40-85% were maintained throughout the bioremediation process with frequent tilling of the waste.
11. Moisture levels were monitored on a daily basis by using hydrometers.
12. Oil content were monitored on a fortnightly basis by use of a retort kit.
13. Hydrocarbon content were monitored on a monthly basis by lab tests.
14. The following parameters were be monitored on a daily basis:
    - Moisture (40-85%)
    - pH (6-8)
    - Temperature (10 - 45 degrees C)

The treatment is continued until the composting reduces the oil content gradually to less than 1% as per treatment criteria. After Analytical results for the samples taken on the site confirm the required less than 1% OOC. In the event that the analytical results show that the % OOC is indeed less than 1%

oil concentration on dry weight cuttings, there will be no further requirement for bioremediation and the next phase become the land fill operations.

Upon completion of the Bioremediation project the plan is to perform the following operations:

- Back filling / leveling of the site. (Land Farming)
- General housekeeping.
- At close out, samples from all the 10 samples and one from the periphery were taken to ensure environmental safety before backfilling.

The Effectiveness and efficiency of the in-situ bioremediation method for oil-contaminated cuttings treatment are considered as strong advantages with limited local infrastructure and high risk of land transportation at the remote onshore well sites in Myanmar. It is considered as a practical solution to manage the waste to meet with local regulation and industry standard without adverse impact to the environment. This treatment process also can apply to the other projects where limited local infrastructure available and where have strong regulation.

4.5.6.2 Wastewater

4.5.6.2.1 Contaminated Runoff

In case of rainfall during drilling operation, runoff may happen from the well site. The well site area will drain into the cuttings pit which will be designed to contain the runoff from the well site combined with rain falling on the waste pit during extreme heavy rain. The pit will be enclosed by an earth embankment to prevent the excess water drain into the pit.

4.5.6.2.2 Wastewater from consumption

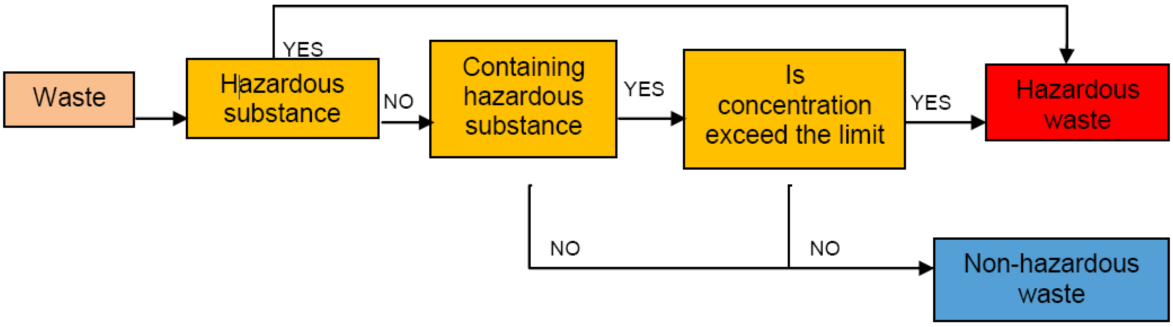
The waste water and sewage will be collected in a plastic-lined sewage pit with a capacity of 8 m^3 (8000 litres). It is estimated that some 7.8 m^3 (7.800 litres) of combined sewage and waste water will be produced each day during maximum manned operations (100 people x 78 litre per person). A septic tank will be installed on all locations for preliminary wastewater treatment then overflow to infiltration field. The sewage sludge from the septic tanks will be left in the septic tank onsite.

4.5.6.3 Non Hazardous Waste and Hazardous Waste

Waste shall be handled and stored in a manner that reduces the risk which may escape to the environment. Waste either at the source or after collection that require different treatment or disposal systems shall be segregated as much as possible at source for collection, storage, transportation, and disposal in accordance with waste classification. In addition, it will reduce the risk of contamination of hazardous wastes with non-hazardous wastes.

The PTTEP SA exploration program will handle waste according to PTTEP SA Standards. All wastes will be classified and segregated before responsible disposal. The classification and segregation process is shown in **Figure 4-34**.

Figure 4-34: Waste Classification and Segregation Process



4.5.6.3.1 Containers

All wastes will be collected, stored, and segregated in arranged containers. All provided containers will be as follows:

- Install adequately in the working area, accommodation and office area,
- Make from durable materials compatible with the waste to be collected, leakage proof, sturdy, stable and easily handled,
- Prevent the ingress of animals, escaping odor and place under cover to avoid leachate.
- Medical or clinical waste shall be separated from other wastes because, they may contain infectious agents and potentially toxic substance for example sharp objects shall be packed in puncture-proof containers.

Containers used for medical waste shall be marked prominently with universal warning signs and/or the word “Medical waste”. Used needles and syringes represent a particular threat as failure to dispose of them safely may lead to recycling and repacking. Where possible, management of medical/clinical wastes should be integrated into existing healthcare waste management system.

4.5.6.3.2 Non Hazardous Waste

Both the well site and the accommodation campsite will generate non-hazardous waste, consisting of “domestic” garbage such as food scraps, plastic packaging, paper, cardboard, tin cans and glass. In addition there will be “industrial” waste such as wooden cases, large glass containers, ferrous and non-ferrous metal items, plastic and metal drums and containers, plastic and cardboard packaging. The amount of non-hazardous waste from the workers is expected to be 1 kg / per / day. Therefore the generated non-hazardous waste for each phase; construction: 50 kg/day, Drilling: 100 kg/day, Well testing: 100 kg/day and Site restoration: 30 kg/day.

General waste will be separated on-site to facilitate recycling. This waste will be stored in separate skips to be transported off site for recycling, reuse, treatment and/or disposal.

All wastes shall be handled and stored in a manner that reduces the risk of escape to the environment. Wastes either at the source or after collection that require different treatments or disposal systems shall be segregated as much as possible at source for collection, storage, transportation, and disposal.

A waste management plan will be prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. All general waste (solid waste) will be disposed as per local Thayet Township municipal regulations.

4.5.6.3.3 Hazardous Waste

The well site and accommodation campsite combined will generate a low volume of hazardous waste. The estimated amount of hazardous waste based on previous projects is expected to be 500 kg per month. Those items that have been identified from previous drilling operations are:

a) Medical Waste
b) Used lubricating oil
c) Used hydraulic oil
d) Filters contaminated with oil
e) Drums and containers used for oil or chemical transportation and storage
f) Mud additive chemicals
g) Rags, paper, plastics and other materials contaminated with oil

All materials brought onto the well site and accommodation campsite will be logged and all sources of potential toxic waste will be identified by the relevant supplier or contractor. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

It is assumed that there will be only chemical/mud/additive containers and batteries. Some will be reused and the rest shall be returned to where they came from. Any hazardous waste will be transferred to Yangon for disposal of at an approved waste disposal area (YCDC) or DOWA waste management facility

Medical or clinical waste will be separated from other wastes because, they may contain infectious agents and potentially toxic substance for example sharp objects shall be packed in puncture-proof containers. The medical waste will then be transferred to Yangon for disposal of at an approved waste disposal area (YCDC) or DOWA waste management facility.

4.5.6.3.4 Fluids Produced from the Separators during Testing

Should testing be conducted, the produced reservoir fluids will be separated at the surface. The gas portion will be flared while the liquid portion will be separated into water and a condensate-water emulsion. The water portion will be stored in the cuttings pit. The condensate-water emulsion will be moved to a series of settling tanks where natural buoyancy of the emulsion breaks down, separating the water and condensate phases further. The separated water will be stored in the cuttings pit and the remaining condensate and emulsion will be collected in storage tanks for disposal.

The expected condensate-to-gas ratio is 5 bbl (0.795 m^3) per 1 mmscfg. Based on a worst case of a 10 mmscfgd during a LTP test for 22 days – equating to an average condensate production of 50 bbl (7.95m^3) per day, the total condensate production potential could be 1,100 bbl (175 m^3).

Condensate will be decanted from the settling tanks and stored to await disposal.

4.5.6.4 Air Emissions

The air emissions from the well site would be from the following sources:

1. Dust
2. Combustion emissions

4.5.6.4.1 Dust

During construction and upgrading of access roads and well site construction, the main air quality issue will be control of dust. Standard operating procedures require the civil engineer contractor to ensure daily or as required sprinkling of water on all non-sealed surfaces to subdue the amount of

dust. The standard operation procedure will also limit the speed of traffic on site and to restrict speed of traffic on portions of the road that have not yet been sealed. Daily consultations by the construction contractor with the local villages will ensure that any significant problems are identified and resolved.

The handling and storage of bulk drilling mud additives, including barite, bentonite, calcium carbonate and cement powder will result in relatively minor fugitive dust emissions. Any emissions will be reduced significantly by the standard procedure of equipping all silos with bag filters.

4.5.6.4.2 Combustion Products

Combustion products from the proposed exploration drilling project consist of diesel combustion and flaring emissions.

Diesel Combustion

Diesel combustion from the on-site electrical power generation units and from vehicles will emit greenhouse gases. The amount of emissions will vary with time, depending on the operational activity and power demand. The emissions from diesel consumption for all four well sites are provided in **Table 4-16**.

Flaring

If it is decided to test the well (DST or LPT), a significant quantity of gas could be flared. The actual flow rate of the reservoir at this location is a parameter which the drilling of the well is intended to determine.

The rate of gas production will range between 0-30 mmscfgd (30 mmscfgd being the maximum handling of the rig’s processing equipment). If a DST found less than 5 mmscfgd an LTP test would unlikely proceed. If an LTP test is to proceed, the drilling rig would be demobbed and a smaller well testing package brought in to conduct the LTP test. During an LPT test flaring would be conducted at various rates and sustained rates combined with shutin’s to observe pressure build ups and flowed again. The data gathered is used to establish reservoir characteristics. The maximum flow during an LPT tests generally never exceed 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 22 days.

The overall greenhouse gas emissions from flaring at the well sites are provided in **Table 4-16**.

Table 4-16: Greenhouse Gas Emissions per Well

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Site Preparation	Granular Fill Transport	6.0
Drilling	Drilling rig mobilization	24.8
	Equipment and Supplies	10.3
	Drill cuttings transport	43.5
	Transport (fuel, water, personnel)	13.0
	Heavy equipment use	1299.5
	Generator to power drilling rig and camp site	1,298.4
Testing Activity	Flaring	15,136.70
Abandonment and Restoration	Heavy Equipment and transportation.	378.70
Total per well		18,8210.9

Total

This entire project is estimated to generate a worst case maximum of 75,2843.6 tonnes of CO_2 equivalent for all four well sites, based on 60 days of drilling per well including 22 days of flaring at all well sites. Air emissions and their impacts are discussed in the **Chapter 6 - Impact Assessment**.

4.5.6.5 Noise

During the civil work phase, noise will primarily be generated from project vehicles, generators, and construction equipment such as bulldozer, backhoe, grader, dump trucks and others. (**Table 4-17**)

Table 4-17: Noise Level from Construction and Drilling Equipment

Source	Maximum dB(A) at source	Number of Sources at one time
Bulldozer	85	1
Backhoe	80	1
Grader	85	1
Compactor	82	1
Heavy trucks (dump trucks)	88	1
Water truck (Lmax truck)	84	1
Jack-hammer	80	1
Drilling Rig (auger)	85	1
Generator	81	4

Source: US Federal Highway Administration, US Department of Transportation, 2008; reference distance 50 ft (15.24 m); (http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm)

During the drilling phase, noise will be generated from project vehicles, generators and drilling operations.

Potential impacts from noise during the well abandonment phase will be virtually identical to those in the construction phase. The same mitigation measures should be applied, and the impact significance will be similar.

4.5.6.6 Summary of Waste Inventories

A summary listing of wastes generated by this proposed project is provided in **Table 4-18**.

Table 4-18: Waste Inventory (per Well Site)

Waste Type	Estimated Quantity	Disposal Plan
1) Drill cuttings	1000 m^3 per well	WMB / SBM will be either bioremediated onsite will be transported to DOWA for disposal.
2) Drilling Mud (WBM or SBM)	5000 bbls per well	Drilling Mud will be re-used at next well site and at the end of drilling campaign any waste mud will be returned to Mud Contactor for re-use or disposal or use for PTTEP offshore drilling campaign.
3) Unused chemicals	N/A	Returned to supplier or kept for future drilling campaigns.
4) Domestic waste	Construction: 50 kg/day Drilling: 130 kg/day Well abandonment: 30 kg/day Site restoration: 25 kg/day	**Biodegradable waste** (food waste) will be segregated and transferred to local government waste disposal facilities (like YCDC in Yangon). **Recycle and General Non-Hazardous waste except recycle and biodegradable waste** shall be transferred to local government waste disposal facilities (like YCDC in Yangon) or disposed at a site approved by Local Authority.
5) Industrial waste (scrap metal, plastic, paper, wood, glass etc.)	N/A	Recyclable or reusable waste to be sold or donated. Other non-recyclable or reusable waste will be transferred to local government waste disposal facilities (like YCDC in Yangon).
6) Hazardous waste	Drilling: 500 kg/month	**Medical or clinical waste** shall be transferred to Yangon for disposal at approved location by YCDC or DOWA waste management facility **General Hazardous Waste** - Transported to Yangon for disposal at approved location by YCDC or DOWA waste management facility
7) Sanitary wastewater	Construction: ~3 .9 m^3/day Drilling: ~7.8 m^3/day Well Testing: ~7.8 m^3/day Site Restoration: ~3.9 m^3/day	**Grey water** will be treated in soak pit. **Black water** will be treated in septic tank and soak pit.

4.5.7 Safety, Security, Health and Environment Management

4.5.7.1 PTTEP SA Safety Security Health and Environment (SSHE) Policy

PTTEP Myanmar Asset is committed to safe Exploration and Production (E&P) Operations in Myanmar with an ultimate goal of "Target Zero - Nobody Gets Hurts in Our Operations" which covers (1) Zero Injury, (2) Zero Major Accident (e.g. zero major hydrocarbon leak, vehicle accident, ship collision), and (3) Zero Spill or External Complaint (e.g. zero complaint by authorities/ communities/ sea users).

To accomplish this, PTTEP Myanmar Asset implements Safety, Security, Health and Environmental Management System (SSHE-MS) that outlines the main principles and accountabilities to drive for continuous improvement. We are committed to:

- Comply with Myanmar SSHE laws, other applicable requirements and PTTEP Standards.
- Perform hazard identification and SSHE risk assessments so that risks are As Low As Reasonably Practicable
- (ALARP).
- Hold employees accountable for SSHE performance by setting and monitoring SSHE Plans and KPIs.
- Prevent operational and process incidents by implementing asset integrity programs and monitoring of Safety Critical Elements addressed in Safety Cases and complying with Management of Change (MOC) Standard.
- Work with contractors and suppliers to achieve PTTEP's SSHE requirement.
- Ensure all employees and contractors are assessed and maintain the required level of job and SSHE competency.
- Apply "Stop Work Authority Policy" for unsafe work by implementing Behavior-Based Safety (BBS) programs to improve positive SSHE culture.
- Implement security management for potential threats to safeguard personnel, assets, information and reputation.
- Promote occupational health and hygiene in the workplace by conducting health risk assessments, medical
- Surveillances, education and regular industrial hygiene monitoring.
- Prevent environmental impacts by strictly following the mitigation measures stated in Environmental Impact Assessment.
- Promote sustainable development by implementing waste management, greenhouse gas reduction and energy efficiency programs.
- Report, investigate and analyse SSHE incidents to prevent recurrence and close out corrective actions with evidence.
- Ensure that emergency and crisis management plans are proactive and effective.
- Ensure policy and SSHE Management System compliance through regular SSHE audits and Senior Management visits with corrective actions follow up for continuous improvement.

Strong leadership and commitment is a key successful implementation of this policy which is required from PTTEP employees and contractors at all levels.

4.5.7.2 SSHE Management System Manual

PTTEP SA's SSHE Management System Manual objective is to serve as practical interpretation of Company SSHE policy with respect to their moral obligations for SSHE issues for all persons working on, visiting or affected by operations at sites for which PTTEP SA has responsibility.

The manual covers details on the areas specified in **Table 4-19**. The document is designed to serve as a comprehensive guide for all Operational Assets to develop its own SSHE management system and related documents. This document also provides an overview of SSHE management system approach.

It should be noted that PTTEP SA currently does not have its own internal SSHE policies, procedures or documentation. PTTEP SA is the concession holder for Block MOGE-3, and the operator is PTTEP International (PTTEPI). For this project, PTTEP SA will adopt all of PTTEPI's relevant SSHE policies and procedures. Throughout this chapter, SSHE policies, procedures and documents will be referred to as belonging to PTTEP SA, however they actually belong to PTTEPI and are being adopted by PTTEP SA for this project. The PTTEP SA's Waste Management Plan and Emergency & Crisis Management Plan are included in **Appendix 2**. The Blowout Contingency Plan (BOCP), Spill Contingency Plan and Medical Response Plan are managed under PTTEPs Myanmar Asset Emergency Management and Myanmar Asset Crisis Management Plan included in **Appendix 2**.

Table 4-19: PTTEP SA SSHE Management System Standards

Item	Document	Document Number
1	SSHE Training and Compentency Procedure	11027-PDR-SSHE-340-003-R01
2	Myanmar Asset Alcohol and Drugs Testing Procedure	11027-PDR-SSHE-564-002-R00
3	PTTEPI SSHE Requirements for Contractors	Myanmar 13036-PDR-078
4	SSHE Regulatory Compliance Standard	Myanmar-0550-STD-014
5	Myanmar Asset Land Transport Safety Procedure	Myanmar-SSHE-11027-PDR-306
6	Fitness to Work Procedure	Myanmar-SSHE-11027-PDR-508
7	Myanmar Asset Waste Management Procedure	Myanmar-SSHE-11027-PDR-510
8	Myanmar Asset Emergency Management Plan	11027-PDR-SSHE-340-005-R01
9	Myanmar Asset Crisis Management Plan	11027-PDR-SSHE-340-006-R01
10	Land Campaign Blowout Contingency Plan	Myanmar-0550-MNL-004
11	MOGE-3 Operations Medical Emergency Response Plan (MERP)	Myanmar-SSHE-11027-PDR-515
12	Myanmar Asset Security Management Procedure	11027-PDR-SSHE-340-004-R00
13	Spill Contingency Plan	Myanmar-0550-PLN-002

4.5.7.3 Potential for Accidents, Hazards and Emergencies

PTTEP SA will ensure the contractor will have an EMERGENCY & CRISIS MANAGEMENT PLAN that includes response procedures for blowout, fire, earthquake, medical emergency, release of hazardous/toxic substances, etc. PTTEP SA has an Emergency & Crisis Management Plan (ECMP) that will be updated specifically for each well site operations and site specific location.

This ECMP is considered a standard E&P Emergency Management System and is based on Industry accepted standards and practices (e.g. ISO, BCI, EMI, BS etc.). Topics of the ECMP are outlined in **Table 4-20.**

Table 4-20: Emergency Response Plan

Main Sections	Topics
Procedure & Responsibilities	h) Drilling Superintendent i) On-Scene Commander j) PIC (Person-In-Charge)

Emergency Organisation	k) Introduction l) Emergency Response Philosophy m) Overview of the Response Organisation
Emergency Arrangements And Facilities	n) Major gas release / H_2S o) Explosion / fire p) Accommodation fire q) Blow-out r) Oil spill land s) Hazmat spill t) Helicopter incident u) Man missing v) Loss or damage of radioactive source w) Traffic accident x) Medevac y) Bomb threat / terrorist act z) Fatality aa) On-scene Commander Field Arrangements and facilities
Risk Management	bb) Major Hazards - Emergency Plans

The Emergency Response Procedures are detailed in **Section 8.13, Emergency Response Plan**.

4.5.7.4 Gas, Smoke and Fire Detection Systems

The following detection systems are installed at each drilling site.

- H_2S Monitoring System (portable and fixed)
- Combustible Gas Monitoring System (portable and fixed)
- Explosimeters
- CO_2 Gas Detectors (portable)
- O_2 Meter (portable)
- Fire/Smoke Detectors
- Fire detectors/alarms

4.5.7.5 Fire Fighting Systems

4.5.7.5.1 Rig Site

The rig site will be equipped with two separate firefighting systems designed for different purposes. The first is a comprehensive set fire extinguishers, the second is a water deluge system.

In the event of a large fire beyond the control of the designated crew fire team members on site, then necessary efforts must be made to seek professional fire fighting services.

Fire Extinguishers

A comprehensive set of dry chemical all-purpose fire extinguishers will be positioned around the well site, within accommodation cabins, equipment cabins, adjacent to equipment units and around the rig floor:

- The majority of these will be standard size 9 kg hand portable extinguishers, suitable for containing or extinguishing minor fires.

- A set of larger 25 kg extinguishers will be positioned strategically around the rig site to act as back-up in case of a larger fire or prolonged containment is required.
- A set of spare extinguishers will be kept at both the dry storage area and the equipment store.
- Larger 50-kg foam extinguishers will be positioned where fuel and lubricants are stored.

The rig contractor will be responsible for ensuring that all extinguishers are serviced and certified before mobilisation and periodically checked during the operation. PTTEP SA's rig manager will be responsible for verifying this process.

The rig contractor is responsible for training their crew in fire fighting techniques and to hold regular practice drills. PTTEP SA's rig manager will be responsible for verifying this process.

Water Deluge System

The rig will be equipped with a water deluge system, with banks of spray-heads surrounding the well head and BOP, the solids removal chokes of the drilling surface equipment and the flare stack.

Water for this deluge system will be provided from the water storage tanks by a series of electrical pumps, which will be permanently installed and equipped with independent diesel generators to ensure they continue to function even if the rig's electrical generators are off line or power lines are severed during an incident.

This system is designed to contain or prevent a fire resulting from any leaks or ruptures in the hydrocarbon handling system. It will protect the major pieces of equipment until the well is shut in by the blowout preventers and the flow of hydrocarbons stopped.

4.5.7.5.2 Accommodation Camp Site

A comprehensive set of dry chemical all-purpose fire extinguishers will be positioned around the accommodation camp site, within all accommodation cabins, utility cabins and adjacent to equipment units:

- The majority of these will be standard size 9 kg hand portable extinguishers, suitable for containing or extinguishing minor fires.
- A set of larger 25 kg extinguishers will be positioned strategically around the site to act as back-up in case of a larger fire or prolonged containment is required.
- A set of spare extinguishers will be stored on the site.
- Larger 50 kg foam extinguishers will be positioned where fuel and lubricants are stored.

The rig contractor, who is also providing the accommodation camp trailers and equipment, will be responsible for ensuring that all extinguishers are serviced and certified before mobilisation and periodically during the operation. PTTEP SA's rig manager will be responsible for verifying this process.

The rig contractor is responsible for training their crew in fire fighting techniques and to hold regular practice drills. PTTEP SA's rig manager will be responsible for verifying this process.

4.5.8 Land Compensation

The land on which the well sites and access roads will be constructed is privately owned. The land for the project sites and access roads will be leased or bought under the name of MOGE from the owners as per mutual agreement between PTTEP SA, MOGE and the owners as determined by the compensation committee. The land acquisition procedure is detailed in **Section 8.19, Land Lease/Acquisition Compensation Plan.**

A Grievance Mechanism has been established in the form of SSHE Grievance Handling Guideline (**Section 8.15, Public Consultation & Grievance Mechanism).** Grievance mechanism is a mechanism through which communities and individuals affected by the project activities can formally communicate or channel their concern and grievances to the company and facilitate resolutions that are mutually acceptable by the parties, within a reasonable timeframe. The grievance mechanism along with the External Relations Officer appointed to facilitate the grievance process is a management tool designed to help address stakeholder concerns promptly and facilitate a trustworthy and constructive relationship. The roles of the external relations officer are; to perform an initial review of the grievance and determine the relevance to project, serve as the grievance investigation facilitator, investigate and record the complaint in the grievance form and propose a solution if the case the grievance can be solved by an immediate action.

The grievance record form is to be used to record the grievance through the process with the PTTEP web based Incident Management System (IMS) is used to be used to record the management of the grievance handling throughout the process until completion and close out.

5 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

5.1 Setting the Study Limits

5.1.1 Introduction

This section presents the existing environmental, social, economic and health conditions of the project area, including physical and biological resources, human use values, and quality-of-life values.

The project Study Area is focused on the proposed exploration drilling wells in Block MOGE-3 for the purpose of describing baseline environmental, socio-economic and health conditions potentially affected by the project and affecting the project **(Figure 5-1)**. Where appropriate for the purpose of establishing context, data and observations from the region are also referenced.

Block MOGE-3 lies within Thayet, Kanma and Aunglan Townships of Thayet District in the Magway Region in Myanmar. The exploration drilling wells are located only in the Thayet Township. The administrative centre is the town of Thayet, which is located in the Thayet District. Thayet District is a district of the Magway Regional government in central Myanmar. The total area of this block is 1198 sq. km (463 sq. miles) and is located 270 km northwest of Yangon and 100 km southwest of Myanmar's capital Nay Phi Taw.

Geography of Block MOGE-3 consists of river valleys, paddy fields, forest areas and hill/mountain terrain. Geologically Block MOGE-3 is situated between the Pyay Embayment sub-basin and the Pegu-Yoma Sittuang Basin in central Myanmar.

5.1.2 Scope of Study

The environmental setting of the Project consists of physical (earth, air, water, acoustic), biological, and human components. The human component includes land use, demographics, socio-economic, cultural and quality of life aspects. The study is focused on the conditions found within the block, however, broader regional information is provided where it provides relevant context to the assessment.

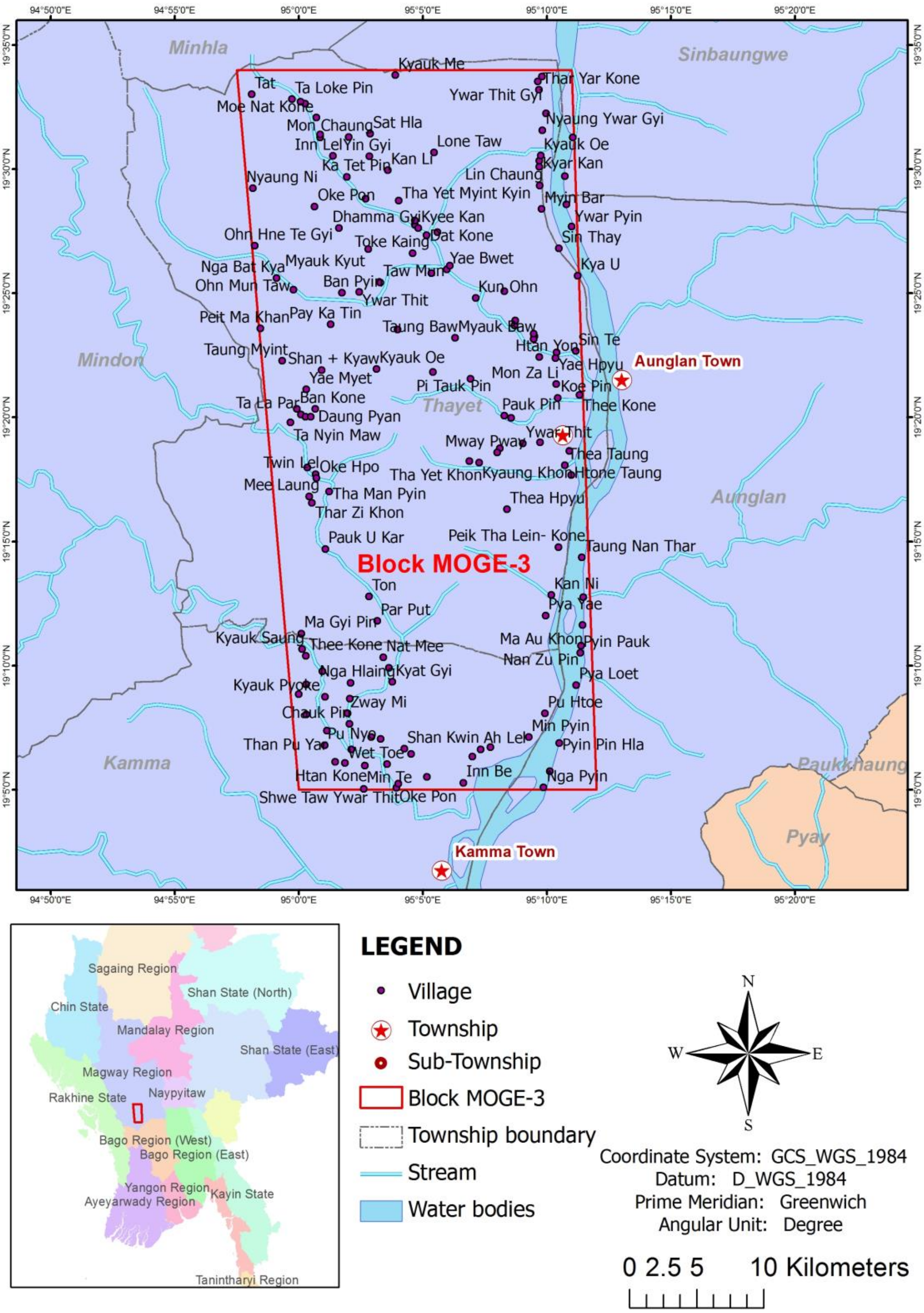


Figure 5-1: Project Location

5.2 Methodology for Data Collection and Analysis

5.2.1 Data Sources

5.2.1.1 *Primary Data*

For the baseline survey, a detailed, field sampling plan was developed to supplement the existing secondary database for the Study Area. Data collected for this EIA includes details of the proposed project, environmental baseline, socio-economic setting and health conditions of the potentially affected areas. Data were obtained from primary and secondary sources.

Primary data sources include:

- Environmental quality baseline survey for surface water, groundwater quality, and soil survey conducted on 6 – 9 February, 2018;
- Environmental quality baseline survey for noise and air quality survey conducted on 6 – 10 February, 2018;
- Environmental, social and historic & archeological information collected from meetings and interviews with Thayet General Administrative Department (GAD), Forestry Department and City Development Committee (CDC) officials conducted on 5 – 8 February, 2018;
- Traditional Ecological Knowledge (TEK) surveys with local farmers which focused on a number of ecological indicators regarding biodiversity and ecological status was conducted on 5 – 8 February, 2018;
- Land use, biodiversity and forestry field survey 6 – 9 February, 2018;
- Socio-economic surveys conducted on 5 – 8 February, 2018; and
- Focus Group meetings with villagers on 5 - 8 February, 2018.

A total of 34 communities were selected to participate for socio-economic information in the block (**Table 5-1**). These villages were selected to provide a representative sample of the socio-economic setting for the well sites.

Table 5-1: Community environmental and socio-economic sampling sites

No.	Date	Time	Meeting Venue	Stakeholders Covered/Villages	Number of participant
1	5th February	09:30 – 11:30	Thayet Township Town Hall	1. Township & District Level Authorities 2. Forestry & ECD 3. NGOs 4. CSOs 5. Media	102
2	5th February	14:00 – 16:00	Padaukpin village	1. Kyauk-O 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay	167
3	6th February	14:00 – 16:00	Baw village	1. Tazigauk (East) 2. Tazigauk (West) 3. Talokpin 4. Monatkon 5. Tat 6. Baw (North)	214

No.	Date	Time	Meeting Venue	Stakeholders Covered/Villages	Number of participant
				7. Baw (South) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon	
4	7th February	14:00 – 16:00	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Ohn Mun Daw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi	272
5	8th February	14:00 – 16:00	Paput Village	1. Ton 2. Paput 3. Paukuga	59

Primary data collected during the field survey included the following:

- Surface water samples
- Groundwater samples (from water wells)
- Local perception of water quality
- Air quality samples
- Local perception of air quality and climate change
- Soil samples
- Baseline Noise Measurements
- Flora and fauna (habitat and presence based on observations and local knowledge)
- Aquatic Biota
- Land Use and landscape observations
- Infrastructure and services
- Socio-economic and demographic data
- Health and Health Care Data
- Cultural heritage/archaeology
- Local perspective, concerns and interests regarding oil and gas development

The geographical scope of the baseline survey provided an overview of site conditions believed representative of the Block MOGE-3 exploration drilling program.

The specific methodologies and results from the analyses performed for Block MOGE-3 are discussed in the corresponding sections in this report.

5.2.1.2 *Secondary Data*

Secondary data sources came from literature, and relevant authorities in the project area. The secondary data sources are cited throughout this report, and listed in the references section.

5.2.2 Laboratory Analysis

All samples were sent to ISO certified laboratory; ALS Life Sciences Division in Hong Kong for analysis.

ALS Life Sciences Division
11/F Chung Shun Knitting Centre
1-3 Wing Yip Street
Kwai Chung, NT, Hong Kong
T +852 2610 1044
F +852 2610 2021
www.alsglobal.com

5.3 Physical Components

5.3.1 Topography

The main geographic features of Myanmar can be divided into five physiogeographic zones, consisting of the northern mountains, the western ranges, the eastern plateau, the central basin and lowlands, and the coastal plains[1], characterized by elongated north-south topographic trends.

The Block MOGE-3 is located entirely in the central basin and lowlands physiographic zone lying between the Rakhine Mountains and the Shan Plateau, are structurally connected with the folding of the western ranges and predominantly occupies generally mountain and rolling plain but in the eastern part is flat towards the Ayeyarwady River on Ayeyarwady floodplain **(Table 5-2)**.

Topographically the study area is generally undulating (slope 2-23%) and sloping hill covered with dry deciduous forest alternating cultivation area. The height of study area is ranged from 40-260 m MSL while the proposed wells well01, well02, well03, well04, well05, well06, and well07, well08 are at 170, 140, 146, 121, 94, 227, 105, and 112 m MSL, respectively. The topographic and elevations of the proposed wellsites are included in **Figure 5-3** to **Figure 5-10.**

From the field survey and satellite image, the study area consists of deciduous forest, agricultural area and community area.

1 Michael Arthur Aung-Thwin David I. Steinberg Maung Htin Aung (2018) ***Myanmar***. Retrieved from Encyclopedia Britannica: https://www.britannica.com/place/Myanmar. Access on 26 Jan 2018

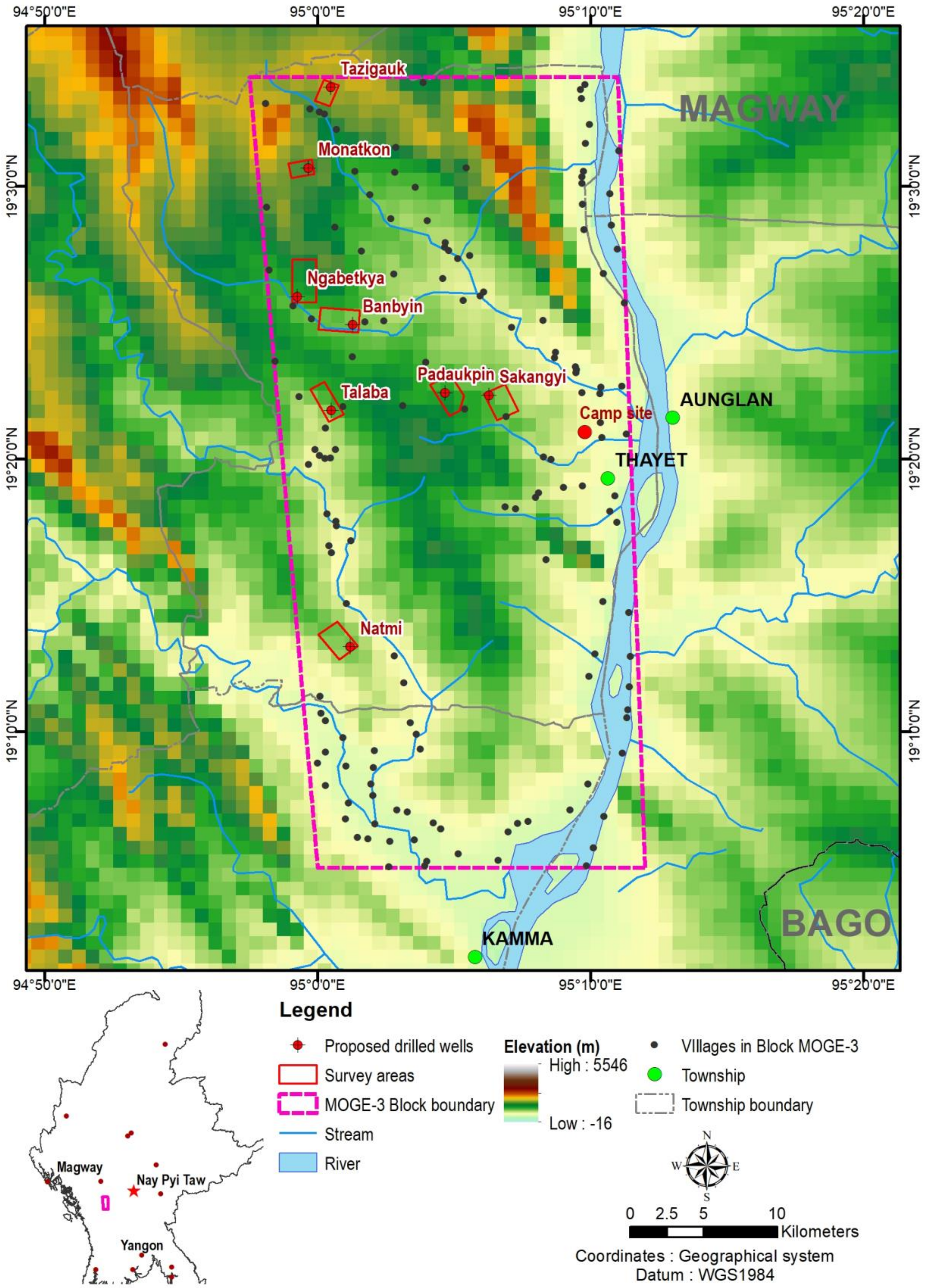


Figure 5-2: Topographic Map of Block MOGE-3

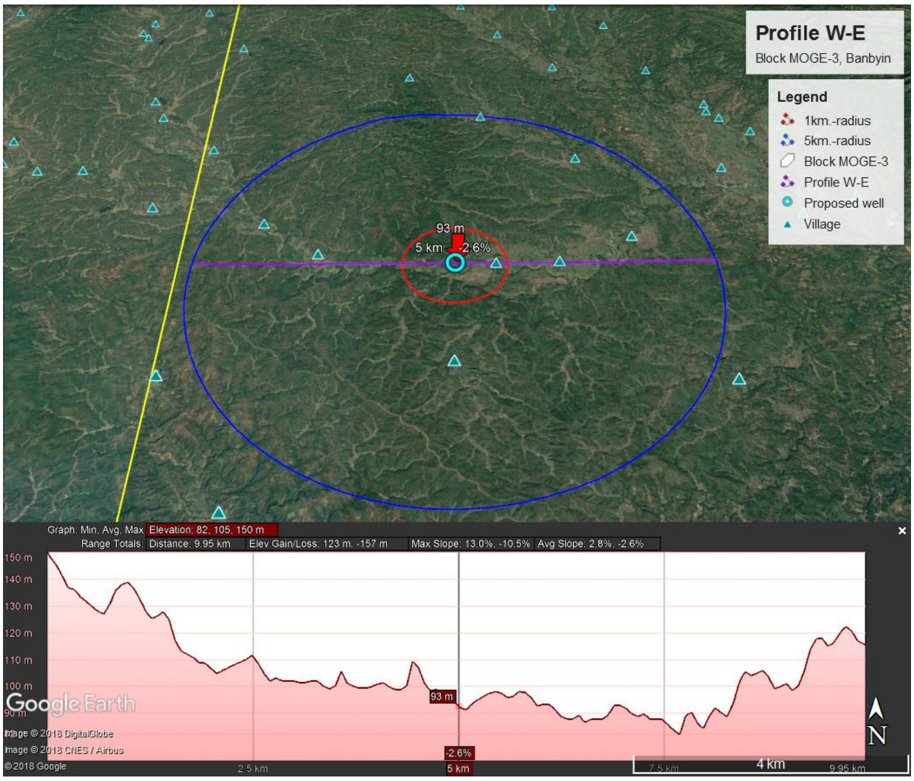


Figure 5-3: Profile W-E of Proposed Banbyin Study Area

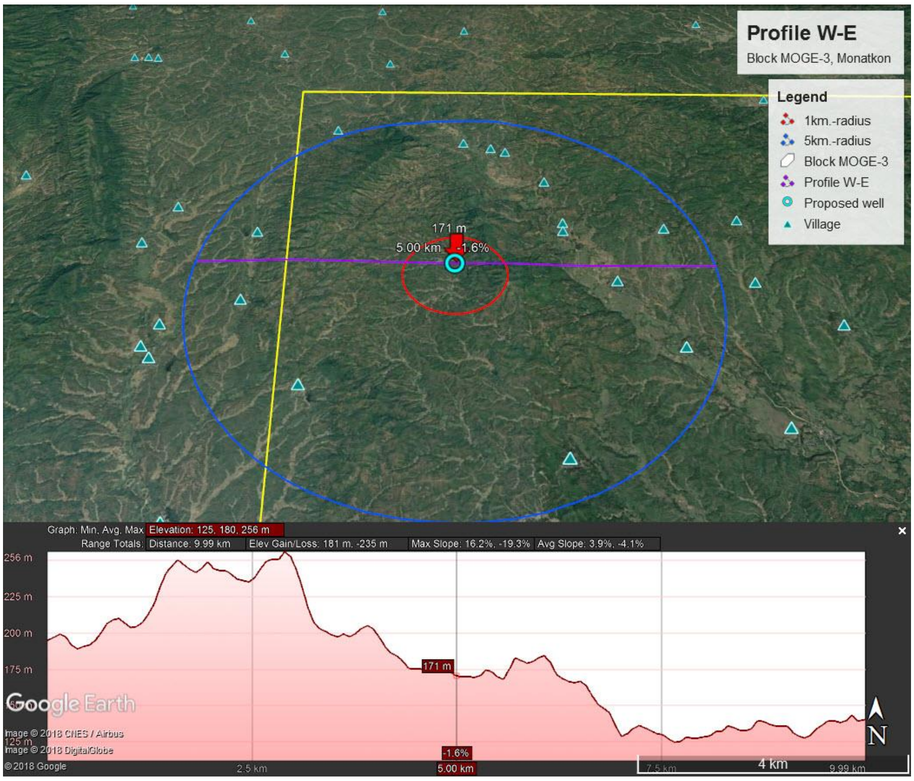


Figure 5-4: Profile W-E of Proposed Monatkon Study Area

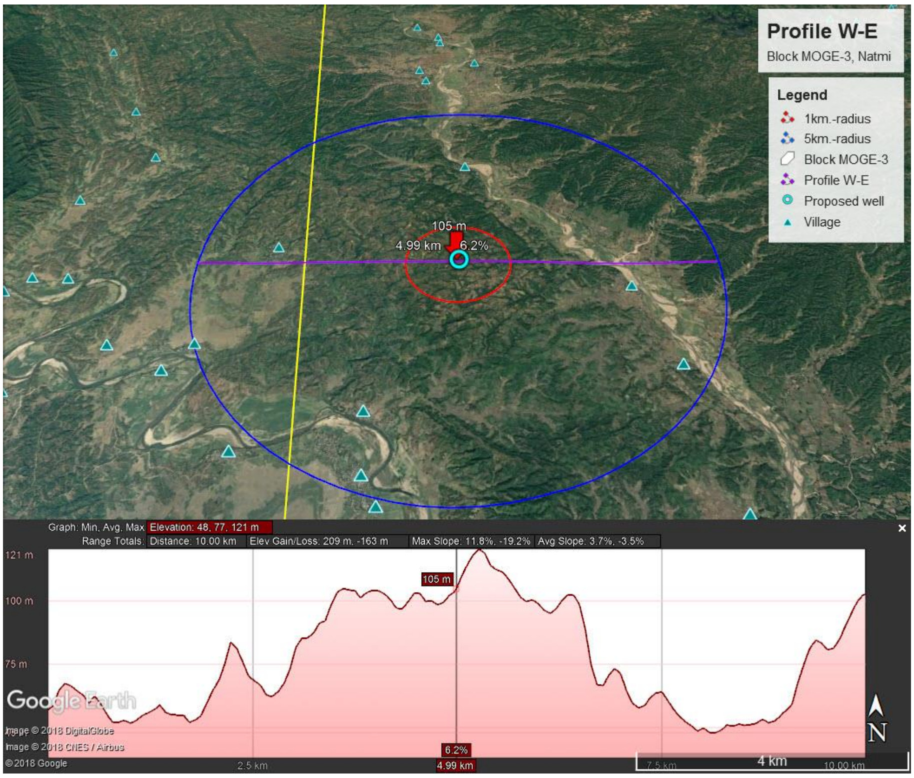


Figure 5-5: Profile W-E of Proposed Natmi Study Area

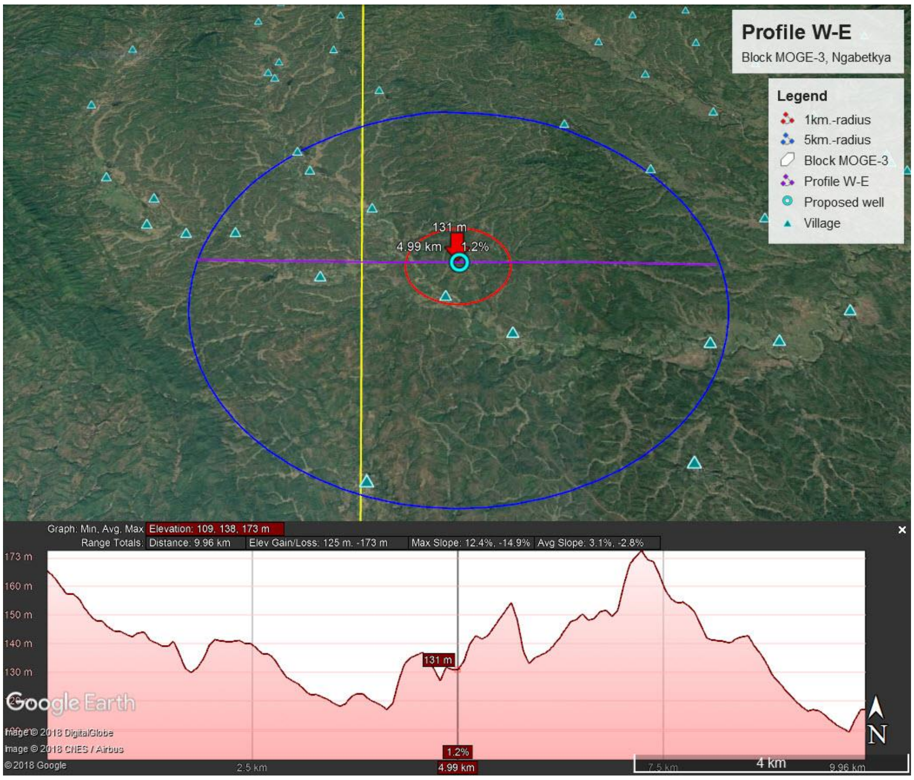


Figure 5-6: Profile W-E of Proposed Ngabetkya Study Area

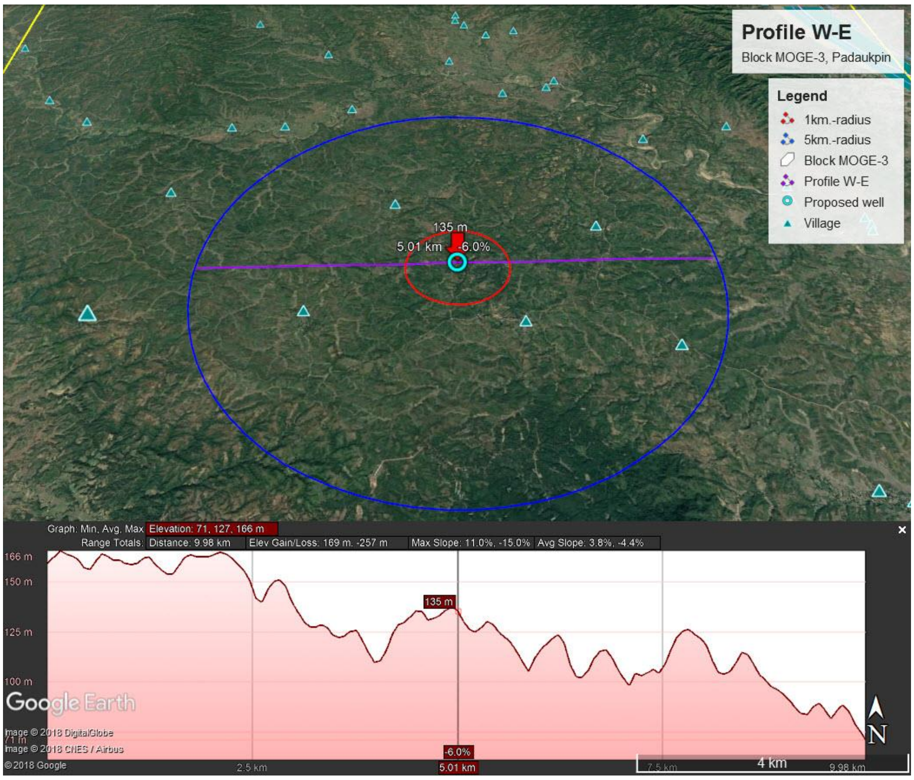


Figure 5-7: Profile W-E of Proposed Padaukpin Study Area

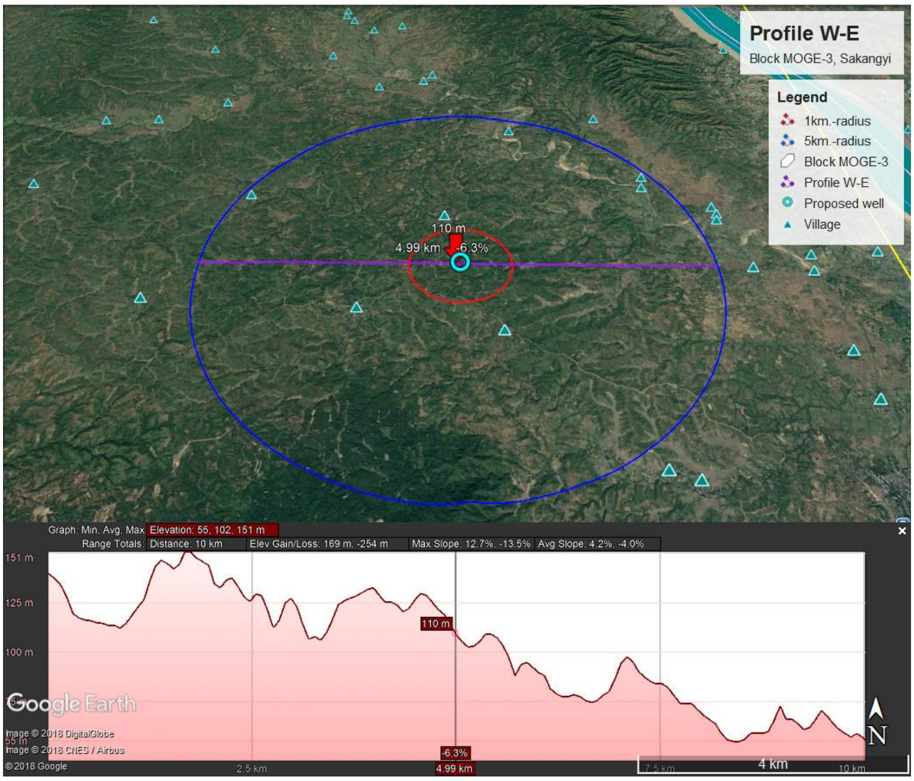


Figure 5-8: Profile W-E of Proposed Sakangyi Study Area

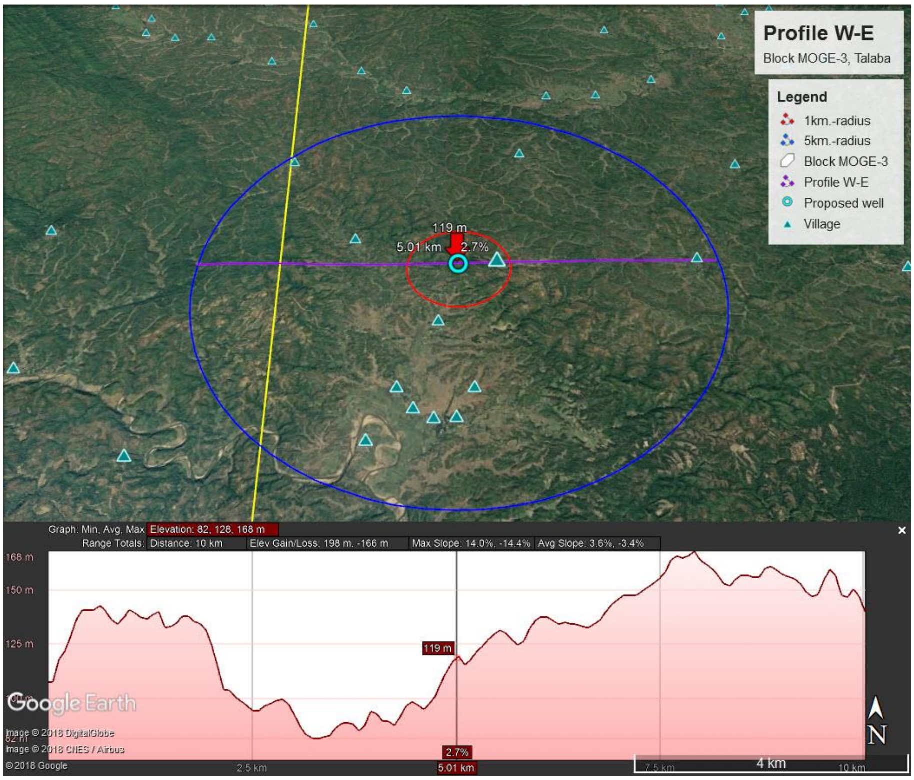


Figure 5-9: Profile W-E of Proposed Talaba Study Area

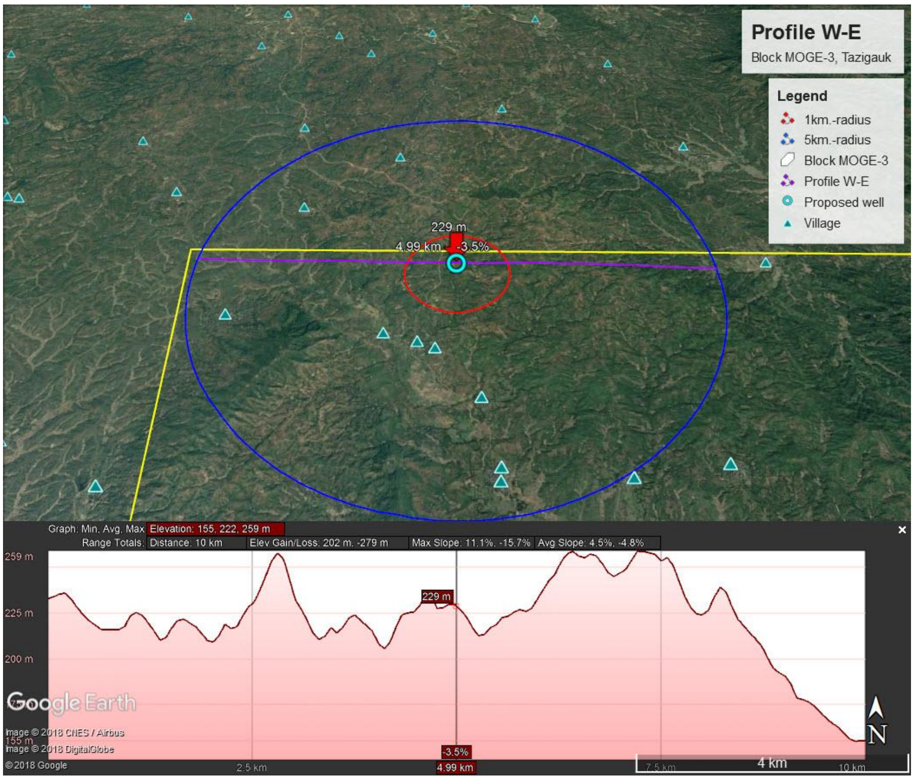


Figure 5-10: Profile W-E of Proposed Tazigauk Study Area

5.3.2 Climate and Air quality

The climate of Myanmar is controlled by the monsoon circulation system of South East Asia resulting in tropical monsoon climate but it is also influenced by the presence of major landforms. The mountain ranges generally run north-south acts as effective climate barriers for the southwest monsoon (approx. end of May through October) in the summer and the northeast monsoon in the winter (approx. December through April). Therefore this condition causes the difference climate zone in regions.

Focusing Magway region, according to Köppen and Geiger this region has three different climates and is dominated by Aw: Tropical savana climate i.e. Thayet, Magwe, Myaydo, Minbu, Gangaw. While the less is Ash: Hot semi-arid climate i.e. Pakokku, Yenangyaung, Chauk, Taungdwingyi, Yesagyo and Csa: Hot-summer Mediterranean climate in Gote Gyi Village. The study area is located at 30km west from Thayet Township therefore the best reference climate will be Aw.

The weather generally in Myanmar can be divided into three seasons consisting of (1) Winter or Northeast monsoon season (November - February), (2) Summer or Hot weather season (March - Mid May), and (3) Rainy or Southwest monsoon season (Mid May - October)

Block MOGE-3 is at the southern edge of central dry zone which has higher rain than Magway Station and even though Thayet is located in Magway Region, the nearest station is Pyay (54 km S).

5.3.2.1 *Temperature and Precipitation*

Pyay weather station is located in Pyay Town which is 54km S away from the proposed wells. This station is representative of weather condition of the study area. From **Figure 5-11** in the 30 year period (1981-2010), the average annual rainfall was 1,227 mm. The minimum temperature was ranged between 16.2 - 24.8 °C and the maximum temperature was ranged between 31 - 38.7 °C throughout the year.

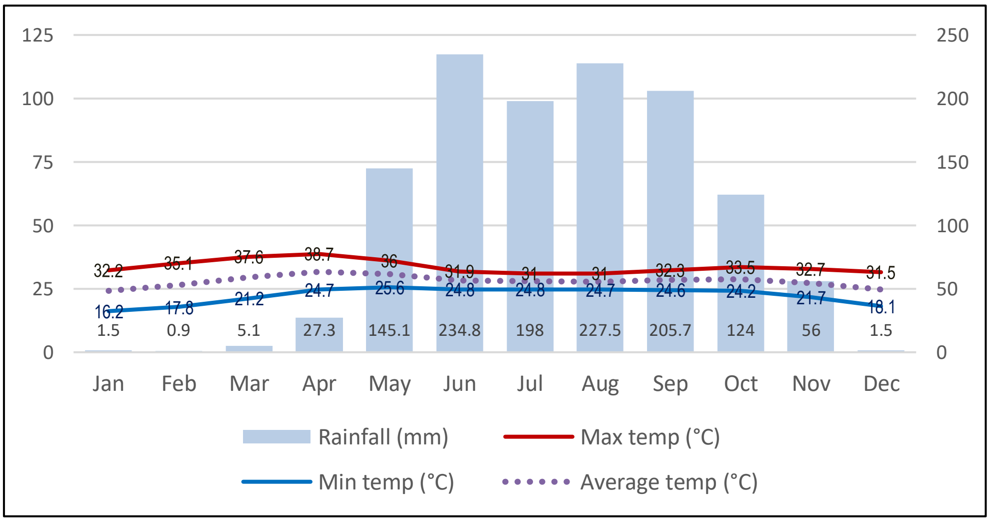


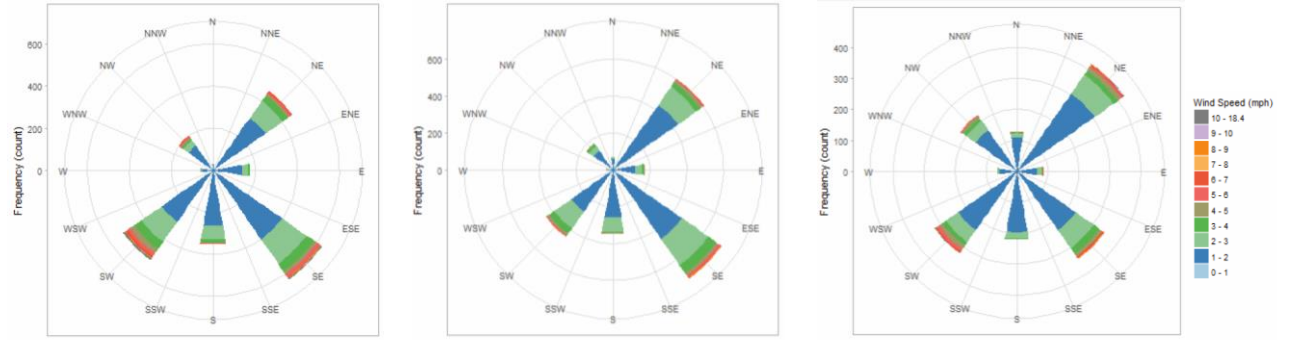
Figure 5-11: Temperature and Precipitation at Pyay Weather Station (1981 -2010)

Source: Modified from Lai Lai Aung, et al (2017)[2]

2 Lai Lai Aung, *et al*. (2017). ***Myanmar Climate Report***. Department of Meteorology and Hydrology Myanmar and Norwegian Meteorological Institute, Norway. Retrieved from https://www.met.no/publikasjoner/met-report/_/attachment/download/c4122b3a-0f79-43cd-ac86-e3887177ad07:859e8b441ab11b1e7d3d1a08679f8d67089a3497/MyanmarClimateReportFINAL11Oct2017.pdf

5.3.2.2 *Wind*

Dominant wind patterns in the Study Area are driven primarily by regular southwest monsoon wind in the rainy season and northeast monsoon wind in the winter or cold-dry season. These wind patterns are mediated by more mountainous terrain to the West and East. Localized meteorological conditions are also influenced by diurnal thermal cycles and cloud cover. Maximum sustained wind speeds can approach 30 km/hr (18.4 mph) under certain conditions. The win rose of Magway can represent the wind speed and direction in the study area. **(Figure 5-12)**



(a) Pre monsoon season (b) Monsoon season (c) post monsoon season

Figure 5-12: Wind rose of Magway (Nearest Station to Study Area) [2]

5.3.2.3 *Air Quality*

Air quality monitoring stations were deployed in the 5km-radius of the proposed drilling well during November 8 – 9, 2017 to collect ambient air monitoring data along with meteorological data on wind speed, wind direction, temperature and relative humidity. These data are compared with the Myanmar and WHO standards.

5.3.2.3.1 *Methodology for Study*

The air quality sampling methodology used for this project is described as follows:
The air monitoring survey used the HAZ-SCANNER EPAS Wireless Environmental Perimeter Air Monitoring System (EPAS) which is factory calibrated with the appropriate USEPA certified target gas and correlated with USEPA methods. (Ref: Code of Federal Regulation 40CFR part 53).

The survey monitored 24hr continuously except battery change after 8hr interval. The parameters which were monitored included:

1) Particulates: TSPM, PM10
2) Gases: NO_2, SO_2, CO, VOC, NH_3, H_2S, and Atomic Radiation
3) Meteorology: Temperature, Relative Humidity, Wind Speed, Wind Direction and Relative Humidity

5.3.2.3.2 *Sampling Location*

Four ambient air-sampling locations were set at Padaukpin, Tazigauk, Ohn Mun Taw and Ton village, which were the nearest representative receptors to the proposed drilling locations.

The current conditions, sampling locations, and sampling stations are presented in **Table 5-2**, **Figure 5-13**, and **Figure 5-14,** respectively.

Table 5-2: Air Sampling Locations for MOGE-3 Drilling Program in February, 2018

Station	Village	Coordinates (GCS WGS84)		Coordinates (UTM Zone 46 N)		Start Date	End Date
		Latitude	Longitude	X	Y		
A/N_1	Padaukpin Village	19°22' 18.50"N	95°4'52.89"E	718609.4	2143285.2	6.2.2018	7.2.2018
A/N_2	Tazigauk Village	19°32'42.11" N	95°0'5.54"E	709999.8	2162363.1	8.12.2017	9.12.2017
A/N_3	Ohn Mun Taw Village	19°25'9.03"N	94°59'38.04" E	709359.8	2148420.8	9.2.2018	10.2.2018
A/N_4	Ton Village	19°12'49.48" N	95°2'42.49"E	715010.0	2125741.3	10.2.2018	11.2.2018

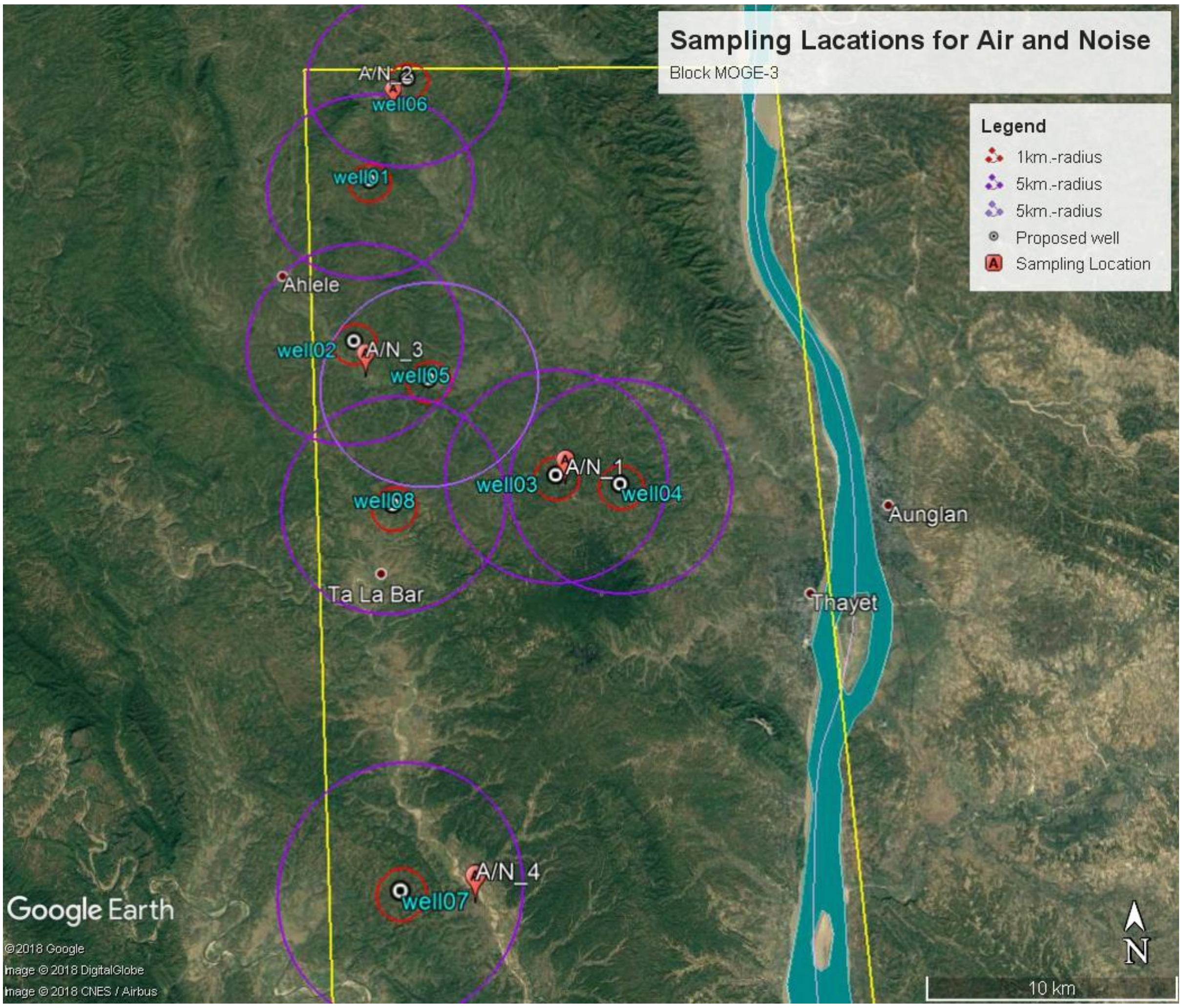


Figure 5-13: Air Sampling Locations for MOGE-3 Drilling Program in February, 2018

(a) A/N_1 Padaukpin village)

(b) A/N_2 Tazigauk village

(c) A/N_3 Ohn Mun Taw village

(d) A/N_4 Ton Village

Figure 5-14: Ambient Air and Noise Sampling Stations

5.3.2.3.3 *Comparing Air Quality Legislation and Guidelines*

Ambient air quality in this report will be compare to country and WHO guideline as it available to each parameter as listed below;

1) Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012[3],
2) WHO Air quality guideline (2006) and amendment.

5.3.2.3.4 *Result of Study*

Local Climate

The onsite meteorology data during the one week monitoring period starting from February 6 - 11, 2018 measured by the EPAS monitoring station indicates Temperature, Relative Humidity, Wind speed and Wind direction. **Table 5-3** presents the wind direction that generally comes from the east to the south. The wind direction degrees are varied from 82-178 degrees for 4 villages. Generally, the

3 The Pyidaungsu Hluttaw Law No. 9/2012

average ambient temperature was ***19-21 degree centigrade***, wind speed average was ***1 kph*** except at Padauakpin village that was ***3 kph***. The relative humidity was shown in the range of ***71-73%*** except at Padauakpin village that had a RH of **60%**.

Table 5-3: Meteorology data obtained from Baseline Survey

Elements* (unit)	Station Village	Point 1 Padaukpin Village	Point 2 Tazigauk Village	Point 3 Ohn Mun Taw Village	Point 4 Ton Village
Temp (°C)	Avg.	21	19	19	19
	(min.-max.)	(15 - 28)	(13 - 28)	(12 - 29)	(14 - 30)
Wind speed (kph)	Avg.	3	1	1	1
	(min.-max.)	(0 - 16)	(0 - 19)	(0 - 31)	(0 - 13)
Wind direction (degree)		82 East	150 South-South East	178 South	97 East
Relative humidity (%)	Avg.	60	71	71	73
	(min-max)	(32 - 98)	(32 - 100)	(30 - 100)	(26 - 100)

Remark: Measurement duration was 24hrs

Summary of Air Quality Results

The selected villages where the air quality samples were collected were agriculture-based areas. The baseline data gathered at these locations were considered to be representative and typical of other nearby locations. The variation in ambient air concentration will be more or less similar due to the same topography, land use and meteorological conditions.

The results from the baseline survey indicate that the 24-hour average levels of both $PM_{2.5}$ and PM_{10} did not meet the WHO guideline (50 µg/m^3) at all sampling points. This area is dry and dusty, with fugitive dust emissions being high due to the wind action, agriculture activities, open burning, forest fires and usage of wood stoves contributing to high particulate daily levels in rural background area. The existing baseline levels of dust (respirable $PM_{2.5}$ and PM_{10}) in all regions can cause nuisance and respiratory tract infection.

Air quality for the air pollutants: the 24 hour average levels of SO_2 were higher than WHO standard (20 µg/m^3) at all sampling points within the proposed project area and varied from 23-57 µg/m^3. The high SO_2 levels throughout the survey area attributed to the usage of diesel fuel with high sulphur contents in power generators and transportation. Generally, Myanmar's sulphur content in diesel is 500 ppm and met to Euro II[4,5] (**Table 5-4**). Furthermore, open burning as well as forest fires will also be contributing factors.

Other gases (VOC, O_3, CO, NH_3 and H_2S) were also monitored and this can be used as the background concentration and comparison in the post monitoring assessments as well. These values were in the range of WHO standards at all sampling points. Background ambient atomic radiation level was also in the range of the USEPA standard.

4 [NEWS] The Global New Light of Myanmar - MPTA to request govt to scale down sulphur levels Date: January 5, 2018 http://www.globalnewlightofmyanmar.com/mpta-request-govt-scale-sulphur-levels/
5 The evolution of EU fuel specifications for sulfur content https://www.transportpolicy.net/standard/eu-fuels-diesel-and-gasoline/

Table 5-4: Ambient Air Quality in 2km-radius of Drilling Wells

Substance*	Unit	Station / Village	Point 1 / Padauakpin Village	Point 2 / Tazigauk Village	Point 3 / Ohn Mun Taw Village	Point 4 / Ton Village	Myanmar EQG (2015)	WHO AQG (2006)
Gas quality								
NO_2	$\mu g/m^3$	Avg. (1hr)	12	24	21	39	200 ug/m^3	200 ug/m^3
		Avg (24hr)	11	24	20	24	(1hr)	(1hr daily max)
		(Min.-Max.)	(2 - 74)	(2 - 81)	(2 - 66)	(2 - 67)		
SO_2	$\mu g/m^3$	Avg. (24hr)	**57**	**44**	**24**	**23**	20 ug/m^3	20 ug/m^3
		(Min.-Max.)	(0 - 1199)	(0 - 1059)	(0 - 581)	(0 - 684)	(24hr)	(24hr)
CO	$\mu g/m^3$	Avg. (8hr)	106	0.4	0.3	0.3	10,000 ug/m^3	10,000 ug/m^3
		Avg.(24hr)	152	347	192	337	(8hr)	(8hr)
		(Min.-Max.)	(0 - 770)	(0 - 1370)	(0 - 720)	(0 - 820)		
O_3	$\mu g/m^3$	Avg.(8hr)	30	27	27	27	100 ug/m^3	100 ug/m^3
		Avg.(24hr)	31	27	28	25	(8hr)	(8hr)
		(Min.-Max.)	(18 - 45)	(2 - 81)	(12 - 48)	(10 - 49)		
VOC	ppb	Avg.(24hr)	33	56	43	51	N/A	N/A
		(Min.-Max.)	(0 - 662)	(0 - 149)	(0 - 172)	(0 - 122)		
NH_3	ppm	Avg.(24hr)	5	0	1	0	N/A	N/A
		(Min.-Max.)	(0 - 2995)	(0 - 2)	(0 - 8)	(0 - 0)		
H_2S	ppb	Avg. (24hr)	13	19	21	24	N/A	N/A
		(Min.-Max.)	(0 - 103)	(0 - 109)	(0 - 158)	(0 - 83)		
Atomic Radiation	CPM	Avg.(24hr)	15	15	16	16	25-75 CPM (US EPA)	
Particulates								
PM2.5	$\mu g/m^3$	Avg.(24hr)	**54**	**90**	**73**	**110**	25	25
		(Min.-Max.)	(1 - 117)	(1 - 409)	(1 - 296)	(1 - 226)		
PM10	$\mu g/m^3$	Avg.(24hr)	**68**	**109**	**93**	**127**	50 ug/m^3	50 ug/m^3
		(Min.-Max.)	(2 - 178)	(2 - 456)	(2 - 348)	(2 - 291)	(24hr)	(24hr)

Remark:
* Measurement duration was 24hrs
N/A - Not available

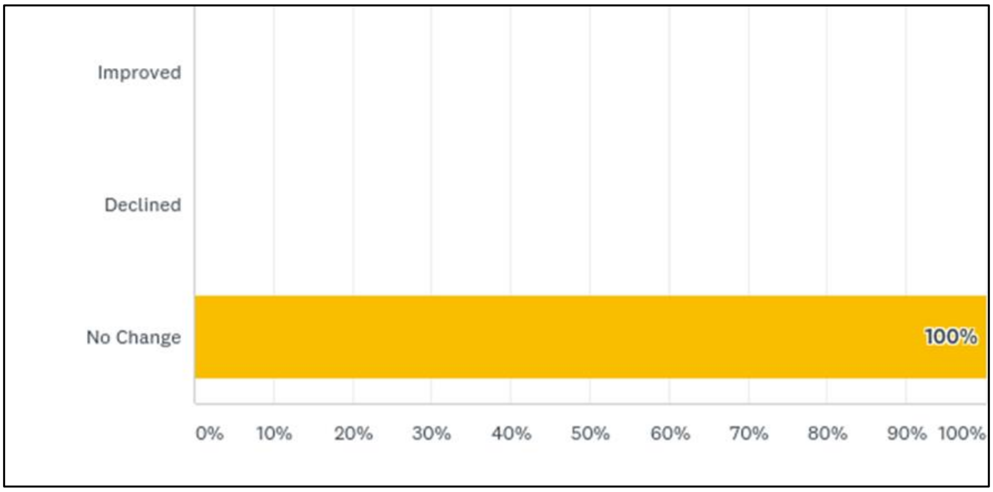
5.3.2.4 *Local perception of Air Quality and Climate Change*

During IEM's comprehensive project socio-economic health and opinion survey of 412 households in the project area, residents were asked socio-economic questions as well as for information on their environmental perceptions.

Air Quality

In regard to Air Quality all of the villagers interviewed have not noticed changes to air quality (**Chart 5-1**).

Chart 5-1: Response of Villagers In Regard To Perceived Changes Observed In Air Quality.



Climate Change

Villagers (54%) perceived that the climate was warmer while 35% indicated that it was unchanged and 9% thought that it was cooler (**Chart 5-2**).

Most villagers (81%) noted less precipitation resulting in a climate that is drier. (**Chart 5-3**)

Chart 5-2: Response of Villagers in Regard to Perceived Changed in Climate (Temperature)

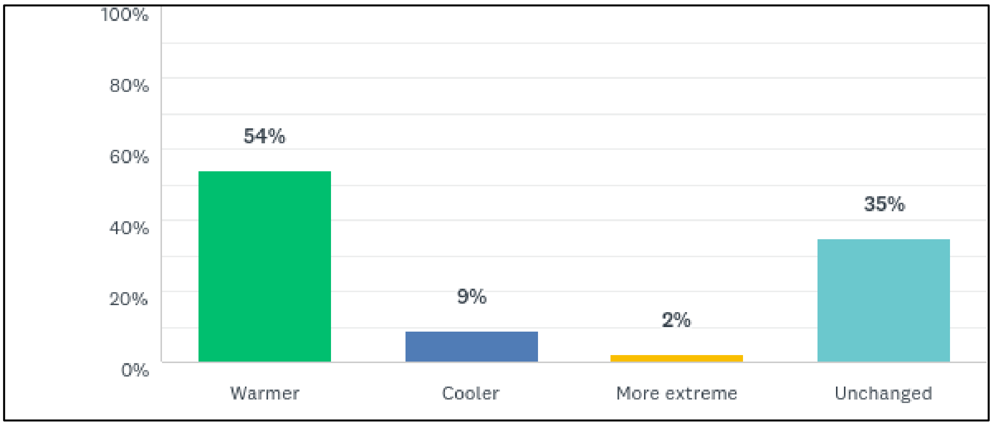
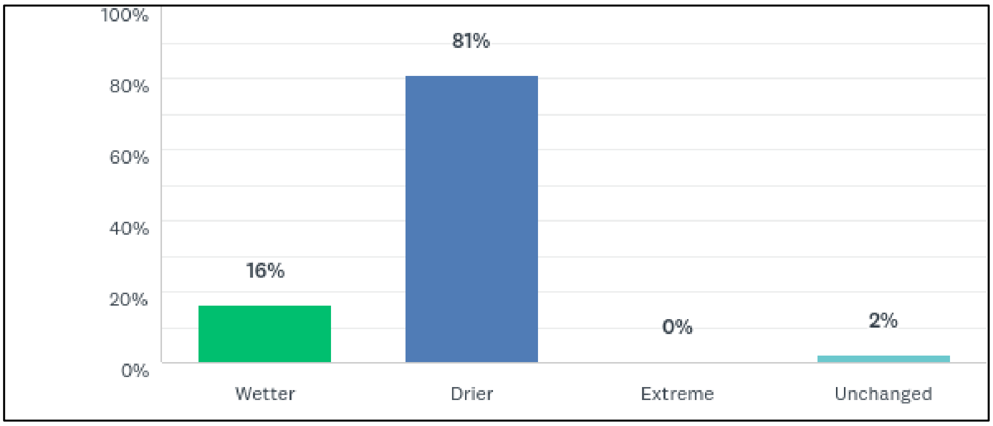


Chart 5-3: Response of Villagers in Regard to Perceived Changed in Climate (Precipitation)



5.3.3 Noise

5.3.3.1 *Methodology for Study*

The internationally recognised 'A' weighting scale (dBA) was used so that the measured noise corresponds roughly to the overall level of noise that is heard by the average human. 24-hour equivalent noise (L_{eq}) were taken every 5 minutes for one day, sound level Baseline noise was measured using a sound level meter model SL-4023SD.

5.3.3.2 *Sampling station*

Ambient noise monitoring surveys for exploration drilling program in MOGE-3 were also undertaken in Padaukpin, Tazigauk, Ohn Mon Taw and Ton village (same location with Air Quality) during February 6 – 11, 2018. **(Table 5-2)**

5.3.3.3 *Comparing Noise Level Guideline*

Ambient noise level in this report will be compare to country and WHO guideline as it available to each parameter as listed below;

1) Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012,
2) WHO Guideline for community noise (1999).

5.3.3.4 *Results*

The Ambient noise measurement data recorded in each community is summarized in **Table 5-5**. The Ambient noise measurements taken at all sampling points near MOGE-3 had 24-hour equivalent noise levels ranging from 37-42 dB and met the WHO Guideline. The day time and night time noise levels met the criteria of the Myanmar EQG and WHO Guidelines at all sampling points except the night time equivalent noise level at Tazigauk Village (46 dB) which was higher than both the Myanmar EG and WHO Guideline standards. The increased noise level was a result of local students having night study sessions near the sampling station.

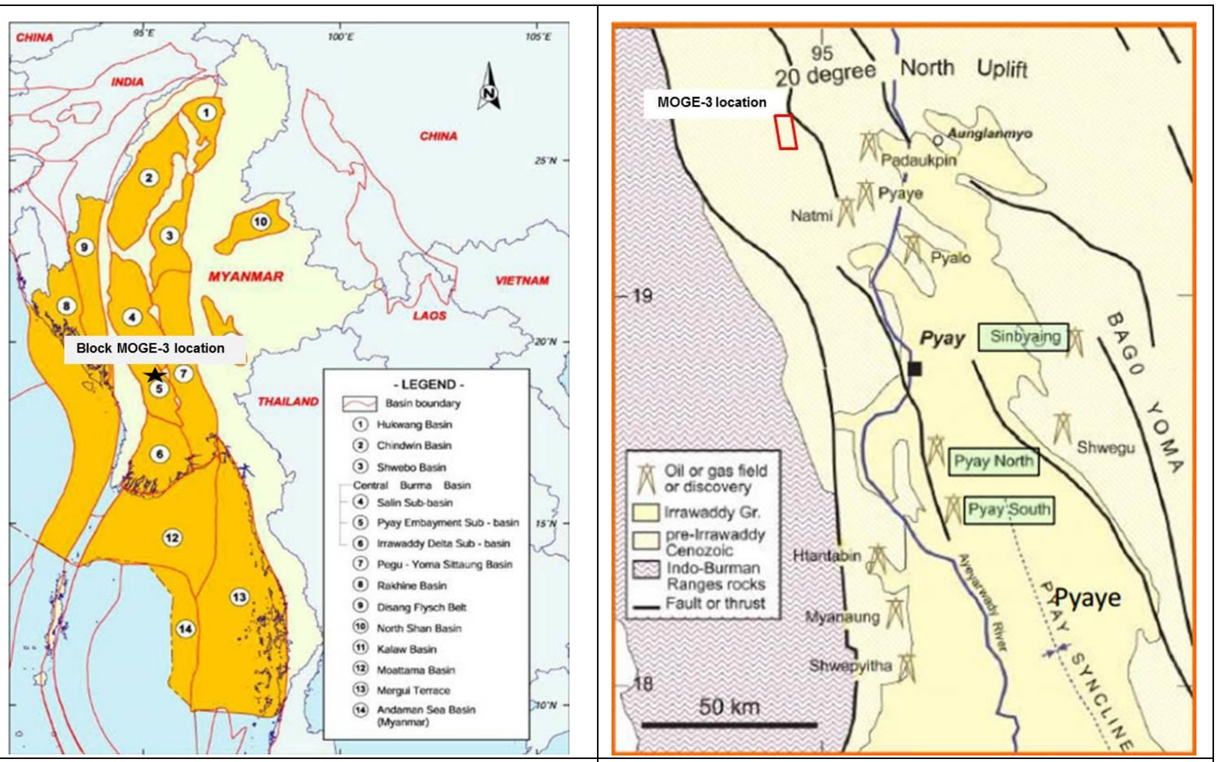
Table 5-5: Average Ambient Noise Level in 12km-radius of Drilling Wells

Station[/1]	Community	L_{eq}	L_{eq}-Day	L_{eq}-Night	L_{min}	L_{max}
1	Padaukpin Village	39	40	40	25	99
2	Tazigauk Village	42	40	**46**	22	77
3	Ohn Mun Taw Village	39	40	38	26	71
4	Ton Village	37	38	35	25	79
Myanmar EQG[/2]		**N/A**	**55**	**45**	**N/A**	**N/A**
WHO Guideline[/2]		**50**	**N/A**	**40**	**-**	**-**

Remark: [/1] Receptor is residential
[/2] Maximum allowable ambient noise levels 1hour Leq (dBA)
Bold indicates higher than guidelines

5.3.4 Geology

Geologically MOGE-3 block is situated at the north of Pyay Embayment sub-basin and the Pegu-Yoma Sittuang Basin in central Myanmar **(Figure 5-15)**.



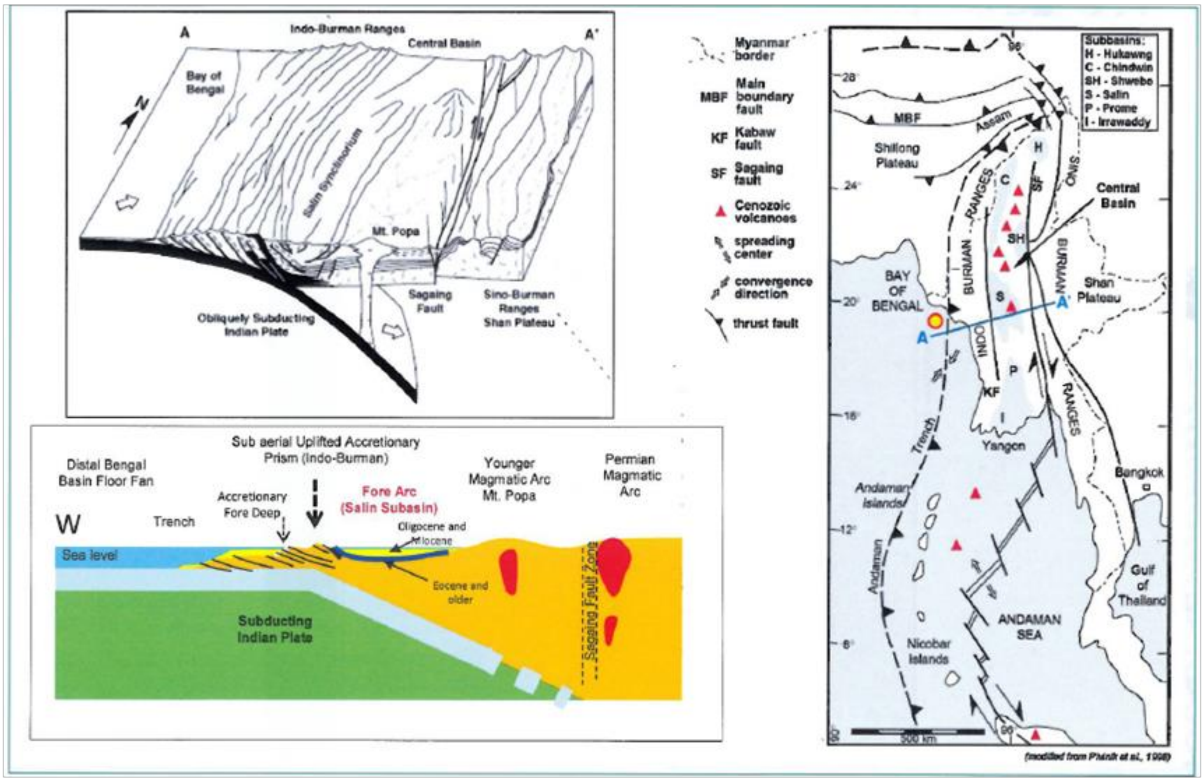
(a) Oil and Gas Fields[6] (b) Pyay Embayment sub-basin and Discoveries[7]

Figure 5-15: Oil and Gas Basin and Production Fields or Discovery in Myanmar

6 Seehapol Utitsan, *et al* (2014). ***Geological Evolution of Bago-Yoma Basin, Onshore Myanmar***. Retrieved on 26 February 2018 from http://www.searchanddiscovery.com/documents/2014/10659utitsan/ndx_utitsan.pdf

7 Thornton, Scott E. (2015) ***The History of Oil Exploration in the Union of Myanmar***. Retrieved on 30 January 2018 from http://www.searchanddiscovery.com/documents/2015/10807thornton/ndx_thornton.pdf

Central Burma Basin a fore-arc basin which was formed as a result of continuous collision of Indian Plate in the North and subduction of northeastern Indian Plate underneath Burma plate (Early Eocene to Late Eocene). This resulted in the generation of active over-thrust faults, western fold-belt mountain ranges and Sagaing strike-slip fault in the east. These faults bound the Central Myanmar Basin. Further collision took place in the Pliocene resulting in the rise of Pegu-Yoma range and the east-west division of sub-basin in Central Burma Basin (CMB). **(Figure 5-16)**



Source: PTTEP SA, 2018

Figure 5-16: Geological Structure of Central Burma Basin

The main reservoir target of exploration wells are mainly Sandstone/Siltstone from intermediate to deep level (**Figure 5-17**). Target depth of each candidate well location is summarized in Table 5-6.

If reservoirs are discovered, further studies on chemical and physical properties of petroleum, age of reservoirs, rock characteristics, porosity, permeability in the formation and others will be conducted. If oil/gas is found then the economics of the potential reservoirs will be evaluated with an appraisal well for assessment/evaluation of the reservoir size.

If oil/gas reserves are economically feasible then a production well will be developed in the area as part of a separate submission.

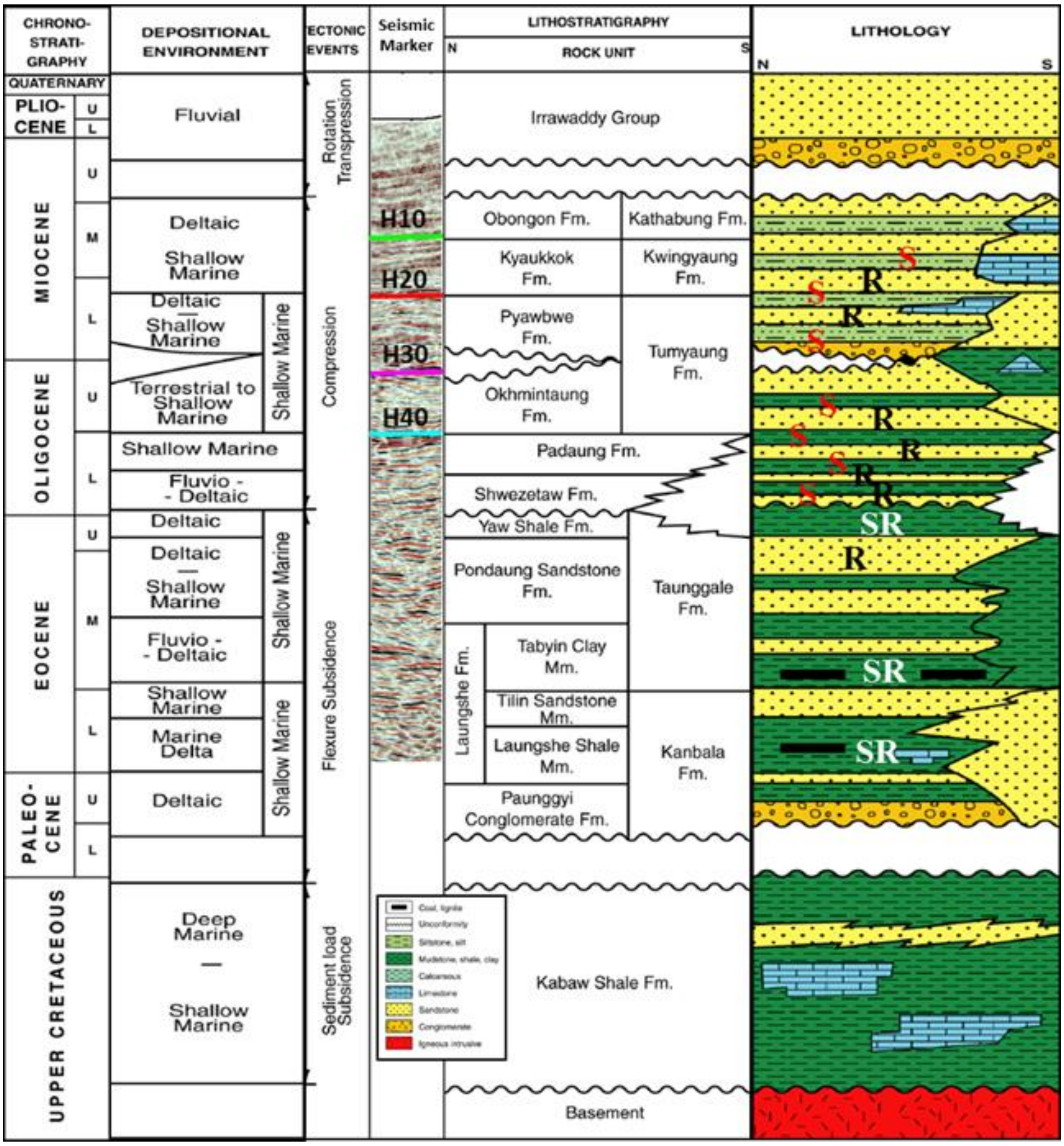


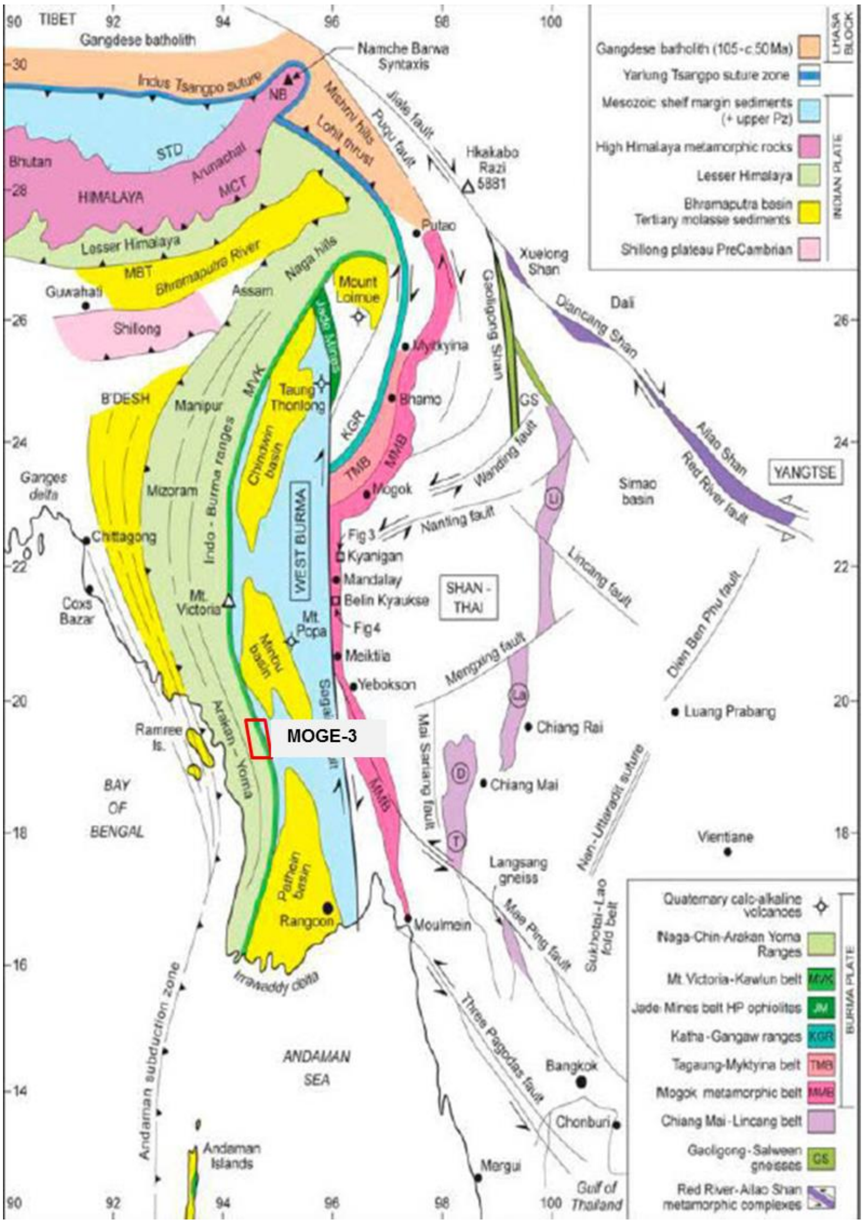
Figure 5-17: Stratigraphic Succession of Block MOGE-3

Table 5-6: Information of the proposed wells

Candidate Location	Padaukpin	Sakangyi	Monatkon	Ngabetkya	Banbyin	Tazi gauk	Natmi	Talaba
Reservoir	Sandstone/Siltstone							
Formation	PY/OK		Lower PY/OK/PA		PY/OK		KK/PY	
Target Zone (mMSL)	600-2575	600-2800	600-2600	600-2800	600-2800	600-2700	600-1650	600-2860
TD Depth (mMSL)	2575	2800	2600	2800	2800	2700	1650	2860
GL. Elevation (m)	125	100	150	150	100	215	115	130

5.3.4.1 *Potential Geohazards (Tectonic Summary)*

Present-day deformation and earthquakes in Myanmar and adjacent parts of Southeast Asia are driven by the northward movement of the Indian subcontinent as it collides with the Eurasian plate. Myanmar, on the eastern side of this collisional zone, lies east of the boundary between the Indian plate to the west, and the Sunda plate. Most of the differential motion between these two plates in Myanmar is concentrated on the Sagaing fault, which is a major north-striking, right-lateral fault that has a slip rate of approximately 18 mm/yr based on GPS data **(Figure 5-18)**. The Sagaing Fault is located 122 km to the east of Block MOGE-3. Numerous large earthquakes have occurred on the Sagaing fault in the past century, including an M 6.9 event in February 1991, which caused 2 fatalities (USGS, 2012).



Source: http://www.searchanddiscovery.com/pdfz/documents/2014/10659utitsan/ndx_utitsan.pdf.html

Figure 5-18: Structural Map showing the Sagaing fault, the Shan Scarp and the Mogok Metamorphic Belt relative to Block MOGE-3

5.3.5 Soil

Interpretation of the distribution of soil types in Block MOGE-3 was based on internationally recognized classification, FAO-UNSECO classification system (1988, 1997), and updated MOECF Agricultural Atlas with GMS database. A limited field sampling program was focused primarily on agricultural soils within the study area.

5.3.5.1 *Soil Classification*

Based on the FAO-UNSECO classification system (1988, 1997), soil in the study area is classified as Rhodic Ferralsols (Agriculture Atlas, MOECAF referred in ICEM Website) see **Figure 5-19**.

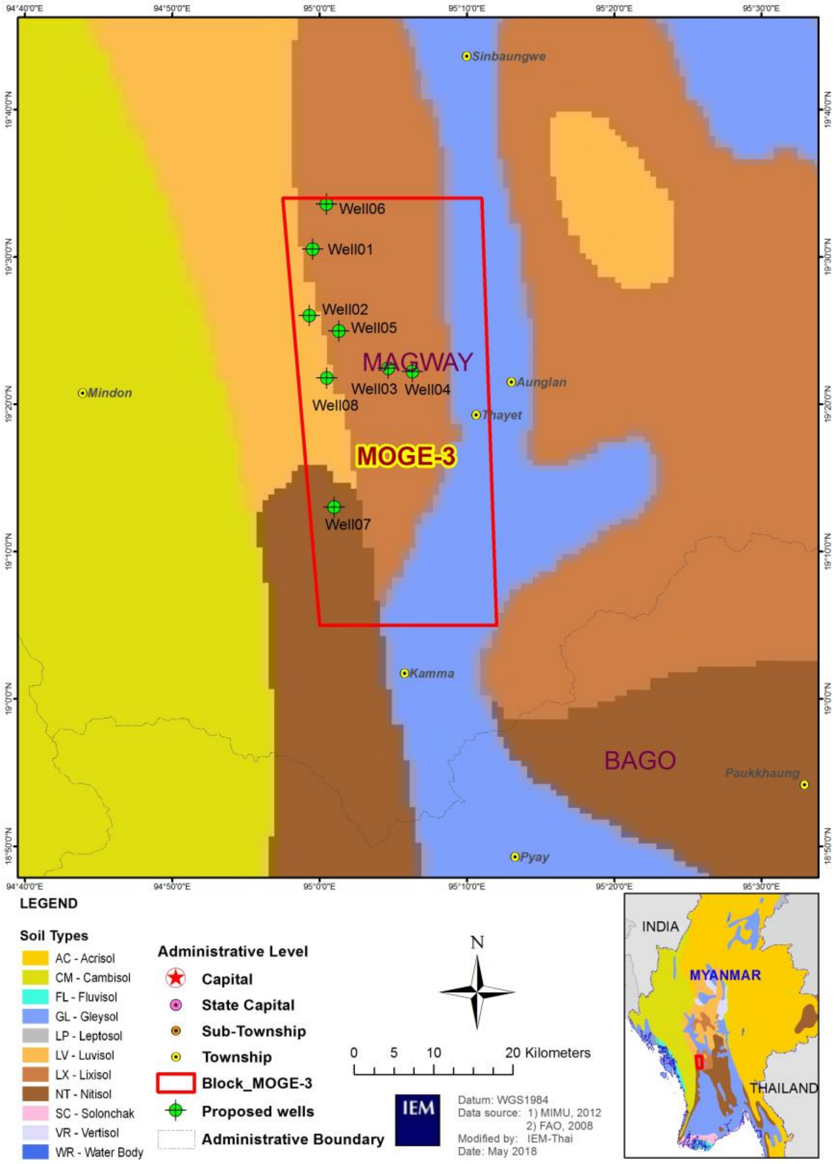


Figure 5-19: Soil Map of MOGE-3 Block MOGE-3 Drilling Program Study Area[8]

8 ICEM (2018) Soil Types and Biochar Land Application Suitability and Hotspots || Greater Mekong Subregion. Retrieved on 27 February 2018 from http://icem.com.au/biochar/

Rhodic Ferralsols or Red Brown Forest soils are the typical soils of tropical evergreen forest of Myanmar. They occur on the well-drained hill slopes at the elevation from 1,000 to 4,000ft above sea level (300 to 1,200m). These soil also occur in the northern hilly region and on the hill slopes of Rakhine mountain range, Taninthayi and Dawna range. These soils are formed under the influence of tropical evergreen forests with the annual rainfall of about 80 to 200 inches (2,000-5,000mm). 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 (Phyu Phyu Swe, *et al*, 2015[9)]. There is 15.2% of country area where Rhodic Ferralsols was identified (After Myanmar Environment Portal, 2018).

5.3.5.2 *Soil Quality*

5.3.5.2.1 *Methodology for Baseline Study*

During sample collection, the following procedure was followed: sampling team wore gloves, and rinse gloves and soil augur with clean water after each sample. Each hand-augured hole was dug to approximately 15 cm depth. During sample collection, soil samples were collected according to the standard procedure named Test Methods of Evaluating Solid Waste, Physical/Chemical Methods (SW-846) Method 5035 (US EPA) and kept in a cooling box at 4°C and sent to an accredited laboratory for characterization. Parameters tested included basic soil chemistry as well as hydrocarbons and metals

The sampling locations are shown in **Figure 5-20** and current condition present in **Table 5-7.**

9 Phyu Phyu Swe, Swe Swe Htun, and Billy Ne Win (2015) ***A Comparative Study of the Physio-chemical Properties in Soil Profile Under Different Forest Types***. Leaflet No.23/2015. Forest Department, Ministry of Environmental Conservation and Forestry retrieved on 27 Feb 2018 from http://www.forestdepartment.gov.mm/sites/default/files/Research%20Books%20file/Leaflet%20No.23.%20Phyu%20Phyu%20Swe.pdf

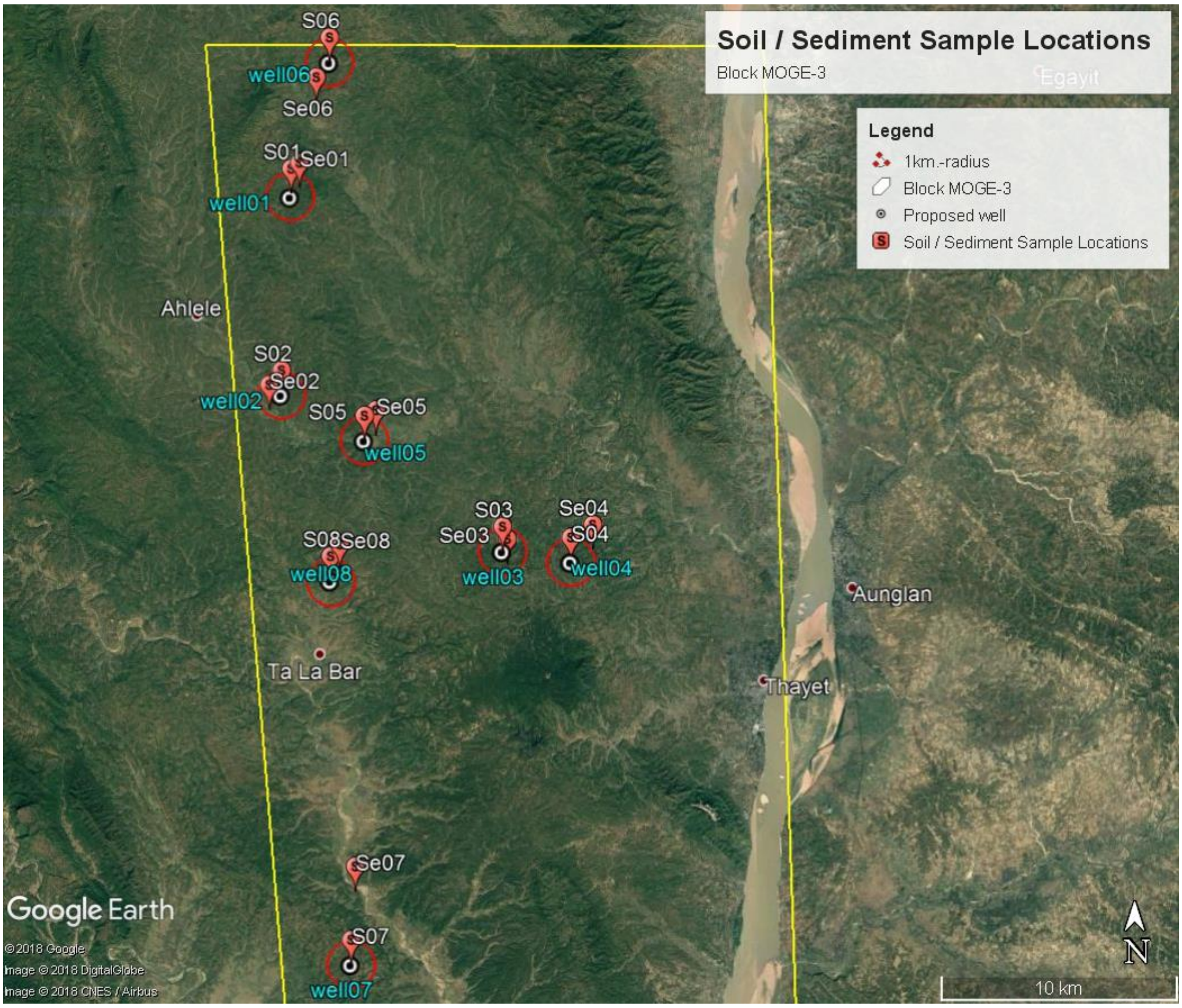


Figure 5-20: Soil / Sediment Sample Locations

Table 5-7: Soil / Sediment Sample Locations

ID	Date	Location (Degrees, Minutes, Second)		Location (UTM Zone 46N)		Photograph	Note / Land Use
		North	East	X	Y		
S01	7/2/2018	19°30'36.98"N	94°59'33.55"E	709111.9	2158504.3		Agricultural Land
Se01	7/2/2018	19°30'45.13"N	94°59'45.75"E	709464.7	2158759.1		Pond
S02	8/2/2018	19°26'1.68" N	94°59'18.96" E	708784.5	2150033.4		Feeding Ground Land
Se02	8/2/2018	19°25'41.52" N	94°59'1.3"E	708276.4	2149406.9		Stream
S03	6/2/2018	19°22'27.40"N	95°4'39.93"E	718227.8	2143554.4		Forest Land

ID	Date	Location (Degrees, Minutes, Second)		Location (UTM Zone 46N)		Photograph	Note / Land Use
		North	East	X	Y		
Se03	6/2/2018	19°22'10.62"N	95°4'46.66" E	718430.5	2143040.7		Lake
S04	6/2/2018	19°22'12.8" N	95°6'19.03" E	721125.6	2143140.4		Unculti vated Land
Se04	6/2/2018	19°22'30.00"N	95°6'50.76 E	722045.2	2143680.7		Pond
S05	8/2/2018	19°24'59.46"N	95°1'19.46" E	712322.3	2148161		Agricult ural Land
Se05	8/2/2018	19°25'6.96" N	95°1'36.12 E	712805.7	2148397.4		Stream

ID	Date	Location (Degrees, Minutes, Second)		Location (UTM Zone 46N)		Photograph	Note / Land Use
		North	East	X	Y		
S06	7/2/2018	19°33'36.00"N	95°0'29.52"E	710679.4	2164028.6		Forest Land
Se06	7/2/2018	19°32'42.00"N	95°0'10.08"E	710132.2	2162361.3		Stream
S07	10/2/2018	19°13'1.03"N	95° 0'59.65"E	712001.7	2126061.4		Uncultivated Land
S08	9/2/2018	19°21'47.05"N	95°0'30.29" E	710956.6	2142227.3		Fallow Land
Se08	9/2/2018	19°22'3.00" N	95°0'43.92" E	711348.7	2142722.4		Stream

Each hand-augured hole was dug to approximately 15 cm depth. During sample collection, soil samples were collected according to the standard procedure and kept in a cooling box at -4°C and sent to an accredited laboratory for characterization. (**Table 5-8**) Parameters to be tested included basic soil chemistry as well as hydrocarbons and metals.

Table 5-8: Laboratory Services For Soils and Sediment Analysis Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Selenium (Se), Arsenic (As), Cadmium (Cd,), Nickel (Ni), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn), pH, Soil Texture, ECe, Chloride

5.3.5.2.2 *Comparing Guideline*

There are no standards for environmental soil and sediment quality in the Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, soil quality results were compared against the internationally recognized agency, Canadian Council of Ministers of the Environment (CCME) as following;

- Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health
- Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008
- Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

5.3.5.2.3 *Results*

Soil

Soils at 4 sampling points (S05-S08) were all consistent in being predominantly sandy loam, with 55% - 68% sand across the sites sampled with various proportions of silt and clay. The pH values were varied in the range of 6.8-9.1. At point S02, S04, S05 and S08, the pH values were basic and higher than CA Standard. At point S01-S04, soil textures were shown as silty clay, silt loam, sandy clay loam and clay, respectively. Most soil samples were free of hydrocarbon contamination except diesel range organic hydrocarbon (DROs: C15-C28) and residual range organic hydrocarbon (RROs: C29-C36)[10] contents found at $S0_2$. The C15-C28 concentration at S02 was 4,370 mg/kg and higher than CCME standard at 300 mg/kg. These could be accidental spills from the existing hand-dug oil operations in the area or natural seepage from shallow oil sources which are present in the area. (**Table 5-9**)

With the exception of Chromium (Cr) and Nickel (Ni), metals data shows that all values are below standards for agricultural purposes. Chromium (Cr) and Nickel (Ni) were found above standards for agricultural use at locations S01, S02 and S04. These areas are agricultural areas consisting of cultivated, uncultivated and feeding Ground Land that may have become contaminated by the accumulation of heavy metals and metalloids through land application of fertilizers, animal manures sewage sludge, pesticides, wastewater irrigation, or atmospheric deposition.[11]

10 ALS Environmental - Petroleum Hydrocarbon Ranges
http://www.caslab.com/Forms-Downloads/Flyers/PETROLEUM_HYDROCARBON_RANGES_FLYER.pdf

11S. Khan, Q. Cao, Y. M. Zheng, Y. Z. Huang, and Y. G. Zhu, “Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China,” Environmental Pollution, vol. 152, no. 3, pp. 686–692, 2008.

Table 5-9: Summary of Significant Soil Quality Results from Block MOGE-3

Parameter	Unit	Block MOGE-3								Standard*	
		S01	S02	S03	S04	S05	S06	S07	S08	Source	Limit
pH	-	7.3	**9.1**	7.8	**8.9**	**8.7**	7.1	6.8	**8.6**	CA	6-8
Soil Texture**	-	Silty Clay	Silt Loam	Sandy Clay Loam	Clay	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	N/A	c
· % gravel	%	0	2	0	0	0	2	1	0	N/A	-
· % sand	%	5	15	51	18	62	60	68	55	N/A	-
· % silt	%	58	60	25	36	27	24	22	30	N/A	-
· % clay	%	37	23	24	46	11	14	9	15	N/A	-
ECe	µS/cm	14	324	26	94	45	20	33	26	CA	2000
Salinity	g/L	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	N/A	-
Moisture Content	%	9.1	6.6	3.2	18.8	2.9	5.4	4.1	6.3	N/A	-
Chloride	mg/kg	110	540	80	80	60	80	50	50	N/A	-
Ammonia as N	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	N/A	-
Arsenic (As)	mg/kg	8	7	3	5	4	9	10	3	CA	12
Cadmium (Cd)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	1.4
Chromium (Cr)	mg/kg	**92**	**77**	39	**111**	42	55	42	32	CA	64
Copper (Cu)	mg/kg	33	30	10	39	12	15	8	9	CA	63
Lead (Pb)	mg/kg	20	24	9	14	9	16	13	9	CA	70
Mercury (Hg)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	CA	6.6
Nickel (Ni)	mg/kg	**102**	**81**	32	**108**	43	49	50	34	CA	50
Silver (Ag)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	CA	20
Vanadium	mg/kg	78	63	32	97	35	53	68	37	CA	130
Zinc (Zn)	mg/kg	93	82	28	101	40	52	40	40	CA	200
Total PAH	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A
Total DDT	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	CA	0.7
Total PCBs	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	CA	0.5
TPH											
· TPH C6-C9	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	CCME	30
· TPH C10-C14	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	CCME	150
· TPH C15-C28	mg/kg	<100	**4370**	<100	<100	<100	<100	<100	<100	CCME	300
· TPH C29-C36	mg/kg	<100	2440	<100	<100	<100	<100	<100	<100	CCME	2800

Remarks: CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008

CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada

Sediment

Sediment types at Se01-Se08 were silt loam, sandy loam, clay loam, clay, silty clay loam, loam, sand and sandy loam respectively. The pH values at almost all sampling points were basic and higher than CA Standard except at locations Se01 and Se03. All sediment samples were free of hydrocarbon contamination above the standards. With the exception of Chromium (Cr) and Nickel (Ni), metals data shows that all values are below standards for agricultural purposes. Chromium (Cr) was found above standards for agricultural use at locations Se01, Se03, Se04, Se05, Se06 and Se08. For location Se08, chromium concentration at this point was 53 mg/kg and slightly higher than standards for agriculture use at 50 mg/kg. Nickel (Ni) was found above standards for agricultural use at locations Se01, Se03, Se04 and Se05. (**Table 5-10**)

The accumulation of Nickel and Chromium in the sediment is attributed to the accumulation of heavy metals and metalloids through land application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, and/or atmospheric deposition.[12]

12S. Khan, Q. Cao, Y. M. Zheng, Y. Z. Huang, and Y. G. Zhu, "Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China," Environmental Pollution, vol. 152, no. 3, pp. 686–692, 2008.

Table 5-10: Summary of Significant Sediment Quality Results from Block MOGE-3

Parameter	Unit	Block MOGE-3								Standard*	
		Se01	Se02	Se03	Se04	Se05	Se06	Se07	Se08	Source	Limit
pH	-	7.8	8.9	7.8	8.5	8.7	8.7	9.2	8.9	CA	6-8
Soil Texture**	-	Silt Loam	Sandy Loam	Clay Loam	Clay	Silty Clay Loam	Loam	Sand	Sandy Loam	N/A	c
· % gravel	%	1	0	5	1	0	0	1	1	N/A	-
· % sand	%	25	77	35	18	13	46	92	63	N/A	-
· % silt	%	49	13	33	37	53	38	5	18	N/A	-
· % clay	%	25	10	27	44	34	16	2	18	N/A	-
ECe	μS/cm	176	136	384	1100	450	131	136	90	CA	2000
Salinity	g/L	<0.1	0.1	0.2	0.6	0.3	0.1	0.1	0.1		
Moisture Content	%	29.6	17.3	39.2	25.1	23.7	22.3	21.8	18.6	N/A	-
Chloride	mg/kg	20	10	200	80	80	130	50	80	N/A	-
Ammonia as N	mg/kg	<10	<10	22	<10	<10	<10	<10	<10	N/A	-
Arsenic (As)	mg/kg	8	5	5	5	5	6	4	7	CA	12
Cadmium (Cd)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	1.4
Chromium (Cr)	mg/kg	76	46	66	106	80	59	31	42	CA	64
Copper (Cu)	mg/kg	26	14	24	37	29	16	7	12	CA	63
Lead (Pb)	mg/kg	21	11	15	16	14	13	6	11	CA	70
Mercury (Hg)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	CA	6.6
Nickel (Ni)	mg/kg	83	48	74	101	73	63	33	53	CA	50
Silver (Ag)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	CA	20
Vanadium	mg/kg	66	39	62	93	69	50	30	45	CA	130
Zinc (Zn)	mg/kg	75	46	83	103	83	51	35	41	CA	200
Total PAH	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total DDT	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	CA	0.7
Total PCBs	mg/kg	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	CA	0.5
TPH											
· TPH C6-C9	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	CCME	30
· TPH C10-C14	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	CCME	150
· TPH C15-C28	mg/kg	<100	<100	124	<100	<100	<100	<100	<100	CCME	300
· TPH C29-C36	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	CCME	2800

Remarks:
CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008
CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada
**Calculated from USDA Soil Texture Triangle, accessed on March 2018

5.3.6 Surface Water

5.3.6.1 *Hydrology and Flooding*

As described in **section 5.3.1**, the Block MOGE-3 is in the central lowland of Myanmar at the south of the dry zone. This area has less rainfall due to Rakhine Yoma acts as the rain barrier to central area of the country. The area is rolling plain and mountain with seasonal gullies and intermittent streams in small valleys alternating cultivated area.

The study area is sufficient with water from intermittent streams which the farmer use as major source for their farms including some part of Ayeyawaddy River. The block area is not in the Ayeyarwady seasonal flooding area **(Figure 5-21)** and NO floods have been recorded in Block MOGE-3 in 2015 (**Figure 5-22**) therefore the study area was not in flooded risk area.

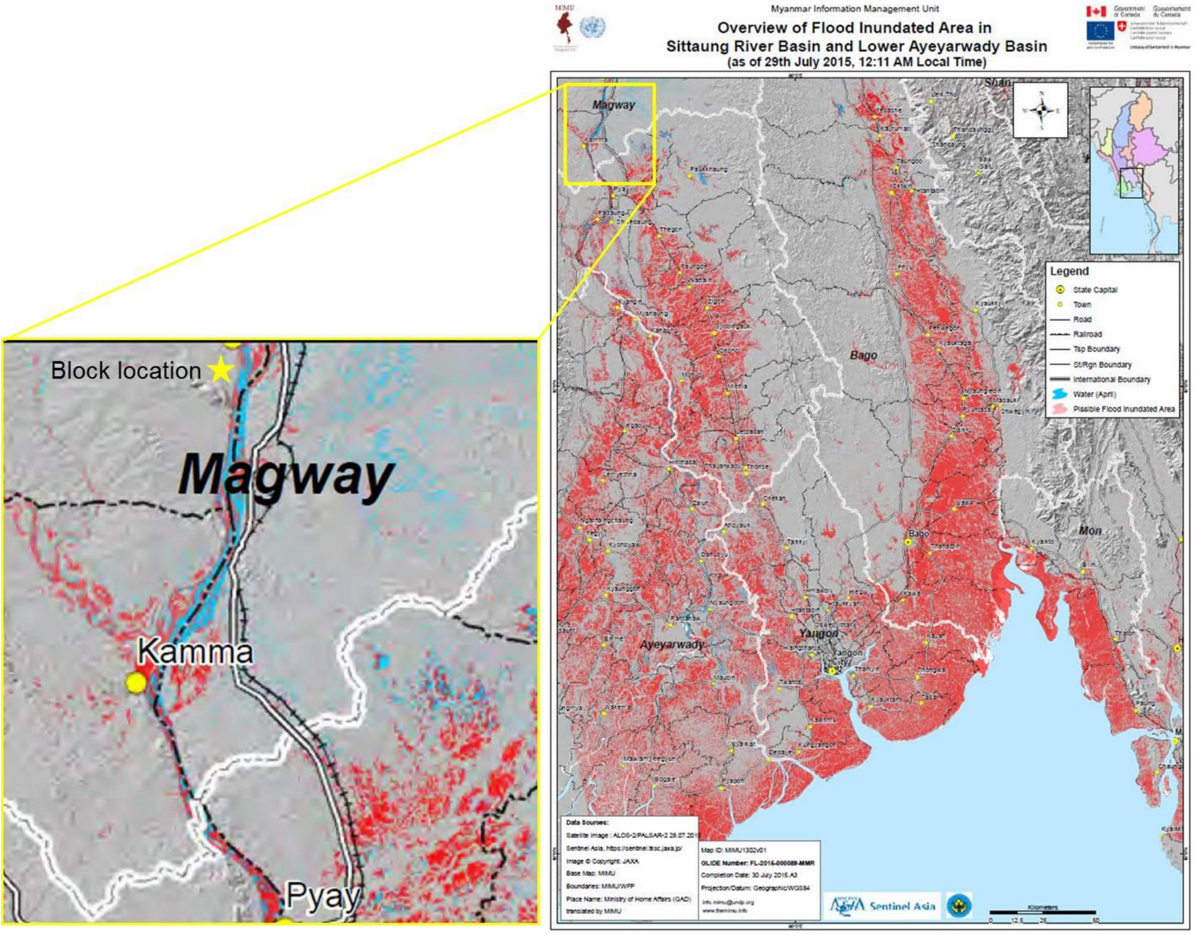
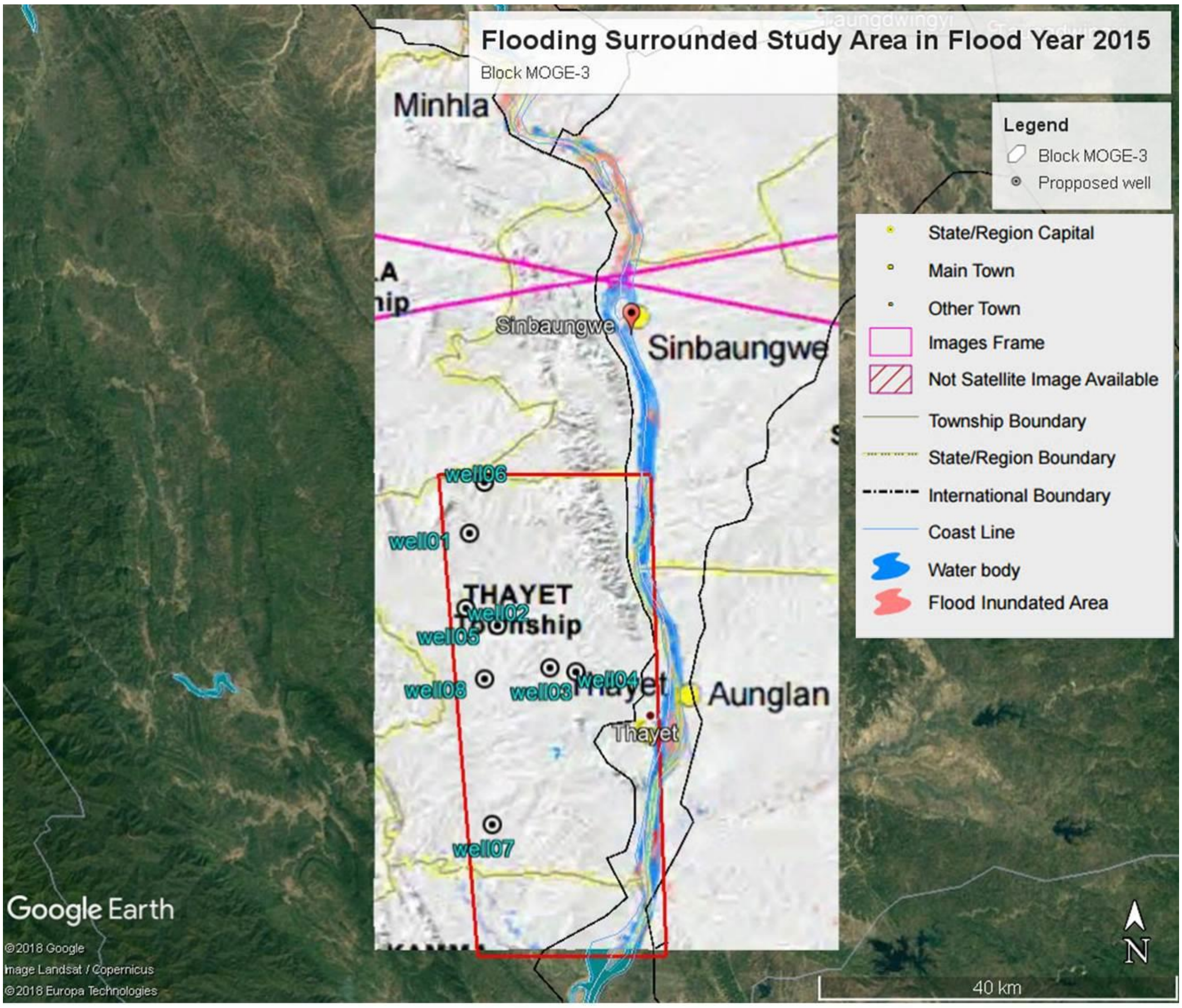


Figure 5-21: Flood Area in Ayeyarwady Basin



Source:tp://themimu.info/sithtes/themimu.info/files/documents/Hazard_Map_CountryWide_Overview_Flooded_Map_in_Myanmar_MIMU1305v01_08Aug2015_6ft-3ft_0.pdf

Figure 5-22: Block MOGE-3 Flooding Surrounded Study Area in Flood Year 2015

5.3.6.2 *Surface Water Quality*

5.3.6.2.1 *Methodology for Study*

As standard operation procedure, a clean sampling dipper was used for all samples in order to avoid sample contamination from other sources.

Before sample collection, the appropriate measures including wearing of disposable and powder less gloves and rinsing of sampling dipper with clean water was carried out in order to equilibrate to the sample environment and make sure that all cleaning-solution residues had been removed. The water sampling dipper is immersed to approximately 1m depth into the flowing stream and then filled into the sample bottles.

The sample bottles were partially filled and rinsed with the water to be sampled (rinse water). In order to avoid suspended sand particles, water for rinsing was collected at the edge of the stream in an area of low-flow turbidity and then drained. The surface water quality sampling was conducted near the well site locations. (**Table 5-11**) The sampling locations are shown in **Figure 5-23**.

As sampling was conducted in the winter season the landscape surface water was generally restricted to impoundments, seasonal drainage canals, rivers and streams. In general, either a grab pole or in some cases a bucket was used for collecting water in ponds or flowing water bodies (Direct immersion of meters and dipping sample bottles was used in others). During sample collection, water samples were collected according to the standard procedure and kept in a cooling box with ice. Duplicate samples were also taken for the QA/QC of the lab.

The Total dissolved solid (TDS), electrical conductivity (EC), Dissolved Oxygen (DO), Temperature and pH value were measured on-site at the sampling stations and again at the laboratory along with other parameters. (**Table 5-12**)

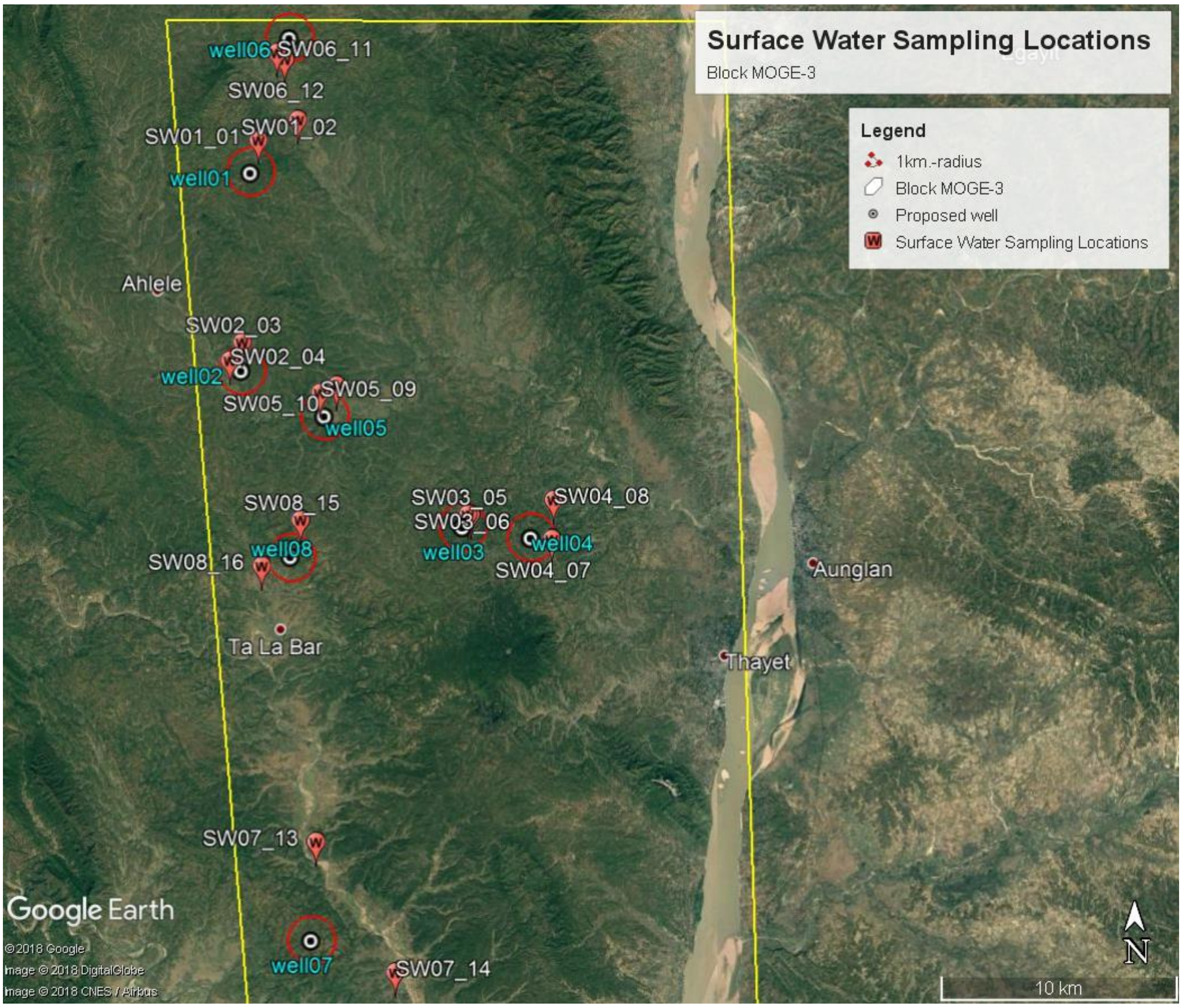


Figure 5-23: Surface Water Sampling Locations

Table 5-11: Surface Water Sampling Locations

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
SW01_01	7/2/2018	19°30'45.13" N	94°59'45.75" E	709464.7	2158759.1		Pond
SW01_02	7/2/2018	19°31'10.56" N	95°0'39.96" E	711036.3	2159559.5		Stream
SW02_03	8/2/2018	19°26'6.72" N	94°59'19.24" E	708790.8	2150188.5		Hand dug well in stream bed
SW02_04	8/2/2018	19°25'41.52" N	94°59'1.32" E	708277	2149407.6		Stream
SW03_05	6/2/2018	19°22'10.62" N	95°4'46.66" E	718430.5	2143040.7		Lake

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
SW03_06	6/2/2018	19°22'10.62" N	95°4'50.75" E	718549.8	2143042.1		Lake
SW04_07	6/2/2018	19°21'36.53" N	95°6'48.46" E	721998.2	2142035.5		Lake
SW04_08	6/2/2018	19°22'30.30" N	95°6'50.76" E	722045.1	2143689.9		Pond
SW05_09	8/2/2018	19°24'57.01" N	95°1'12.25" E	712112.8	2148083.2		Stream
SW05_10	8/2/2018	19°25'6.96" N	95°1'36.12" E	712805.7	2148397.4		Pond
SW06_11	7/2/2018	19°32'42.00" N	95°0'10.08" E	711879.0	2162381.8		Stream

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
SW06_12	7/2/2018	19°32'34.08" N	95°0'20.52" E	710439.4	2162121.3		Lake
SW07_13	10/2/2018	19°14'41.64" N	95°1'5.52" E	712137.2	2129157.3		Stream
SW07_14	10/2/2018	19°11'42.36" N	95°3'0.36" E	715556.4	2123683.4		Stream
SW08_15	9/2/2018	19°22'3.00" N	95°0'43.92" E	711348.7	2142722.4		Lake water
SW08_16	9/2/2018	19°21'0.00" N	94°59'47.04" E	709711.0	2140765.8		Stream water

Table 5-12: Laboratory Services for Surface Water Samples Collected Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	TSS, Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Arsenic (As), Cadmium (Cd), Total Chromium (Cr), Lead (Pb), Nickel (Ni), Total Mercury (Hg), Selenium (Se), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn)

*Analytical Methods followed to Standard Methods for the Examination of water and Wastewater, recommended by APHA-AWWA-WEF.

5.3.6.2.2 *Comparing Guideline*

There are no standards for environmental water quality in the Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, water quality results were compared against the internationally recognized agency, Canadian Council of Ministers of the Environment (CCME) and US EPA as follows:

- Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater)
- CA WQG (Irrigation) – Canadian Water Quality Guidelines for the Protection of Agriculture (Irrigation)
- IFC Environmental, Health, and Safety (EHS) Guidelines
- National Environmental Quality Guidelines (NEQG)

5.3.6.2.3 *Results*

As the surface water quality results in **Table 5-13**, pH most of the surface water parameters were within water quality standards. The TDS was above standard at SW04_08. The Total Suspended Solids were above the IFC / NEQG discharge standards at SW02_03, SW04_08, SW05_10, SW06_12, SW08_16. These locations were dry steam beds, dug wells, ponds and streams that resulted in the high-suspended solid load.

The total chromium (Cr) and Zinc (Zn) were above the standard for aquatic environments at SW02_03. This is attributed to the contamination through run-off of land application of fertilizers, animal manures, and sewage. Iron was detected above standard at most sampling points except at SW03_05 and SW03_06. Iron was detected in all sample locations including Groundwater locations. These high levels are attributed to naturally high iron content resulting from geological weathering.

Total residual chlorine was detected slightly above the IFC / NEQG discharge standards at SW08_16. This was a small stream and the chlorine could be the result of upstream washing / contamination of chlorine. Total coliform bacteria were detected above the standard at SW03_05. This sampling point is a small lake and high levels are attributed to livestock, and animal fecal matter contaminating the water over the standard.

Table 5-13: Summary of Surface Water Quality Results For Block MOGE-3

Parameter	Unit	Block MOGE-3																Standard	
		SW01_01	SW01_02	SW02_03	SW02_04	SW03_05	SW03_06	SW04_07	SW04_08	SW05_09	SW05_10	SW06_11	SW06_12	SW07_13	SW07_14	SW08_15	SW08_16	Source	Limits
pH	-	8.3	8.4	8.1	8.5	8	8.4	8.5	8.1	8.3	8.4	8.4	8.5	8.3	8.3	8.6	8.2	IFC/ NEQG	6.0 to 9.0
Temperature	°C	20.2	23.6	22.6	23.5	22.4	28.2	22.8	27.6	26.9	27.4	23.5	28.3	23.4	21.9	23.7	19	-	-
Conductivity	µS/cm	766	934	1267	1344	3200	667	1029	5230	1647	1623	1512	2900	362	367	628	945	-	-
TDS	mg/l	543	662	900	957	2270	474	730	3710	1170	1150	1070	2050	257	261	446	676	CA*	500-3500
Salinity	ppt	0.40	0.50	0.69	0.74	1.83	0.36	0.56	3.11	0.91	0.9	0.83	1.65	0.19	0.19	0.33	0.51	-	-
DO	mg/l	5.26	5.62	4.30	7.76	5.03	7.04	6.53	7.21	6.21	6.22	5.02	7.01	5.77	5.77	7.33	2.02	-	-
TSS	mg/l	11	32	800	14	11	3	15	62	26	39	18	134	6	15	12	215	IFC / NEQG	35
Chlorine (total residual)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	IFC/NEQG	0.2
Cyanide (free)	µg/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	CA	5
Cyanide (total)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	IFC / NEQG	1
Fluoride	mg/l	0.6	0.6	1.7	0.6	1.1	0.6	2.1	0.6	0.5	0.5	0.7	1.1	0.2	0.2	0.5	0.7	IFC / NEQG	20
Ammonia	mg/l	0.05	0.04	0.12	0.05	0.03	<0.01	0.01	0.06	<0.01	<0.01	<0.01	0.04	0.03	0.04	<0.01	0.03	IFC / NEQG	10
Total Nitrogen	mg/l	0.5	0.6	0.9	0.5	1.1	0.6	1.7	2.2	0.3	0.4	1.0	2.5	0.6	0.2	0.8	1.3	IFC / NEQG	10
Total Phosphorus	mg/l	<0.10	<0.10	0.34	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	IFC / NEQG	2
Sulphide	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	IFC/NEQG	1
Hex. Chromium (Cr^{6+})	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	**CA**	**1**
Oil and grease	mg/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	IFC / NEQG	10
COD	mg/l	11	9	17	11	28	18	36	48	6	9	13	66	6	2	14	12	IFC / NEQG	125
BOD (BOD_5)	mg/l	<2	<2	<2	<2	<2	<2	4	2	<2	<2	<2	5	<2	<2	<2	<2	IFC / NEQG	25
Phenols (as Phenol)	µg/l	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	**CA**	**4**
Arsenic (As)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**CA**	**5**
Cadmium (Cd)	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	5.1
Total Chromium(Cr)	µg/l	<1	3	73	1	<1	<1	<1	6	2	4	2	6	<1	<1	<1	<1	CA	8.9
Copper (Cu)	µg/l	1	2	32	1	<1	<1	1	5	1	2	2	6	<1	<1	<1	<1	CA	700
Lead (Pb)	µg/l	<1	1	18	<1	<1	<1	<1	1	<1	<1	<1	4	<1	<1	<1	<1	CA*	200
Mercury (Hg)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	CA*	3
Nickel (Ni)	µg/l	2	5	62	2	2	<1	2	9	3	5	3	11	<1	<1	2	2	CA*	200
Selenium (Se)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	CA*	50
Silver (Ag)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	IFC / NEQG	0.5
Zinc (Zn)	µg/l	20	<10	120	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10	6	10	CA	30
Iron (Fe)	µg/l	380	1,650	3,780	420	260	150	340	2,550	720	1,930	780	4,800	280	560	460	490	CA	300
Total coliform bacteria	MPN/100 ml	ND	ND	ND	ND	420	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	IFC / NEQG	<400

Remarks: Analytical Methods followed to Standard Methods for the Examination of water and Wastewater, recommended by APHA-AWWA-WEF
CA* - Water Quality Guideline for the Protection of Agriculture, Canadian Council of Ministers of the Environment Guidelines
CA - Water Quality Guideline for the Protection of Freshwater Aquatic Life, Canadian Council of Ministers of the Environment,
IFC – Environmental, Health, and Safety (EHS) Guidelines, GENERAL EHS GUIDELINES and Myanmar Environmental Quality (Emission)
NEQG – National Environmental Quality Guideline

5.3.7 Groundwater

5.3.7.1 *Hydrogeology*

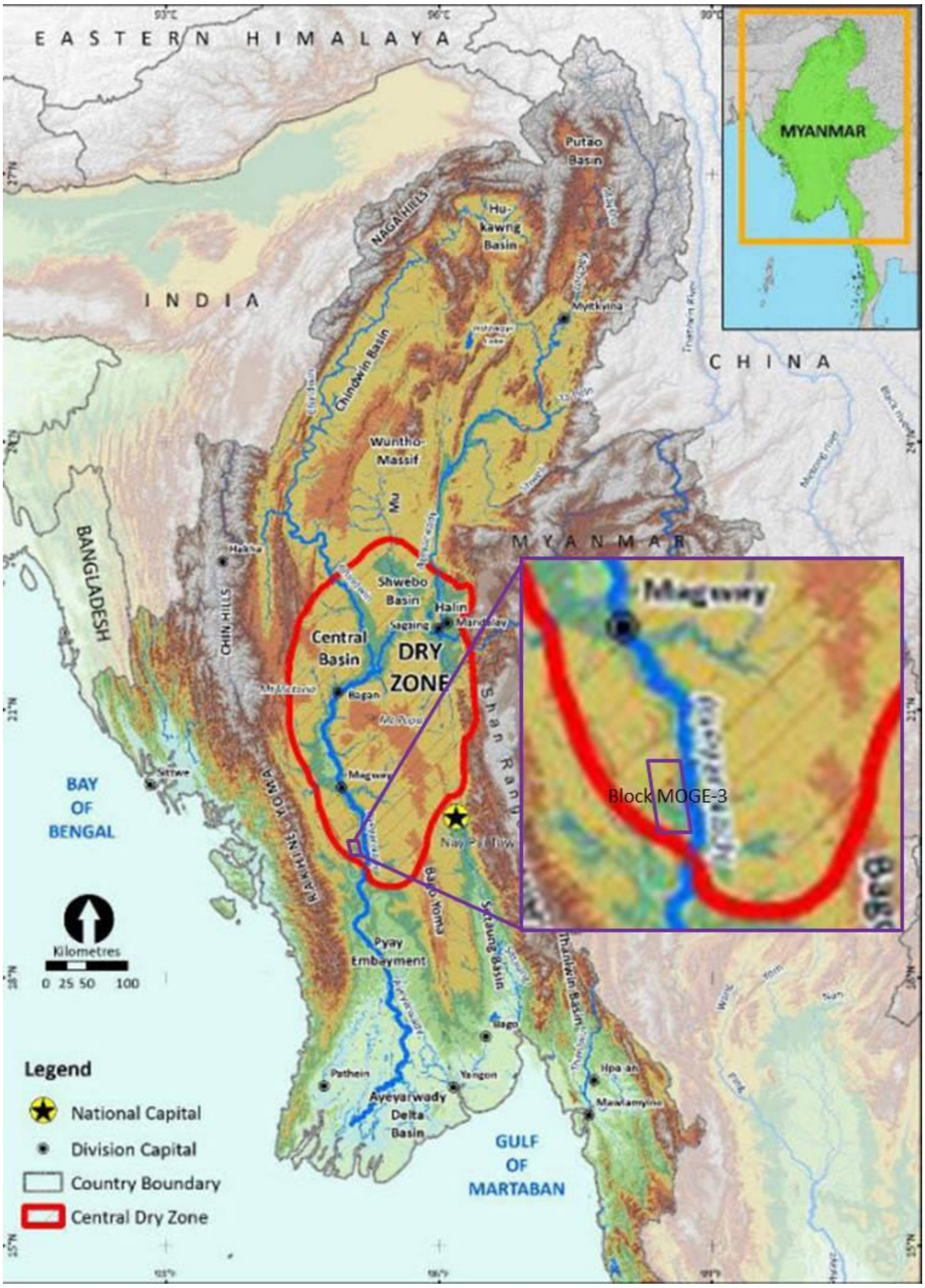
Block MOGE-3 is located in transition area to Myanmar central dry zone (see **Figure 5-24**). The Central Lowlands is a tectonically active area in the Dry Zone, with a complex system of faults, folds and thrusts resulting in multiple sub-basins within three main structural zones: the Western Trough, the Central Volcanic Line and the Eastern Trough.

The main aquifers in the Dry Zone, the depth and their hydrogeological and hydrochemical characteristics are largely controlled by topographic location, mode of geological deposition and associated geological structure. The project area is located in the Pegu and Eocene aquifers. (**Figure 5-25**) The aquifer characteristics are described in **Table 5-14**.

Table 5-14: Aquifer Characteristics of Block MOGE-3

Formation[13]	Area of Dry Zone (%)	Lithology	Location	Mode of Deposition	Quality/Yield
Pegu Group	20	Sandstone, fractured shale	Central and west	Marine, fluviatile and deltaic	Brackish to saline, low yield
Eocene	7	Sandstone, shale	Western foothills	Marine	Brackish, low yield

13 Drury, Leonard W. (2017). Hydrogeology of the Dry Zone - Central Myanmar. Australian Water Partnership Retrieved on 31 Jan 2018 from https://waterpartnership.org.au/wp-content/uploads/2017/10/Hydrogeology-of-the-Dry-Zone-Central-Myanmar.pdf



Source: Modified from Drury, Leonard W, 2017[14]

Figure 5-24: Myanmar Central Dry Zone

14 Drury, Leonard W. (2017). ***Hydrogeology of the Dry Zone - Central Myanmar***. Australian Water Partnership Retrieved on 31 Jan 2018 from https://waterpartnership.org.au/wp-content/uploads/2017/10/Hydrogeology-of-the-Dry-Zone-Central-Myanmar.pdf

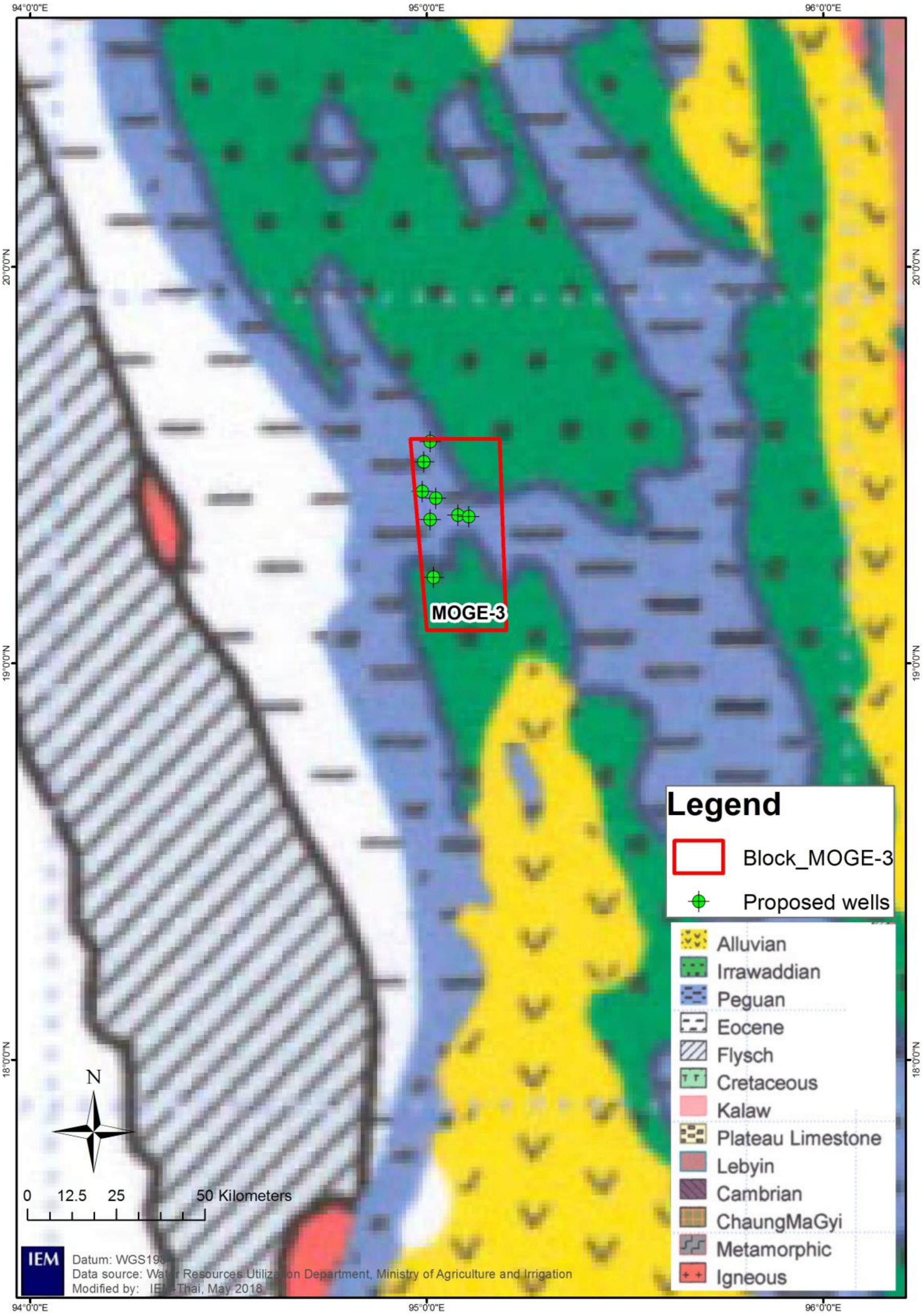


Figure 5-25: Major Aquifers of Myanmar Relative to Block MOGE-3

5.3.7.2 *Groundwater quality*

5.3.7.2.1 *Methodology*

Sample bottles and sampling dipper were washed and cleaned with purified water as well as deionized water three times to ensure that no contamination remains. A checklist was followed for the list of water parameters to be tested, and to label sample parameters, including site identification code and inclusion of field date and time on the bottles. Before sample collection, appropriate measures including wearing of disposable and powder less gloves and rinsing of sampling dipper with clean water was carried out, and to equilibrate to the sample environment and to make sure that all cleaning-solution residues have been removed.

Ground-water-sampling method was adapted to site-specific conditions. Dug well water was collected by the bucket currently being used for the dug well (metal, plastic, wood). Then water in the bucket was collected by sampling dipper and transferred into sample bottles.

For tube wells, the sample was taken at the closest access to water from the well before the water enters any treatment or distribution system. Water was collected at the outflow and flushed (hand pump and compressor pump for shallow well and deep well respectively) for a few minutes prior to sampling in order to remove any stagnant water in the well casing and to ensure that at least 95 percent of the water sample originates from the aquifer formation being sampled. Then water was transferred to sampling plastic bucket and then filled into the bottles by using sampling dipper.

The sample bottles were partially filled and rinsed with the water to be sampled (rinse water). For bacteriological analysis, the preconditioned sterile glass bottles were used directly from the analytical laboratory.

The Total dissolved solid (TDS), electrical conductivity (EC) and pH values were measured on-site at the sampling stations and again at the laboratory along with other parameters. A duplicate sample was also taken for the QA/QC of the laboratory.

After sample collection, sample bottles were kept in a cooling box with ice/ice packs/ice chests until the laboratory. (**Table 5-16**) The Groundwater quality sampling was conducted near the well site location. (**Table 5-15)** The sampling locations are shown in **Figure 5-26**)

Table 5-15: Groundwater Sampling Locations

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
GW01_01	7/2/2018	19°31'16.64"N	95°0'54.36" E	711454.0	2159751.5		Baw (South) village

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
GW01_02	7/2/2018	19°30'35.64"N	95°1'10.20" E	711930.7	2158496.1		Inlevillage
GW02_03	7/2/2018	19°26'36.96"N	95°4'31.08" E	717877.1	2151225.9		Tokaing village
GW02_04	8/2/2018	19°25'40.80"N	94°58'51.60" E	707993.7	2149382.1		Ngabetky avillage
GW03_05	6/2/2018	19°22'28.92"N	95°4'50.88" E	718546.8	2143604.9		Hand dug well
GW03_06	6/2/2018	19°22'3.72" N	95°5'23.28" E	719501.8	2142841.4		Padaukpi nvillage
GW04_07	6/2/2018	19°21'37.08"N	95°6'59.04" E	722306.8	2142056.2		Sakangyi village

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
GW04_08	6/2/2018	19°21'33.84"N	95°6'56.88" E	722244.9	2141955.8		Sakangyi village
GW05_09	8/2/2018	19°25'5.52" N	95°1'42.60" E	712995.3	2148355.3		Banbyinv illage
GW05_10	8/2/2018	19°25'6.24" N	94°59'44.88 E	709560.4	2148337.3		Ohn Mun Taw village
GW06_11	7/2/2018	19°32'42.36"N	95°0'9.36" E	710111.0	2162372.1		Tazigauk village
GW06_12	7/2/2018	19°32'43.80"N	94°59'52.08 E	709606.8	2162410.5		Talokpin village
GW07_13	10/2/2018	19°12'44.64"N	95°2'55.68" E	715397.1	2125597.0		Ton village

ID	Date	Location		Coordinates (UTM Zone 46 N)		Photograph	Note
		North	East	X	Y		
GW07_14	10/2/2018	19°11'47.40"N	95°3'13.68" E	715943.7	2123843.0		Parput village
GW08_15	9/2/2018	19°20'58.92"N	95°0'18.00" E	710615.1	2140743.1		Yemyetvi llage
GW08_16	9/2/2018	19°21'50.40"N	95°0'52.56" E	711605.4	2142337.9		Shanywa kyaw Village

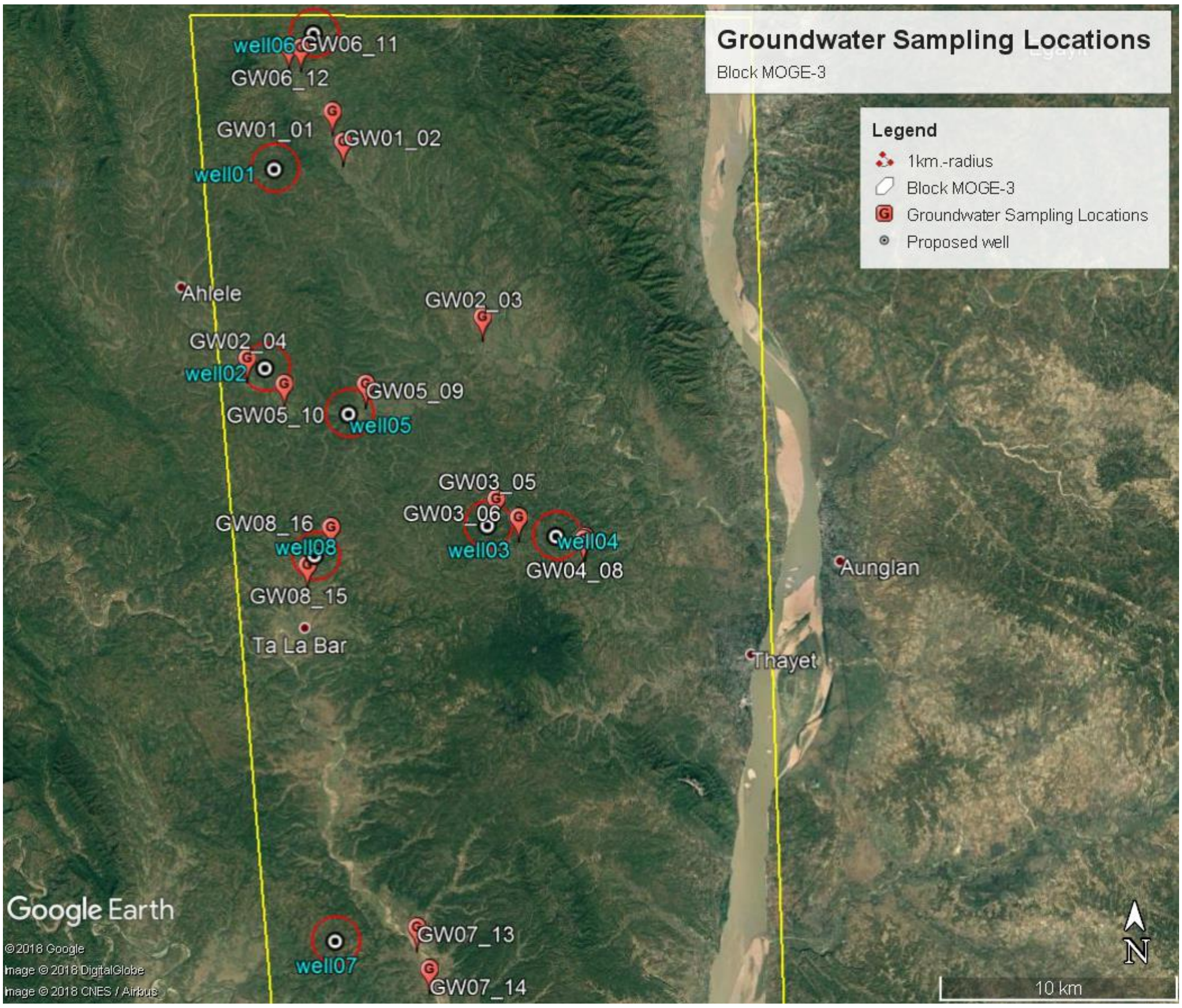


Figure 5-26: Groundwater Sample Locations

Table 5-16: Laboratory Services for Groundwater Sample Analysis Provided to Project

Laboratory	• Parameters
ALS Hong Kong Laboratory	• Total Petroleum Hydrocarbon (TPH including Oil & Grease), Arsenic (As), Cadmium (Cd), Total Chromium (Cr), Lead (Pb), Nickel (Ni), Total Mercury (Hg), Selenium (Se), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn)

5.3.7.2.2 *Comparing Guideline*

There are no standards for environmental groundwater quality in the Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, groundwater quality results were compared against the internationally recognized agencies, as follows:

- US EPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.
- UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).

- Ontario Soil, Ground Water and Sediment Standards for Ontario, Use under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada
- European Union Drinking Water Standards (1998)
- IFC Environmental, Health, and Safety (EHS) Guidelines
- National Environmental Quality Guidelines (NEQG)

5.3.7.2.3 *Results*

Groundwater is the principal source of potable domestic water supply in MOGE-3. Groundwater is being exploited for domestic water. Impoundments are used primarily for watering livestock and some domestic use.

For the groundwater results shown in **Table 5-17**, groundwater pH at all sampling points were neutral except slightly alkaline pH at GW04_07 that was 8.6 and also slightly higher than US EPA standard. The TDS was above the US EPA recommended drinking water standard, this is most likely the natural for the area. This also resulted in an increased conductivity at all sample locations, with six locations (GW01_01, GW03_05, GW03_06, GW04_07, GW04_08, GW05_10) being over the standard. The high TDS appears to be caused naturally by evaporation, precipitation or rock weathering processes in the aquifers. Only TSS at GW02_04 was higher (80 mg/L) and higher than IFC discharge standard at 35 mg/L.

The Ammonia at GW03_06, GW04_07 and GW04_08 was higher than EU standard at 0.50 mg/L. For other sampling points, ammonia concentrations were below the EU standard except ammonia concentrations at GW08_16 that was slightly over EU standard for drinking water.

Total nitrogen concentrations at all sampling points were below WHO standards except total nitrogen at GW05_10 which was 4 times higher than WHO standards at 50 mg/L. Total phosphorus, sulphide, phenol, oil and grease and also organics substances were detected at all sampling points.

Heavy metal concentration at all sampling points was within standard levels, except Iron (Fe) concentration at GW02_04, GW03_06. GW07_13 and GW07_14 that was higher than US EPA standards (300 µg/l) and varied from 430-1.930 µg/l. High Iron (Fe) levels are attributed to natural geological weathering in the area.

Total coliform bacteria were not detected, except at GW02_04 that was higher than EU standards. This fecal contamination is attributing to villages in the area.

Table 5-17: Summary of Ground Water Quality Results For MOGE-3 Baseline Survey

Parameter	Unit	Block MOGE-3																Standard	
		GW01_01	GW01_02	GW02_03	GW02_04	GW03_05	GW03_06	GW04_07	GW04_08	GW05_09	GW05_10	GW06_11	GW06_12	GW07_13	GW07_14	GW08_15	GW08_16	Source	Limits
pH	-	7.6	7.8	8.1	7.5	7.2	7.3	8.6	7.6	7.4	7.5	7.8	8.1	7.4	7.7	8.2	7.9	US EPA	6.5-8.5
Temperature	°C	25.3	25.8	22.9	28.2	30.1	28.5	32.6	28.8	27.8	27.0	25.8	21.9	27.3	27.0	26.1	26.8	-	-
Conductivity	µS/cm	3020	979	747	1722	5860	5820	3370	4140	1945	6430	1519	1429	1367	1453	934	1421	UK	2500
TDS	mg/l	2140	696	531	1220	4160	4110	2390	2940	1380	4560	1070	1010	969	1030	662	1010	US EPA	500
Salinity	ppt	1.72	0.50	0.40	0.97	3.51	3.46	1.94	2.41	1.09	3.87	0.80	0.70	0.75	0.80	0.51	0.78	-	-
TSS	mg/l	<2	<2	<2	80	4	12	<2	<2	6	<2	<2	4	5	17	<2	2	IFC / NEQG	35
Chlorine (total residual)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	IFC / NEQG	0.2
Cyanide (free)	µg/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	CA	5
Cyanide (total)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	IFC / NEQG	1
Fluoride	mg/l	0.5	0.6	0.6	0.7	1.7	0.6	1.5	0.6	0.6	0.6	0.9	0.6	0.5	1.1	0.5	1.4	US EPA	4
Ammonia	mg/l	0.02	0.04	0.02	0.01	0.02	1.98	2.46	1.55	<0.01	0.04	<0.01	0.02	0.04	0.02	0.24	0.57	EU	0.50
Total Nitrogen	mg/l	68.2	0.3	0.1	12.3	0.6	2.7	4.2	2.0	7.0	222	1.6	0.3	2.1	24.6	0.4	0.7	WHO	50
Total Phosphorus	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.6	<0.10	<0.10	IFC / NEQG	2
Sulphide	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	IFC / NEQG	1
Hex. Chromium (Cr^{6+})	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	US EPA	<100
Oil and grease	mg/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	IFC / NEQG	10
COD	mg/l	7	<2	<2	<2	19	<2	8	5	7	13	<2	6	9	4	<2	5	IFC / NEQG	125
BOD (BOD_5)	mg/l	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	IFC / NEQG	30
Phenols (as Phenol)	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	IFC / NEQG	0.5
Arsenic (As)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	US EPA	10
Cadmium (Cd)	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	US EPA	5
Total Chromium (Cr)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	2	<1	<1	US EPA	100
Copper (Cu)	µg/l	2	<1	<1	<1	<1	3	<1	<1	<1	2	<1	<1	2	2	<1	<1	US EPA	1300
Lead (Pb)	µg/l	<1	<1	<1	2	<1	6	2	<1	<1	1	<1	<1	<1	<1	<1	<1	US EPA	15
Mercury (Hg)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	US EPA	2
Nickel (Ni)	µg/l	2	<1	<1	1	3	<1	<1	<1	<1	3	<1	<1	2	3	<1	<1	US EPA	20
Selenium (Se)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	20	<10	<10	<10	<10	<10	<10	US EPA	50
Silver (Ag)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	IFC / NEQG	0.5
Zinc (Zn)	µg/l	<10	<10	<10	<10	20	<10	<10	<10	<10	<10	<10	<10	20	20	<10	<10	WHO	5000
Iron (Fe)	µg/l	<50	<50	60	430	270	1,180	210	130	<50	50	<50	70	1,930	790	<50	180	US EPA	300
Total coliform bacteria	MPN/100 ml	ND	ND	ND	690	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	EU	0

Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF.

Standard from:
USEPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.
UK - UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).
CA – Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada
EU – European Union Drinking Water Standards (1998)
IFC – Environmental, Health, and Safety (EHS) Guidelines, GENERAL EHS GUIDELINES
NEQG – National Environmental Quality Guideline
WHO – World Health Organization Drinking Water Standards (

5.4 Biological Components

5.4.1 Approach and Methodology of the Study

The MOGE-3 Biodiversity Site Reconnaissance and Assessment was carried out in two parts:

1) Review and synthesis of secondary data on local biodiversity, significant supporting habitat and landscape features in the project area of influence.

   Secondary sources included:

   a. Biodiversity databases relevant to the area[15].
   b. Satellite imagery of vegetation cover and land use in the project area.
   c. Available information on Regional and Local Protected Areas or Sites: description, designation criteria (including boundaries, status, legal requirements, etc) and mapping
   d. IUCN listings of Threatened species according to the IUCN Red List.
   e. Information on endangered wildlife species listed as protected wild animals, in respect of their categories under the Forest Department Notification No. 583/94 (26 October 1994)
   f. Information on presence of endemic, migratory and congregatory species and/or key (highly threatened and/or unique) ecosystems in the project area of influence
   g. Information on key species ecology including distribution, habitat requirements, and sensitivities.
   h. Available information on culturally important and iconic species that may be present.
   i. Available information on the potential presence of alien invasive species;

2) Collection of primary data within the seismic survey study area. Primary data was obtained using the following techniques:

   a. Field biodiversity reconnaissance surveys of representative habitat types within the study area. Four areas of what were considered representative habitats dominated by native vegetation were subject to reconnaissance level biodiversity inspections and forest inventory 20 m x 20 m flora plots by the survey team. These four areas provided broad coverage near the PTTEP SA well site areas. The present survey was practically constrained such that intensive, multi-season transect-based techniques to confirm the presence of species which typically occur at low density, are rare or uncommon were not feasible. Data collection on the occurrence of less common species relied instead on local ecological knowledge interviews as discussed below. Ground surveys for rare plants were not undertaken.
   b. Ecological knowledge interviews involving local residents were undertaken to tap into local knowledge and observation on species, seasonality, migration, etc. This activity was supported by reference to species photographs and drawings.

15 http://www.iucnredlist.org/
https://species.wikimedia.org/wiki/Main_Page
Endemics : http://lntreasures.com/burma.html
Flora and Fauna International : http://www.fauna-flora.org/explore/myanmar/
Biodiversity and Nature Conservation Association
https://myanmarbiodiversity.org/

Photographs included wildlife species, which were Critically Endangered and Endangered, which had some potential to have historically occurred in the broad area. A list of field guides used during the interviews is provided in the References section of this report.

Local knowledge is invaluable in providing long-term observation of biodiversity and ecological change in an area. Observations of species types which are not subject to routine harvest or which are not in conflict with the local population are less reliable than those that are.

The communities proximate to the well site areas are detailed in **Table 5-18**.

Table 5-18: Ecological & Biodiversity Interview Locations

Date	Public Consultation Meeting Venue	Villages cover for PC
5th February	Padaukpin village	1. Kyauk-o 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay
6th February	Baw village	1. Tazigauk (E) 2. Tazigauk (W) 3. Talokpin 4. Monatkon 5. Tat ywa 6. Bawya (N) 7.…….Bawya (S) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon
7th February	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Okmundaw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi
8th February	Paput Village	1. Ton 2. Paput 3. Paukuga

c. Review of species habitat requirements relative to available satellite imagery and ground reconnaissance date.

d. Mapping of Natural and Modified[16] habitats according to IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management; and of possible critical habitats, if any.

Mitigation measures were developed to be consistent with IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management and related Guidance Notes[17].

Globally threatened status of Fauna species were categorized using The IUCN Red List of Threatened Species as shown in below:

Status	Code
Critically Endangered	(CR)
Endangered	(EN)
Vulnerable	(VU)
Near threatened	(NT)
and Least Concern	(LC)

Source: IUCN Red List of Threatened Species, Version 3.1. Accessed from www.iucnredlist.org on 01 November 2016.

The detailed species noted during the reconnaissance is provided in the detailed Biodiversity Reconnaissance Report in **Appendix 3**.

5.4.2 Biological Ecoregions

Ecoregions are biogeographic units, which are relatively large units of land or water that contain distinct assemblages of natural communities, sharing a majority of species, dynamics and environmental conditions. Under this classification scheme, ecoregions exist within “bioregions” and typically contain numerous “ecozones”. Within Block MOGE-3, the *Irrawaddy Moist Deciduous Forest*, has been defined (**Figure 5-27**) (WWF 2015).

This ecoregion is located within the Ayeyarwady River Basin, the catchments of the Bago Yoma Mountains, and the foothills of Rakhine Yoma. The ecoregion is strongly expressed within the study area and covers the entire region. The forest region covers large areas in Myanmar. The westward extension is across Ayeyarwady River onto the Yakhine Yoma foothills, and the northern extension is up to the Kachin State. Trees reach a height of more than 30 m. This ecoregion remains under various threats. Conversion of forests to agriculture and shifting cultivation is prevalent. Intense poaching of protected animals, such as star tortoise, for trade is reducing the population in the forests.

16 **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. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. **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.

17 http://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?MOD=AJPERES

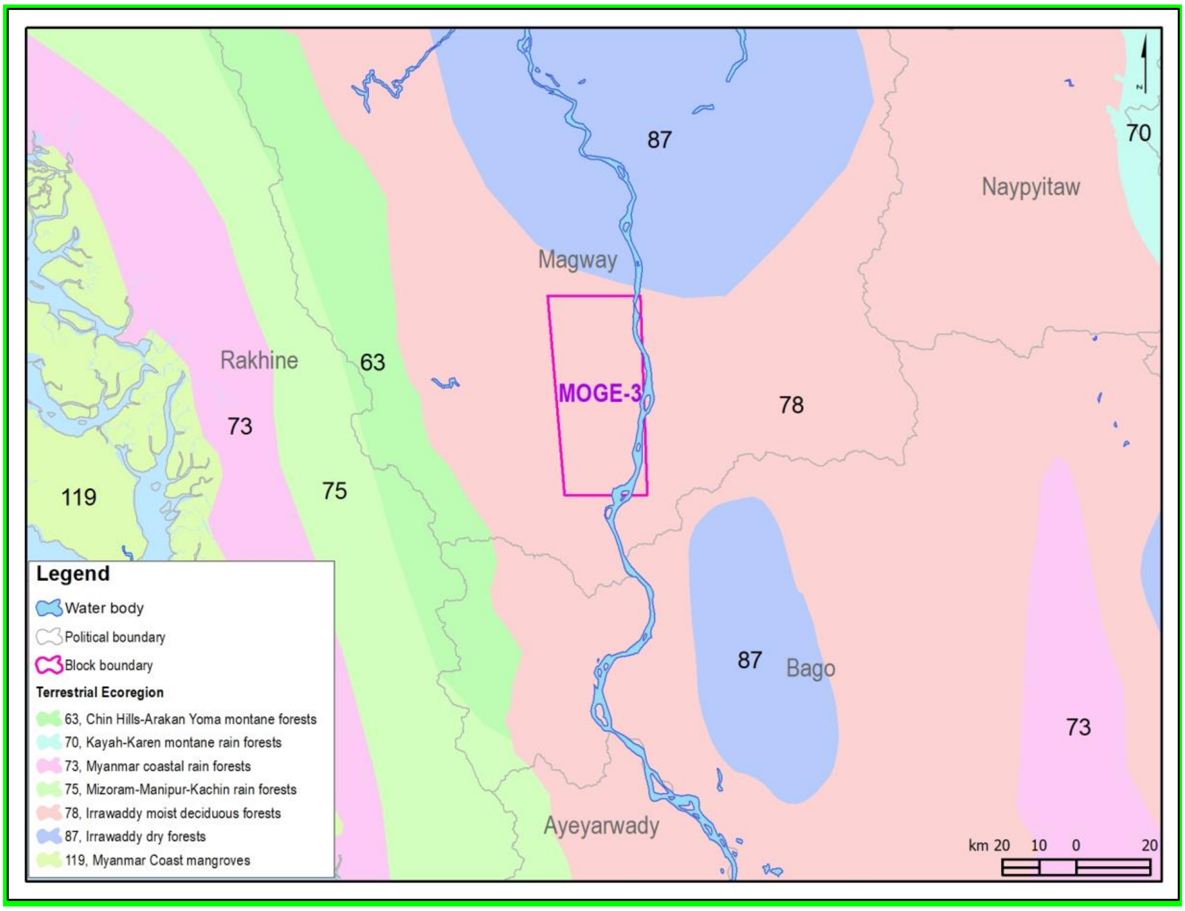


Figure 5-27: Bioregion in Central Myanmar

Regional mapping of native vegetation cover and land use in Block MOGE-3 shows the land is classified as scrubland. However, the predominance of land has converted to agricultural purposes for most of the block.

The dominant species of the *Irrawaddy Moist Deciduous Forest* ecoregion are teak (*Tectona grandis*) and *Pyinkado* or ironwood (*Xylia kerri*). Species composition is varied and intimately mixed with bamboo groves. In the matrix of deciduous species, some evergreen dominants appear in places.

Common tree species are teak, *Xylia kerri, Terminalia tomentosa, T. belerica, T. pyrifolia, Homalium tomentosum, Salmalia insigni, Ginelina arborea, Lannea grandis, Odina wodia, Pterocarpus macrocarpus, Millettia pendula, Berrya ammonilla, Mitravgyna rotundifdlia,* and *Vitex spp. Bambusa polymorpha* and *Cephalostachyum pergracile* are the most common bamboos in lower Myanmar. In the north *Dendrocalamus hamiltonii, D. membranaceus*, and *Cephalostachyum pergracile* are common bamboos.

The undergrowth often consists of *Leea spp., Barleria strigosa*, and other *Acanthaceae*. *Eupatorium odoratum*, a noxious weed, colonized the areas when timber extraction left gaps.

5.4.3 Potential for Species of Concern in Block MOGE-3

Block MOGE-3 occurs in the semi open, dry interior region of Myanmar. Wildlife habitats have been converted to agricultural lands over extensive area. Local inhabitants also make continued use of wildlife for food and medicine. The following subsections identify Species of Concern (SOC) that may occur in Block MOGE-3.

The endangered species in the ecoregion that may occur in MOGE-3 are list in **Table 5-19**.

Table 5-19: Endangered Animals of Irrawaddy moist deciduous forests

Scientific Name (Common Name)	IUCN Status
Aves (birds)	
Ardea insignis (White-bellied Heron)	CR
Asarcornis scutulata (White-winged Duck)	EN
Aythya baeri (Baer's Pochard)	CR
Emberiza aureola (Yellow-breasted Bunting)	EN
Gyps indicus (Indian Vulture)	CR
Heliopais personatus (Masked Finfoot)	EN
Leptoptilos dubius (Greater Adjutant)	EN
Rhodonessa caryophyllacea (Pink-headed Duck)	CR
Sarcogyps calvus (Red-headed Vulture)	CR
Sterna acuticauda (Black-bellied Tern)	EN
Mammalia (mammals)	
Axis porcinus (hog deer)	EN
Bos javanicus (banteng)	EN
Cuon alpinus (Dhole)	EN
Elephas maximus (Asiatic Elephant)	EN
Hadromys humei (Manipur bush rat)	EN
Manis javanica (Sunda Pangolin)	CR
Manis pentadactyla (Chinese Pangolin)	CR
Panthera tigris (Tiger)	EN
Prionailurus viverrinus (Fishing Cat)	EN
Trachypithecus phayrei (Phayre's leaf monkey)	EN
Reptilia (reptiles)	
Batagur trivittata (Burmese Roofed Turtle)	EN
Gavialis gangeticus (Gharial)	CR
Geochelone platynota (Burmese Star Tortoise)	CR
Indotestudo elongata (Elongated Tortoise)	EN
Nilssonia formosa (Burmese Soft-shelled Turtle)	EN

Source: http://www.globalspecies.org/, 2015

5.4.4 Protected Areas

A total of 45 protected areas have been established in Myanmar. The natural areas for protection are categorized as follows:

- Scientific Nature Reserve;
- National Park;
- Marine National Park;
- Nature Reserve;
- Wildlife Sanctuary;
- Geo-physically Significant Reserve; and
- Other Nature Reserve as determined by the Minister.

There are no officially established protected areas in Block MOGE-3. A global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. This key biodiversity areas runs along the eastern edge of the Block and is located far away from the proposed well locations.

In terms of regional protected areas, there are only two reserved forest areas near the 8 proposed wells location: Thel Phyu Reserved Forest and Ka Toe Taung Reserved Forest and two proposed reserved forest areas such as Inn Ma reserved forest and Sat Taung Reserved Forest. All well site areas are outside the reserved forest as confirmed by Thayet Forestry Department.

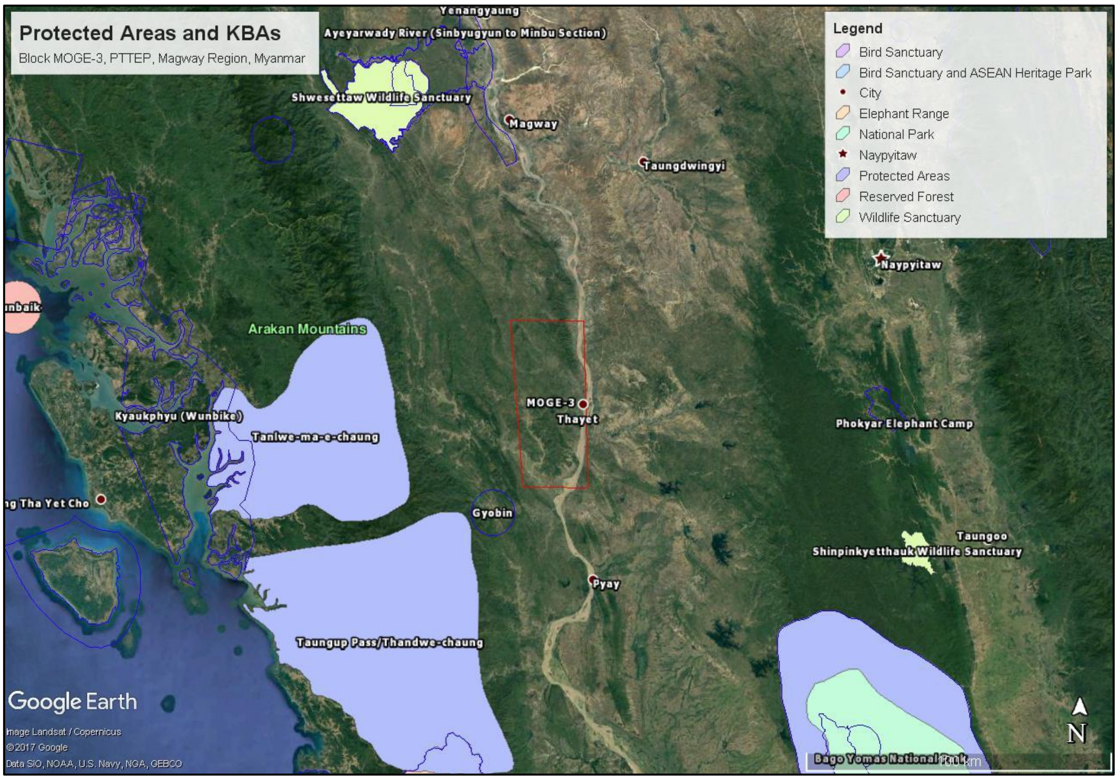


Figure 5-28: Protected Area in Central Myanmar

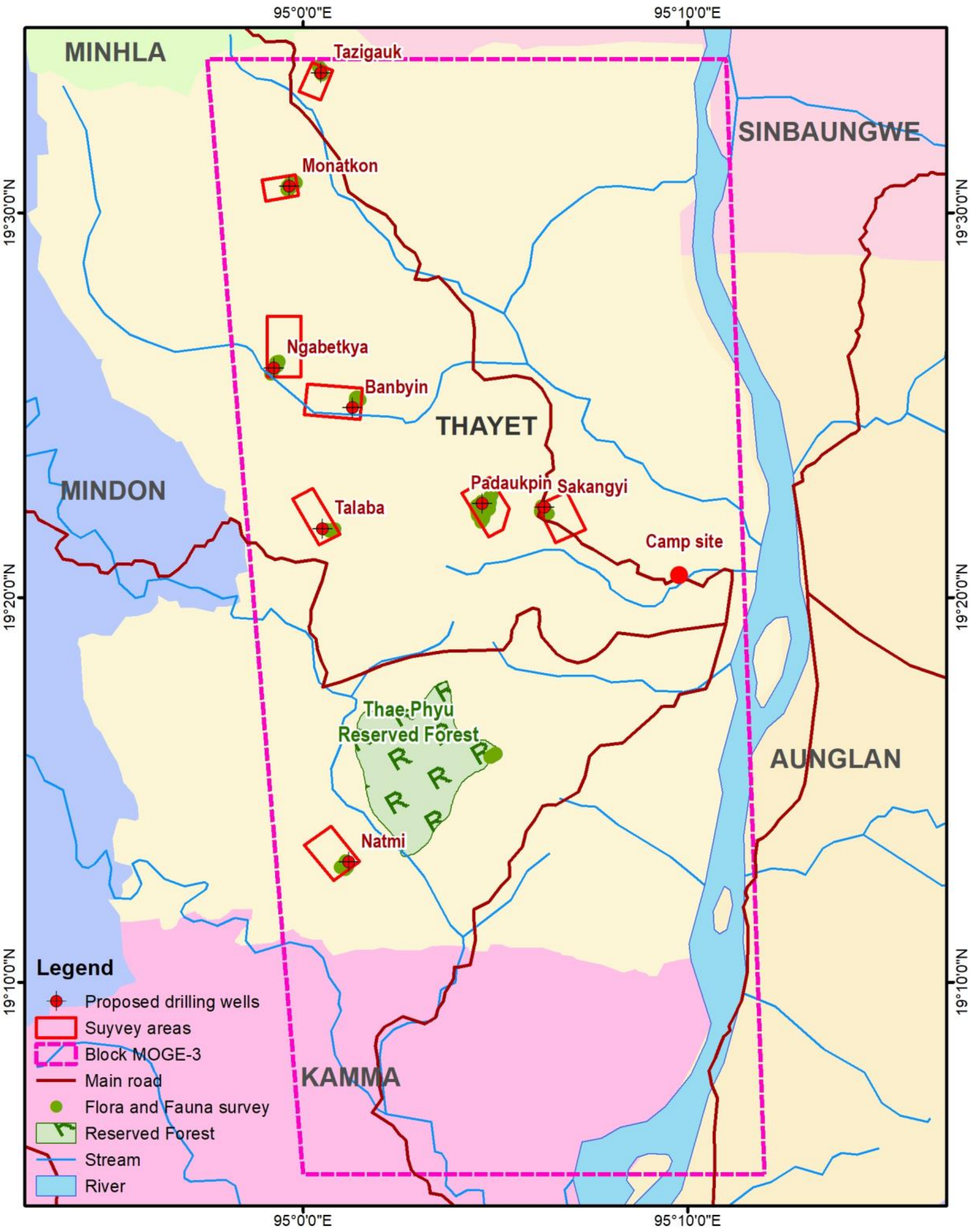


Figure 5-29: Thae Phyu Reserved Forest inside Block MOGE-3 Boundary

5.4.5 Key Biodiversity Areas

The global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. This key biodiversity areas runs along the eastern edge of the Block and is located far away from the proposed well locations. (**Figure 5-30**)

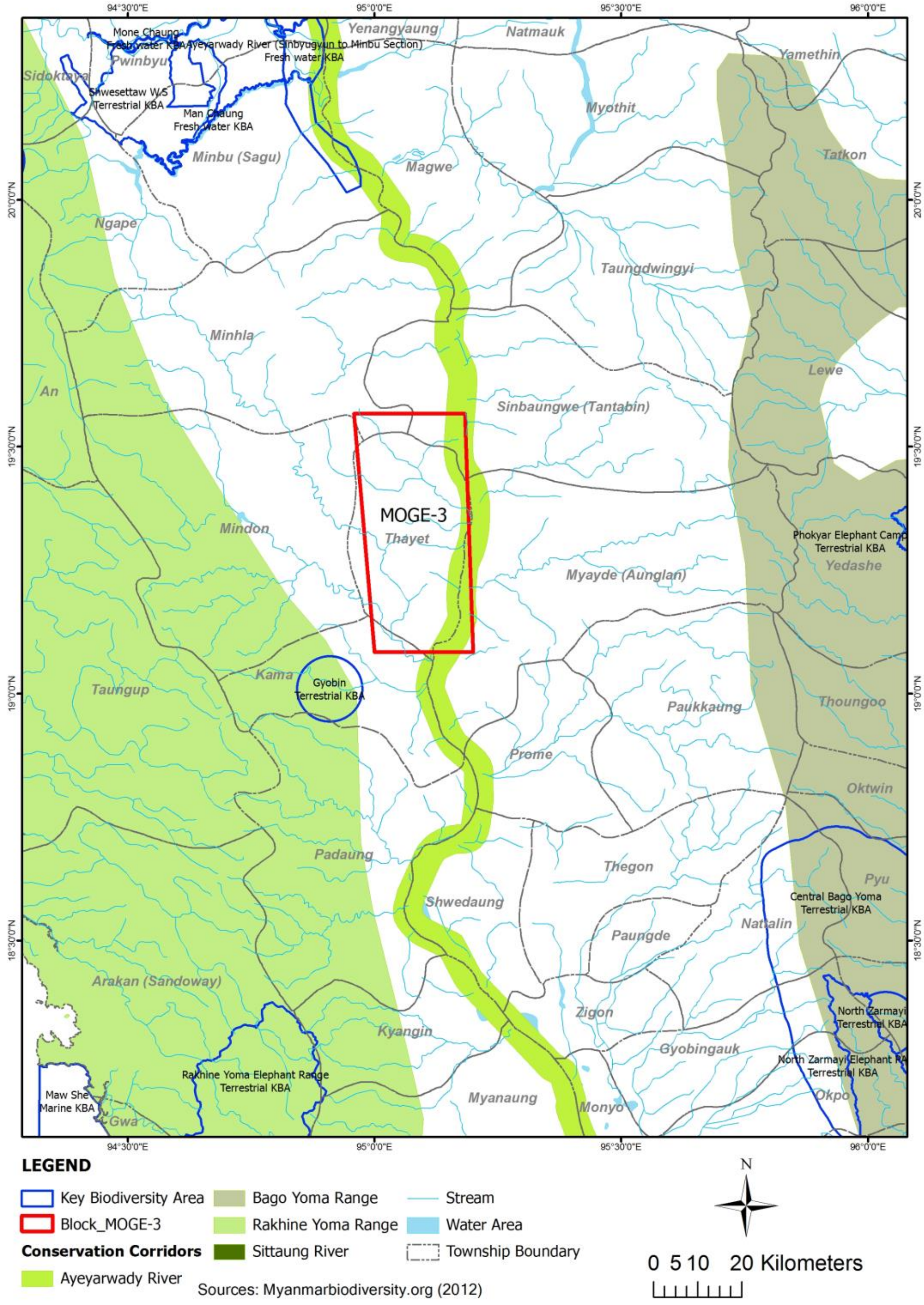


Figure 5-30: Key Biodiversity Areas in Central Myanmar

5.4.6 Field Findings / Observations of Flora

The forests areas included in the project area are 13185 acres. The unique features of the forests are the Bamboo, In and Teak trees. Teak, In and Bamboo are the dominant species in the project area. There is evidence of teak plantations in patches in the forest area and even in the degraded forest (which has now become bamboo forests). The young teak plants and secondary teak trees growing from the stumps are found everywhere in the forests. Another evidence is that almost all houses in the near-by villages are built from teak and the also monastery was built by teak pillar.

The dominant tree species in this area are *Tectona grandis* L.f. (Kyun) followed by *Lagerstroemia venusta* (Zaung-pa-lae), Terminalia pyrifolia (Lein), Dipterocarpus tuberculatus (In), *Terminalia alata* (Heyne) Roth (Htauk-kyant), and *Diospyros burmanica* (Te).

Figure 5-31: Monastery and house were built by teak

A forest inventory of 20 m x 20 m flora plots were completed by the survey team at four locations, around the well sites and Thae Phyu Reserved Forest to cover up the whole area, secondary data was examined in light of habitat conditions present in the MOGE-3 Block.

In Myanmar, there are an estimated 50 threatened plant species, of which 18 critically endangered, 16 Endangered and 16 Vulnerable based on the classification from IUCN Red List. Native vegetation cover within the exploration block has been subject to a prolonged period of alteration and human activity. Timber harvesting, fuel wood collection, clearing for agriculture and plantations and livestock grazing has occurred throughout much of the block.

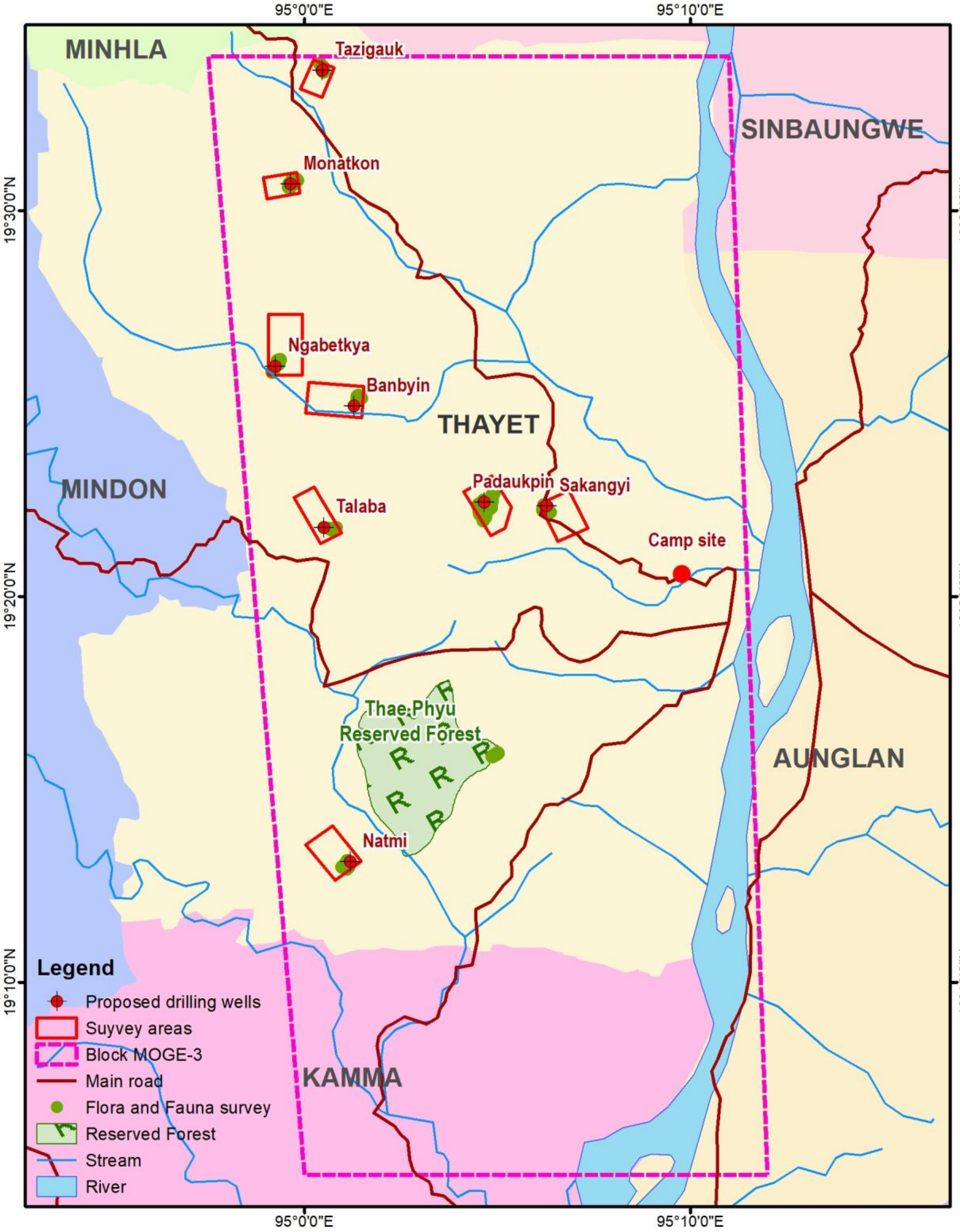


Figure 5-32: Flora Survey Map

Figure 5-33: Mixed Deciduous Forest and Indaing Forest

Figure 5-34: Bamboo Forest

Endemic Species

Myanmar is reportedly home to over 1071 endemic species of flora. It is likely that endemic flora does occur in the project area with higher potential being the wetland complexes as well as in associated with the erosional landforms. During the field reconnaissance the endemic ***Tectona grandis L.f*** was noted. Confirmation of the presence of uncommon local endemics would require intensive, potentially multi-season surveys. In some cases, particularly for herbaceous species, detection may only be practically detected in certain years and under certain conditions.

Iconic Species

The main iconic floras in the exploration block are the more mature *Bombax*, large native *Acacia* and *Ficus,* species. Padauk *(Pterocarpus macrocarpus),* the national flower of Myanmar, is not anticipated to occur in this area.

Alien Invasive Species

During the biodiversity reconnaissance local community representatives were asked whether they had any unusual weed problems and whether they were seeing any new species of plant or animal in their area. Additional information was provided to the community regarding the basis for this concern (e.g. potential for unclean seismic equipment to bring invasive species into the area or spread weeds from field to field). In all cases the community representatives reported they did not have any major weed problems, nor had they noticed any new species in their areas.

Significant invasive plant species previously reported for Myanmar include *Prosopis spp., Acacia auriculiformis, Ageratum conyzoides, Leucaena leucocephala, Eucalyptus spp., Casurina equisetifolia, Chromolaena odorata, Hyptis suaveolens, Lantana camara, Mimosa diplotricha, Mikania micrantha, Sorghum halepense, Paspalum conjugatum, Imperata cylindrica, Echinochloa crus-galli, Eleusine indica, Pennisetum polystachion*. Previous assessment has noted that in Myanmar Dry Forest areas, *Prosopis juliflora and Euphorbia spp.* are widespread, particularly in more open areas.

5.4.7 Field Findings / Observations of Fauna

The February 5 – 8, 2018 biodiversity focused community interviews identified potentially 10 species of bird, and 6 species of mammal, 7 species of reptile /amphibian, 1 species of invertebrate, and 17 species of fish.

Suitable habitat for a number of these latter species was noted in the area; however, confirmation of the actual occurrence of these species would require extensive, multi-season investigation.

Table 5-20: Number of Species with Special Conservation Status[18] Reported By Local Community as currently Occurring in general vicinity of the MOGE-3 Drilling Program

	Mammals	Birds	Reptiles & Amphibians	Insects	Fish
Critically Endangered	1	0	0	0	0
Endangered	3	2	1	0	0
Vulnerable	0	2	2	1	1
Near Threatened	1	1	3	0	2

18 Species with special conservation status were considered those receiving special protecton under Myanmar law and or species which are listed as Critically Endangered, Endangered or Vulnerable

Least Concern, DD or Not Evaluated	1	5	1	0	14

Threatened Fauna

Mammals

The threatened mammal species that were identified in the biodiversity site assessment and interviews included the Chinese Pangolin (*Manis pentadactyla* – CR), dhole (*Cuon alpinus* - EN, fishing cat (*Prionailurus viverrinus* – EN), Flat-headed Cat (*Prionailurus planiceps* - EN). The Common Flying Fox (*Pteropus vampyrus*) is NT.

The two species of pangolin (scaly anteater) are found in Myanmar: Sunda Pangolin (*Manis javanica*) and Chinese Pangolin (*Manis pentadactyla*) are severely threatened by intensive harvesting for trade to China. This is occurring across the entire species range and it is likely that much of the Myanmar population has already been significantly reduced (Duckworth et al., 2008). The Chinese Pangolin (*Manis pentadactyla*) which is CR was identified in the area.

Protection of mammals from impacts from development relies on avoidance of critical habitats and implementing designs and practices which reduce the potential project specific hazards which may impact wildlife species.

Birds

The threatened birds identified include; Green Peafowl (*Pavo muticus*) and Nordmann's Green Shank (Tringa guttifer) are EN and Myanmar Completely Protected, they are reported to be very rare in the area and only occasionally seen.

The Greater Spotted Eagle (*Aquila clanga*) is Vulnerable and Myanmar Completely Protected. The laggar falcon (*Falco jugger*) is NT and MCP and an owl white-fronted scops owl (*Otus sagittatus)* is VU and MCP

As elsewhere in the region large water birds have decreased greatly across the country and continue to be threatened by persecution and human disturbance to their nesting and feeding areas. Protection of bird species from unnecessary development impacts relies on avoidance of important habitats and creation of hazards that attract or otherwise place birds at risk (e.g., contaminated waste water pits, spills, unshielded or higher risk lighting, garbage etc).

Reptiles

The following threatened snake species were identified Kind Cobra (*Ophiophagus Hannah*) which is VU and MCP. The Burmese Python (*Python bivittatus*) and the Reticulated Python (*Python reticulates*) are LC and MCP were also identified. The Bowring's Supple Skink (Lygosoma bowringii) that is NT was possible identified, but this could have been miss identified with a more common skink species.

Four species of tortoises are known to occur in Myanmar: the Burmese Star Tortoise (*Geochelone platynota*), Asian Forest Tortoise (*Manouria emys*), Impressed Tortoise (*Manouria impressa*), and the Elongated Tortoise (*Indotestudo elongate*). All are threatened to some extent by a combination of subsistence and commercial harvesting, over-collection for the pet trade, and to a lesser extent, habitat destruction. Conversion of natural vegetation to agricultural land is primarily a threat to tortoises in the Dry Zone. The Elongated Tortoise (*Indotestudo elongate*) that is EN was identified in the site reconnaissance.

The Elongated Tortoise apparently occurs throughout much of Myanmar and uses a variety of habitats ranging from desert-like scrub of the Dry Zone to moist evergreen forest in the Rakhine Yomas. Healthy populations remain in some remote areas (e.g., Rakhine Yomas; Platt & Khin Myo Myo 2009), although this tortoise is subject to subsistence harvesting wherever it occurs in close proximity

to humans. Large numbers are illegally exported to markets in southern China (Platt et al. 2000). Current harvest levels are clearly unsustainable and field surveys suggest many populations are declining, particularly in the Dry Zone (Platt et al. 2001b).

The project-related concerns in MOGE-3 would only arise where there was potential for disturbance or pollution of riverine and wetland habitats. Project activities that disturb riverine habitats and wetlands are of greatest concern.

Amphibians

The threatened Amphibians identified included the Giant River Frog (*Limnonectes (Rana) blythii*) that is NT and the Big-lipped Burrowing Frog (*Glyphoglossus molossus*) that is also NT. From a project perspective, protection of amphibians hinges largely on avoiding direct disturbance to permanent and seasonal wetlands as well as preventing of offsite contamination of such locations. The Indoburman Torrent Frog (*Amolops indoburmanensis*) that is DD and endemic was identified.

Fish

The conservation status of fish in Myanmar is poorly understood. No specific references were identified for Central Myanmar and the project area; however, given the patterns of human exploitation, any species of fish present in these areas would be very vulnerable. A total of at least 17 species of fish were identified in the project area. Fish is important food source of the local people. The following threatened or vulnerable species under IUCN were observed:

- Wallago catfish *(Wallago attu)* is NT
- Mrigal carp *(Cirrhinus cirrhosis)* is VU
- Mozambique tilapia (*Oreochromis mossambicus*) is NT

Extraction of surface water and or intentional or accidental release of contaminated liquids could both pose a significant impact to native fish species.

Invertebrates

The Golden Birdwing (*Troides aeacus*) was identified in the site biodiversity reconnaissance. Relatively little is known about invertebrate species within Myanmar sufficient to allow classification for the purpose of identifying conservation status and needs for protection. Pollinators such as wild bees and numerous others can play critical roles in ecosystem function as well as human food security and health. Some species groups can have very specific habitat requirements (e.g., butterflies) that, in the absence of knowledge could be locally extirpated. As a general guide, identification and avoidance of uncommon native plant assemblages and retention of native forest cover is a priority. Similarly, indiscriminate use of herbicides and pesticides and failure to control and manage other hazardous substance, and light pollution can increase risks to these and other native fauna.

Endemic Fauna

According to the globally threatened status of recorded species, one is classified as Least Concern (LC) and MCP is the White-throated Babbler (*Turdotdes gularis*) which is endemic to Myanmar. The Indoburman Torrent Frog (*Amolops indoburmanensis*) that is DD and endemic was identified.

Iconic Species

No iconic species of fauna (eg. large carnivores, large herbivores, high profile endangered species) are believed to occur in the project area.

Alien Invasive Species

No alien invasive species of fauna were reported to occur in the project area.

5.4.8 Habitats

The project area is comprised of agricultural and open forestland area only. This would be classified under the 2012 IFC Performance Standard 6 (modified, natural and critical habitats) as modified. The military protected area present the best chance of natural or critical habitats identified near the project areas. As this area is off limits to most people, it was identified to contain natural undisturbed habitat for many wild species including the fea's barking deer, dhole, fishing cat and the flat-headed cat. This area is off limits to all activities and will not be disrupted by the project.

This was confirmed by site biodiversity reconnaissance survey along with ecological knowledge interviews with villagers and the Thayet Forestry Department.

Under IFC PS 6 "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 congregatory species;
iv. Highly threatened and/or unique ecosystems; and/or
v. Areas associated with key evolutionary processes.

5.4.9 Spatial & Human Pressure

As per interviews with the Thayet Forestry Department; in the area there are some fauna species such as deer, jungle chicken, Peacock, Woodpecker, water duck etc. and some teak species (local names of Kyun, pyinkado, Thit Yar, In gyin, Padauk, Didu, Let Pan, Gway, Taukkyan. Most of the teak species are regeneration plants and there is no endangered species because of the degraded forest.

The main forest types are Dry upper mixed deciduous forest and dry In daing forest. The Common bamboo species are the Myin wa and Taik Wa. The area also has eucalyptus fire wood plantation, agroforestry plantation and within the reserved forest area some community forestry areas. For the community forestry area, there are 370.403 acres in the Ka Toe Taung reserved forest and 150.794 acres in the Thel Phyu Reserved forest.

The threats to biodiversity are expansion of farmlands and monoculture plantation (eg. Teak plantation). Due to deforestation, the wild animals are facing food scarcity and habitat loss. The ecological knowledge interviews confirmed that populations of every animal species has decreased over the last 10 years and some have become locally extinct. Most of the Block is covered with shifting cultivation, bamboo forest and scatter trees.

It was found that hunting of wild animals is a low threat in this area with only small birds and squirrel being hunted by villagers. However, villagers reported that the Chinese Pangolin (*Manis pentadactyla*) is trapped and ate in the village. However, the occurrence of the Chinese Pangolin is rare.

5.4.10 Aquatic Biology

5.4.10.1 *Methodology for study*

The phytoplankton survey was conducted within Block MOGE-3 at the freshwater river within the project area. Freshwater was sampled by taking a 20L container then filtering with a 20 µm-maze-size plankton net into containers which were preserved with 5% formalin, stored in ice box, and sent to the laboratory to analyze the type and quantity of plankton.In this study the samples were collected from three stations, 2 samples at each station. The sampling stations were described in **Table 5-21**.

Table 5-21: Aquatic Biology Sampling Locations

ID	Date	Location		Photograph	Note
		North	East		
Aq01	7/2/2018	19°26'21.21" N	95° 4'33.03"E		River.0.3 m depth. Clay and sand Tokaing village
Aq02	10/2/2018	19°14'41.64" N	95°1'5.52" E		River.0.3 -0.5 m depth. Clay sandand gravel SW07_13 Pyauk Oo Kar village.

Table 5-22: Laboratory Services for Aquatic Biology Analysis Provided to Project

Laboratory	Parameters
Myanmar Marine Science University	Phytoplankton and Zooplankton Species

5.4.10.2 *Results*

Phytoplankton

The results indicated species of zooplankton as follows: *Ephemeroptera, Ceratopogonidae, Thaumaleidae, Gomphidae and Sphaerium sp.* The zooplanktons species identified are detailed in **Table 5-23**.

Table 5-23: Fresh water phytoplankton from Myan Aung Station (Ag 01)

		No. of cell/cc			
No.	Name of species	1	2	3	4
1	*Surirella ovalis* Breb	28/660 CC	6/540 CC	0	0
2	*Triposolenia truncata*Kofoid	4/660CC	0	6/660 CC	6/540 CC
3	*Fragilaria intermedia* Grunow	11/660 CC	1/540 CC	0	5/540 CC
4	*Coscinodiscusmarginatus* Ehrenberg	0	0	0	4/540 CC
5	*Coscinodiscus gigas* Ehrenberg	5/660CC	3/540 CC	4/660 CC	2/540 CC
6	*Pleurosigma angulatum* W. Smith	15/660 CC	10/540 CC	8/660 CC	9/540 CC
7	*Synedra ulna* Ehrenberg	30/660 CC	17/ 540 CC	1/660 CC	5/540 CC
8	*Hyalotheca sp.*	12/660 CC	9/540 CC	4/660 CC	0
9	*Prorocentrum mican* Ehrenberg	0	3/540 CC	4/660 CC	0
10	*Gyrosigma balticum* (Ehrenberg)Cleve	0	2/540/ CC	0	0
11	*Navicula distans* (Wm.Smith) Ralfs	0	0	3/660 CC	3/540 CC
12	*Gonyaulax grindleyi* Reinecke	3/660 CC	0	2/660 CC	0
13	*Stauroneis* Ehrenberg	0	0	2/660 CC	7/540 CC
14	*Thalassiothrix frauenfeldii* Grunow	0	0		2/540 CC
15	*Ganicularia* sp	0	0	3/660 CC	1/540 CC

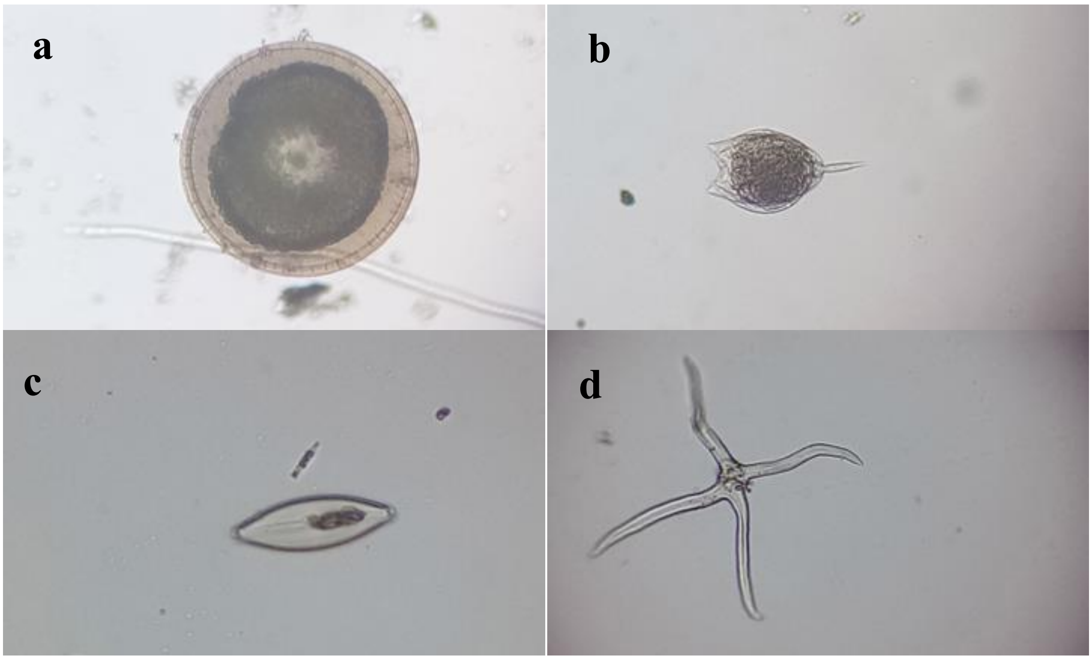


Figure 5-35: Identification Photo of (a) *Coscinodiscus marginatus*. and (b) Gonyaulax grindleyi (c) Stauroneis sp (d) Triposolenia truncata

Zooplankton

The results indicated species of zooplankton as follows: *Ephemeroptera, Ceratopogonidae, Thaumaleidae, Gomphidae and Sphaerium sp.* The zooplanktons species identified are detailed in **Table 5-24** and **Table 5-25**.

Table 5-24: Zooplankton Density

N0.	Name	AgO1	AgO1	AgO2	AgO2
1	Ephemeroptera	2	9	10	10
2	Ceratopogonidae	-	-	1	-
3	Thaumaleidae	2	1	12	1
4	Gomphidae	1	-	-	-
5	*Sphaerium* sp.	1	-	-	-
	Total	**6**	**10**	**23**	**11**

Table 5-25: Zooplankton Species Identified

Phylum	CLass	Order	Family	Genus	Species
Mollusca	Bivalvia	Veneroida	Sphaeriidae	*Sphaerium*	*Sphaerium* sp.
Arthropoda	Inseta	Diptera	Ceratopogonidae		
			Ephemeroptera		
			Thaumaleidae		
		Odonata	Gomphidae		

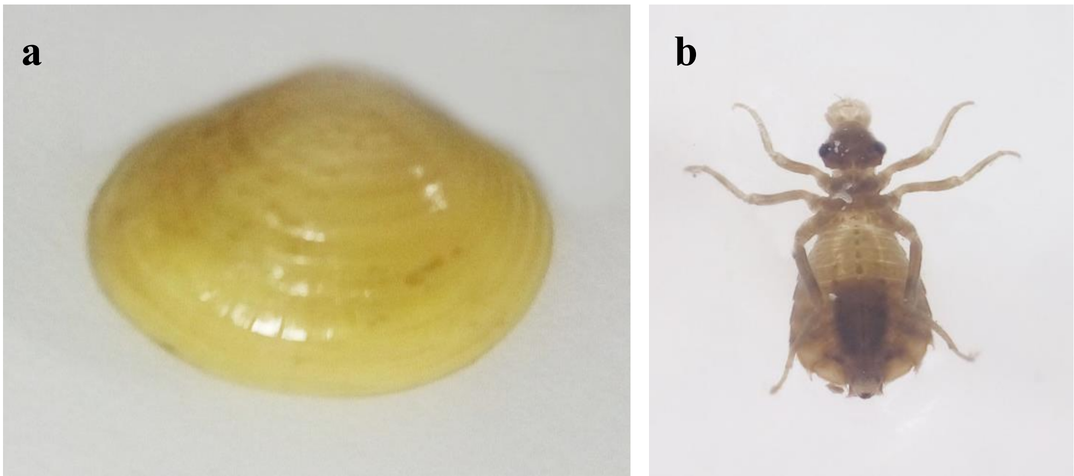


Figure 5-36: Identification Photo of (a) *Sphaerium* sp. and (b) Gomphidae

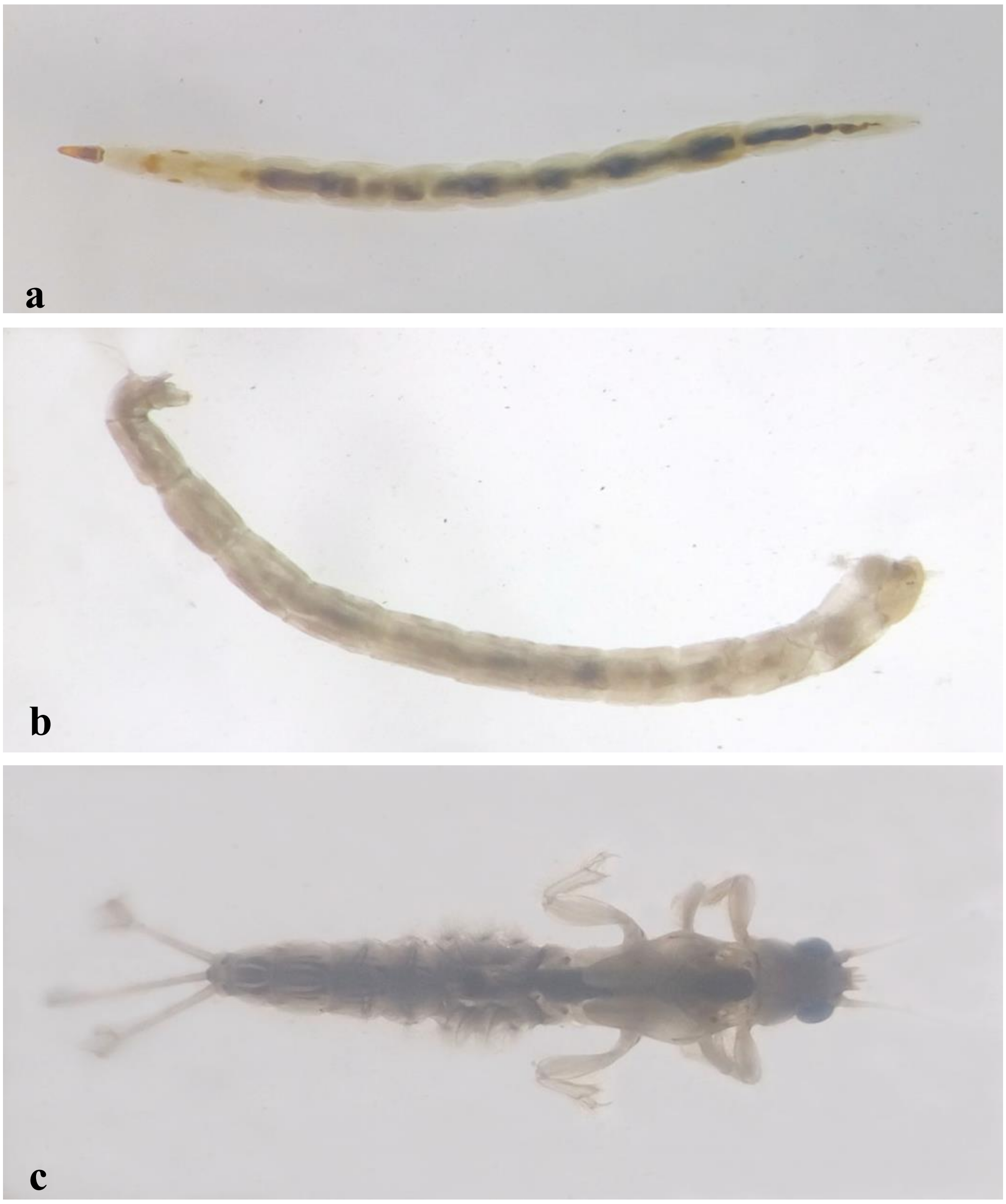


Figure 5-37: Identification Photo of a) Ceratopogonidae, (b) Thaumaleidae and (c) Ephemeroptera.

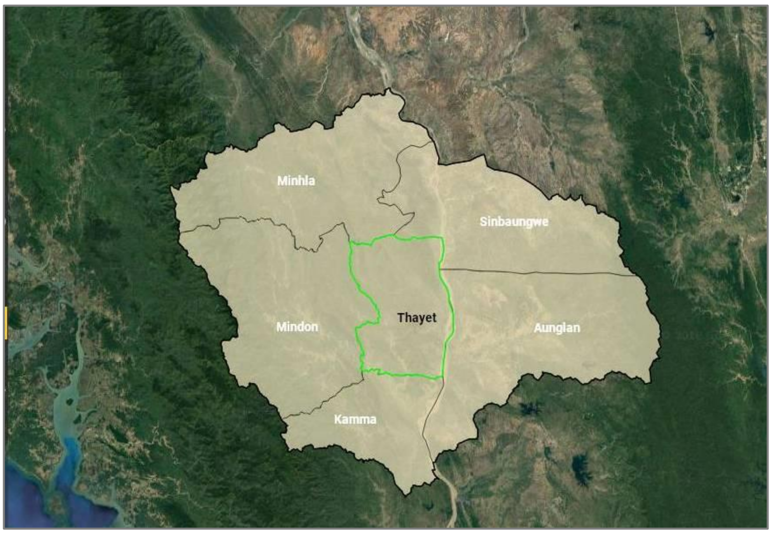
5.5 Socio-Economic Components

The available primary and secondary data was obtained from the multiple sources as detailed below:

- During the drilling phase opinion and attitude surveys of 412 villagers in 34 villages within 1km of the well site areas.
- 2014 Myanmar National Census data and other secondary data reports.

5.5.1 Administration

In Myanmar, states and regions are divided into districts. These districts consist of townships that include towns, wards and village-tracts. Village-tracts are groups of adjacent villages. The administrative structure of the states, regions and self-administering bodies is outlined in the new constitution adopted in 2008. The project is located in the Thayet Township, Thayet District of the Magway Region. The Thayet District is made up of six townships; Aunglan, Kanma, Mindon, Minhla, Sinbaungwe and Thayet. (**Figure 5-38**)



Source: Maps access from https://www.citypopulation.de/php/myanmar-admin.php?adm1id=1406

Figure 5-38: Administrative Region for Project

5.5.2 Governance

Each state or region has a Regional Government or a State Government consisting of a Chief Minister, other Ministers and an Advocate General. Legislative authority would reside with the State Hluttaw or Regional Hluttaw made up of elected civilian members and representatives of the Armed Forces.

The General Administration Department (GAD) under the Ministry of Home Affairs acts as the backbone of the local administration. Thus, at the township level the overall administration (and coordination functions) falls under the authority of township administrators, who are appointed by the GAD and replaced on a three-year basis. In addition sectorial line ministries deliver services and have departments at the township level and refer to the Union level government. While elections take place for the region/state level parliament (which has limited powers) and for the village tract/ward level

(which forms the main point of interaction between the state and its citizens), no elected bodies exist at the township or district levels - although this may change in the future.

The Ward or Village Tract Administration Law of 2012 requires that the VTA/WA be elected from and by the group of 10 household heads. However, the elected VTA/WA is not formally accountable to the local community and reports to the TA, who can assign tasks to the VTA/WA and can dismiss the VTA/WA in case of misconduct. Nevertheless, partly because the developmental role of the VTA/WA has increased and the VTA/WAs have come to be seen as the link between the community at the village tract or ward level and the government at the township level, most of the VTAs/WAs interviewed now feel more accountable to their communities.

The number and size of Civil Society Organisations in Magway Region is still rather limited and so far they play a marginal role in governance. Most organisations are active in health and education, providing direct support to people in need.

5.5.3 Demographics

The 2014 Myanmar Population and Housing Census (2014 MPHC) was conducted from 29th March to 10th April 2014. The 2014 MPHC shows that Myanmar's total population was 51,486,253 persons as of 29th March, 2014. Of these, 24,824,586 were males and 26,661,667 were females. This overall number includes an estimated population of 1,206,353 persons who were not enumerated in certain specific areas of the country. The census enumerated a total population of 50,279,900.

Myanmar is divided into 15 States and Regions. Accordingly, the 2014 Census results show that Yangon Region has the largest population (7.36 million), followed by Ayeyawady (6.18 million), Mandalay (6.16 million), Shan (5.82 million), and Sagaing (5.32 million). These five States and Regions account for almost 60 % of the total population of the country.

With a population of 3,917,055 and population density of 87 persons per km^2, Magway accounts for 7.6% of the populated in Myanmar. The Region is primarily rural, with an urban population of only 15%. There are 1,813,974 (46.3%) men and 2,103,081 (53.7%) women in the region. The average household has 4.1 persons per household (the national average is 4.4). The Thayet District population size in 738,047 with Thayet Township accounting for 104,347 persons. The urban population in Thayet Township is only 19.4 %.

According to the 2014 Myanmar Population and Housing Census the population of Thayet District included 738,047 people. The total area of this block is 1134.4 sq. km (438 sq. miles). Magway Region is the largest of Myanmar's seven regions, with an area of 17,306 square miles (44,820 km^2). Magway Region is made up of 5 districts, one of which is Thayet district which has an area of 4750 square kilometres. On the west is the Arakan Yoma range, and on the east the Pegu Yomas range. The greater part of the district is wooded, and the mountains to the east and west are covered with forests. The chief river is the Ayeyarwady River, which traverses Thayet from north to south. The drainage finds its way to the Ayeyarwady River by three main streams. The chief products in Thayet district are rice, cotton, oil-seeds and tobacco; cutch is also very abundant, as is the manufacture of dye-stuff.

5.5.4 Ethnicity

The Region is made up mostly of Buddhist Bamars. There are some very small minorities of other ethnic groups, including Chins, Rakhine, Kayin and Shan. All respondents are Buddhist.

5.5.5 Agriculture

Land use in Block MOGE-3 study area is dominated by agricultural activities particularly dry land cultivation along with some irrigated cropland.

During the projects socio economic, health and opinion surveys of approximately 412 villagers in 34 villages spread across Block MOGE-3 in the potentially affected exploration drilling area located in Thayet Township, Thayet District. Most households (95%) agricultural land have cropland (**Chart 5-4**), respondents identified The main agriculture crop in this area is beans and pulses (45%), with rice as the next most common crop (40%), with some sesame (9%) and corn (16%). (**Chart 5-5**)

Chart 5-4: Agricultural land in Block MOGE-3

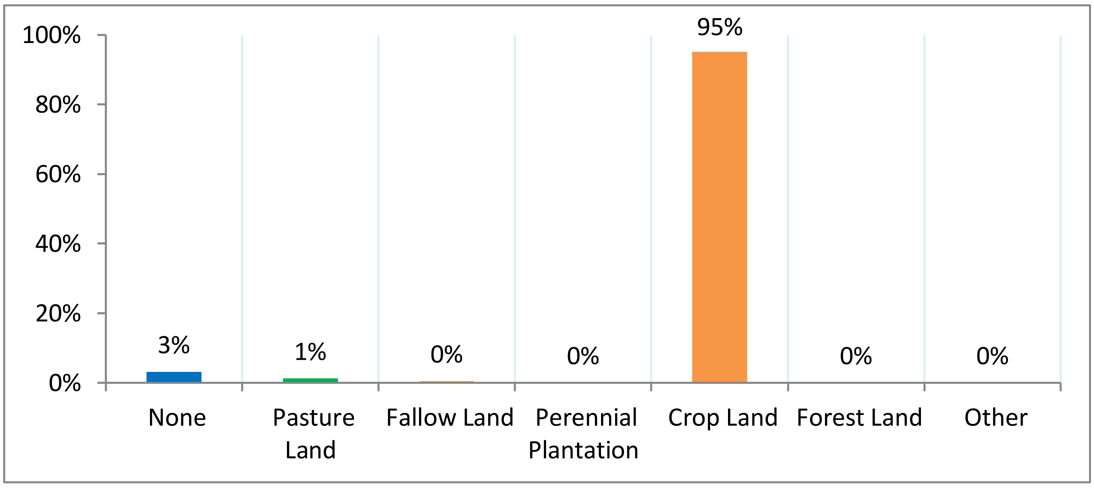
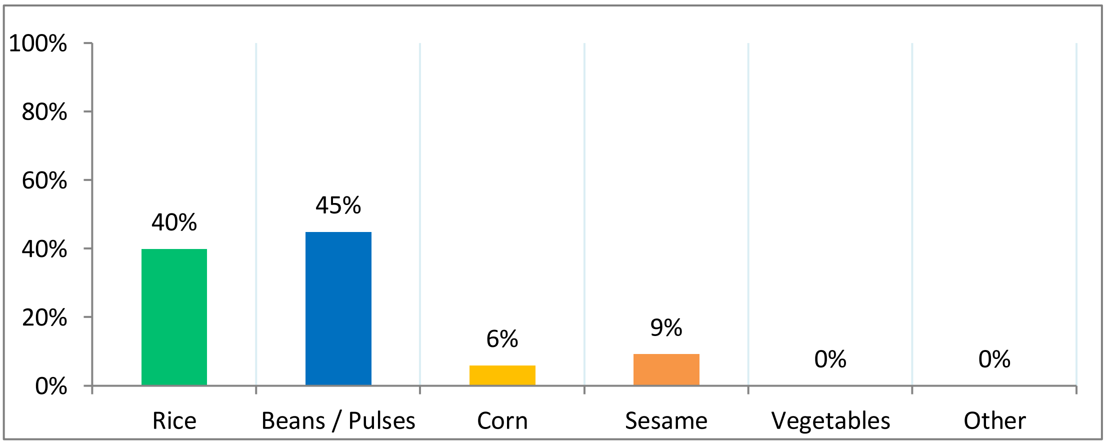


Chart 5-5: Primary agricultural crops grown in Block MOGE-3



5.5.6 Industry

5.5.6.1 *Military Area*

The Military Industry (12) area within Thayet Township is about 72 square kilometer in size and located in the southwest of Sa Khan Gyi Village and can be accessed from Thayet – Mindone road.[19] (**Figure 5-39**)

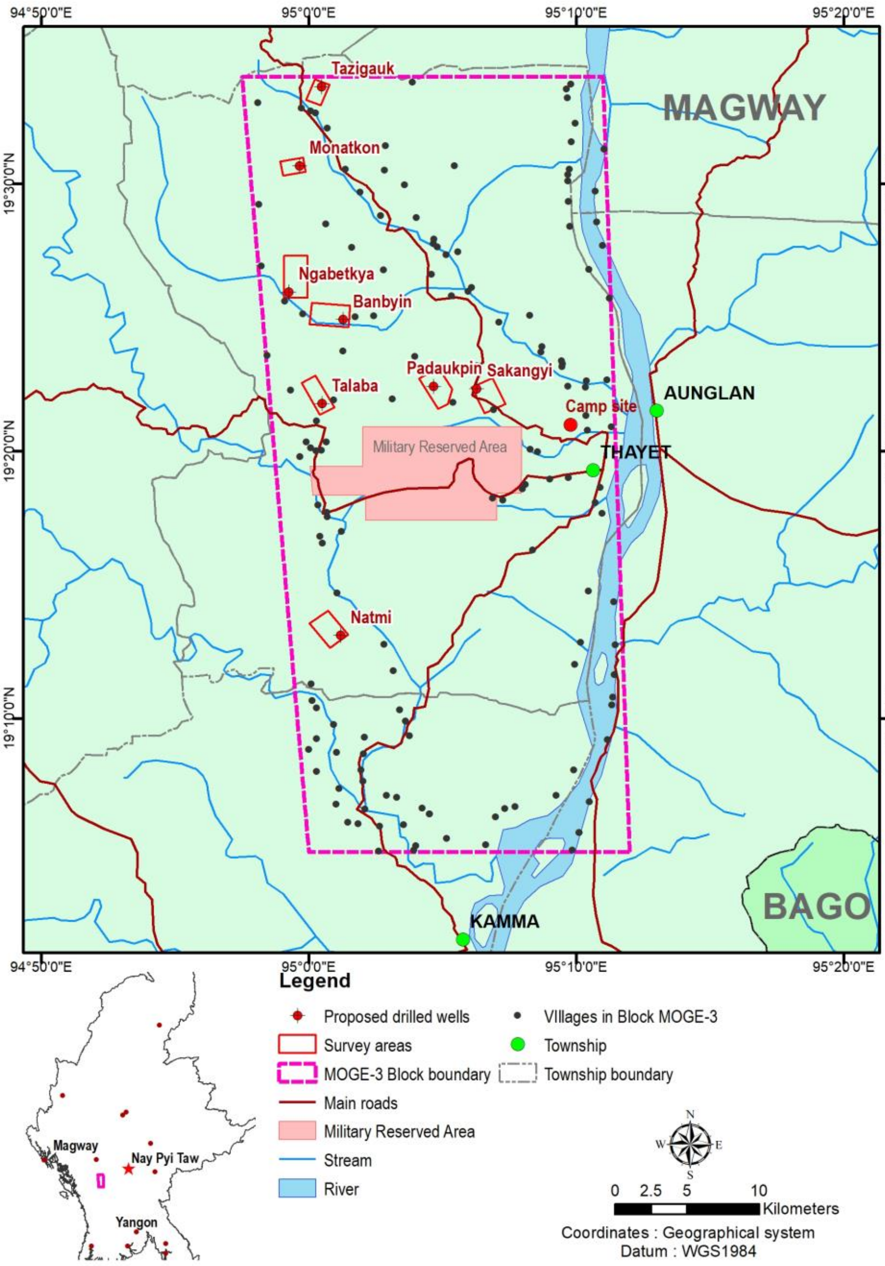


Figure 5-39: Military Industrial Area in Block MOGE-3

19 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

5.5.6.2 *Limestone Quarry and Cement Factory*

Industry in the block is currently limited. However, there is a non-operational limestone mine and cement factory in Thayet Township. (**Figure 5-42**) The limestone mining started sometime in the 1960s to supply a cement factory in Thayet Town. The limestone quarries were rehabilitated in the early 1980s with German help (GTZ) when the aerial ropeway was replaced by trucks as the principal means of limestone transport from the quarry to the factory.[20] The cement factory and limestone quarry have been shutdown since 2016. The cement factory used to by powered by gas, however gas supplies are low so the factory proposed to switch to coal. The local people due to air quality concerns protested this. Therefore, the factory has no been operational since then.[21]

Figure 5-40: Cement Plan and Limestone Quarry in Thayet Township

5.5.6.3 *Hand Dug Well*

The state-owned enterprise consists of 5-acre blocks inside Thayet Township. These state-owned enterprise have been granted for 6 hand dug oil & gas companies. These hand-dug operations are drilling less than 1000 ft.[21] (**Table 5-26**)

20 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015
21 IEM Interview with Thayet GAD Office, February, 2018.

Table 5-26: Hand-dug State Owned Enterprises in Thayet

No.	Name	Information
1	Sa Khan Gyi Hand Dug Well Area Approximately 1 square mile	Approximately 150 to 200 wells drilled Over 50 Production Wells. 37 are Under drilling stage including 10 with Rotary drilling the rest with Local machine
2	Pa Dauk Pin Hand Dug Well Area Approximately 1.5 square mile	Approximately 50 Production Wells
3	Nga Khu I Hand Dug Well Area Approximately 5 Acre	Over 200 wells Under drilling stage; 8 well in Production
4	Ban Pyin Hand Dug Well Area Approximately 2 square mile	Approximately 400 to 500 Wells. Over 35 production Well and over 20 with local machine
5	Baw Hand Dug Well Area Approximately 2 square furlong	Approximately 300+ Wells, 12 are under drilling stage and 30-35 production wells.
6	Oak Pon Hand Dug Well Area	Abandoned

5.5.7 Fishery and Aquaculture

In 2016, total national fish production was 4,645,020 metric tons. Inland and marine fisheries make up nearly 78% of Myanmar's fish production, at 3,630,600 metric tons, and remain a key contributor to the national fish supply. Aquaculture has grown significantly in the past decade, and has now reached 22% of annual fish production, 1,014,420 metric tons in 2016 (according to government statistics reported to FAO)[22].

Inland and marine fisheries make up nearly 80% of Myanmar's fish production at 4.1 million tonnes, and remain a key contributor to the national fish supply. Aquaculture has grown significantly in the past decade, and has now accounts for 22 percent of annual fish production, producing 950,000 tonnes in 2015, according to government statistics reported to FAO.

Based on data from the Food and Agriculture Organization (FAO), world fisheries production in 2012 was at 158 million MT. Marine capture fisheries accounted for 50 percent of the global production or 79.7 million MT. About 76.2 percent of the production came from 18 countries with China as the top producer[23].

Major fish species cultured include Rohu (*Labeo rohita*), Catla (*Catla catla*), Common carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idellus*), Mrigal carp (*Cirrhinus mrigala*), Silver carp (*Hypophthalmichthys molitrix*), Tilapia (*Tilapia spp.*), Striped catfish (*Pangasius sutchi*), Philippine catfish (*Clarias batrachus*). Recently, DoF successfully cultivated another three species of freshwater fish, namely *Piratus branchatus*, *Notopterus chitala* and *Osphronnemus gouramy*.

5.5.8 Waste Management

Myanmar has been facing considerable challenges with the management of waste in the recent past as a result of increasing income and consumption levels, urban growth, and lack of effective waste treatment and disposal methods. Waste management in Myanmar has traditionally been the responsibility of township and city development committees designated within respective States and Regions. Waste collected by respective townships and city development committees is transported to

22 World Fish; Myanmar: https://www.worldfishcenter.org/country-pages/myanmar
23 FAO fishery country profile: the Union of Myanmar : https://data.opendevelopmentmekong.net/library_record/fao-fishery-country-profile-the-union-of-myanmar

open dumping sites. Recycling activities, if carried out is mostly by the informal sector, which includes waste pickers, waste collectors, and waste dealers.[24]

To consider the current condition of waste management practices conducted by Thayet City Development Committee a meeting was held with the Township Administrator from Thayet City Development Committee. The Current township waste management system is open dumpsite with open burning. The waste disposal site is nearly 4.5 acre that is located about 3 mile from the township. Total waste generation is 4 ton per day and most of the wastes are domestic wastes. All wastes including domestic and industrial waste as disposed at the disposal area without separation. Thayet CDC is looking to install a waste to energy plant. They are looking for funds to develop their waste capabilities from private or international organizations. The Thayet CDC can handle and manage non-hazardous general wastes. The general non-hazardous wastes will need to be managed by the Thayet Township CDC with all other wastes managed by DOWA or alternative approved hazardous waste Management Company.

Depending on the location, human wastewater and grey water management in Block MOGE-3 is disposed of variously by: flush/pour systems to piped sewer system/septic tank, pit latrine or open space. Slab toilets, composting toilets, bucket, hanging toilet, hanging latrine are used (DOH, 2010). The Thayet CDC has no liquid waste treatment or management operations.

Interview with Thayet CDC

Open Burning at CDC Waste Disposal Site

Figure 5-41: Photographs of Township Waste Management

5.5.9 Irrigation and Agricultural Water Sources

The country has 18.2 million ha of arable land, of which only 13.3 million ha (73%) are cultivated at present. In the monsoon season, only 2.1 million ha of cultivated land are irrigated, while the remaining 11.2 million ha are rain-fed[25]

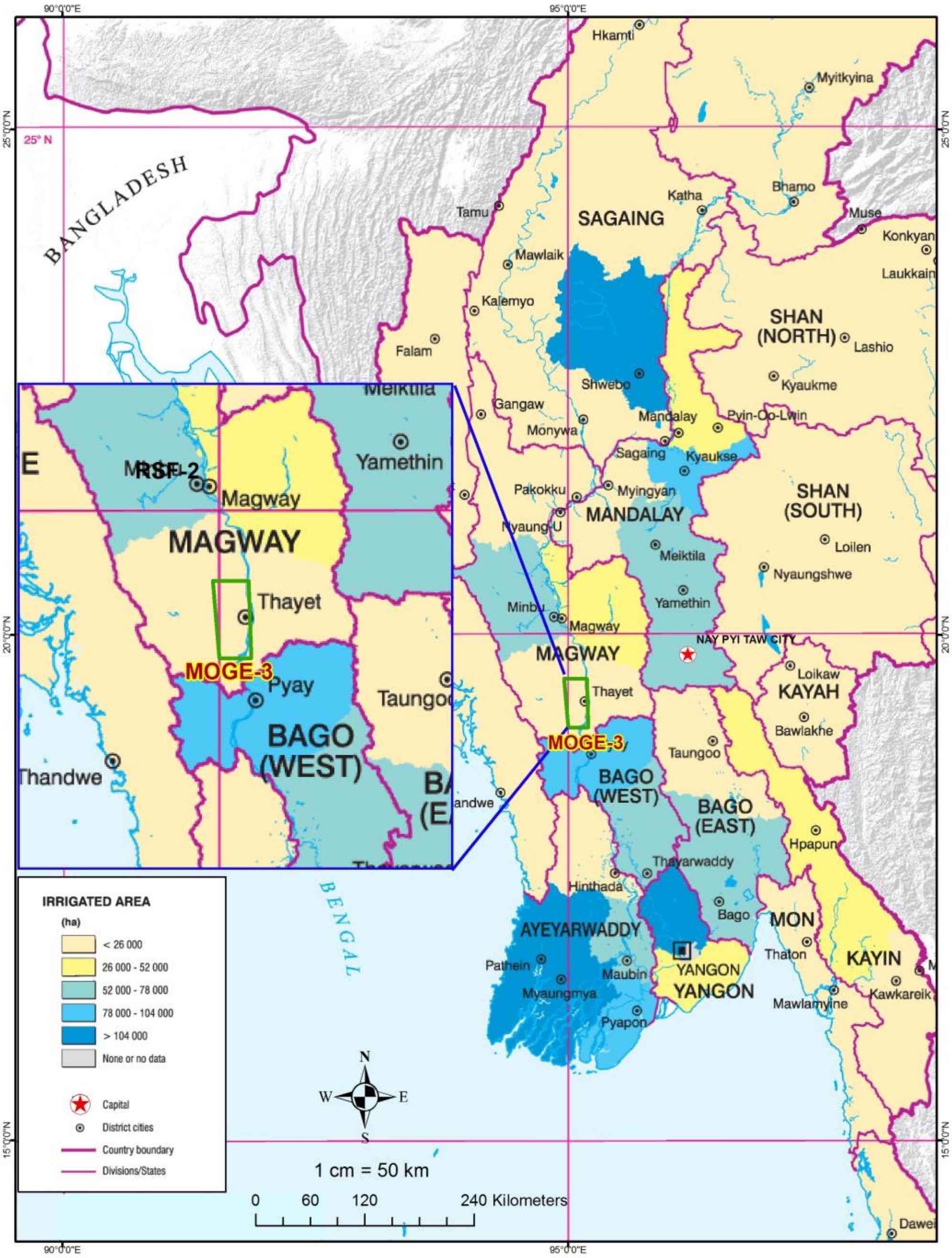
Irrigated areas were traditionally supplied through weirs for river diversion or dams and tanks, but wells and pumping in rivers have developed quite substantially in recent years (FAO, 1999). Pump irrigation was promoted in the 1980s by programmes implemented by the Agricultural Mechanization Department. Water Resources Utilization Department has been implementing pump irrigation water

24 Waste Management in Myanmar: Current Status, Key Challenges and Recommendations for National and City Waste Management Strategies, IGES 2017

25 Republic of the Union of Myanmar: Irrigated Agriculture Inclusive Development Project, ADB 2016

supply programme using high discharge capacity pumps since 1995. Other types of irrigation water supply include windmills, watermills, watering with buckets, ponds, etc. In the central dry zone, where most of the potential for economical run-of-the-river diversion schemes has been utilized, dams, irrigation projects and groundwater irrigation projects were started in the 1980s. Mainly diesel pumps access groundwater. Salinization due to irrigation is mainly found in the central dry zone, near Meiktila in Mandalay Region, where groundwater is used for irrigation purposes (FAO, 2009).

Figure 5-42 shows a map of irrigated areas across Myanmar.



Source: FAO, 2005

Figure 5-42: Irrigated Areas in Myanmar

The irrigated areas and water dams for Thayet are detailed in **Table 5-27**.

Table 5-27: Thayet Dams & Irrigated Areas

No	Dam name	Kind	Water capacity (cubic feet)	Watershed area (AC)
1	Ta-zee-kauk	Soil Embankment	50000	72
2	Ta-lote-pin-kyauk-myaung	Soil Embankment	360000	31
3	Thayet-myint	Soil Embankment	450000	39
4	San-ma-gyi	Soil Embankment	57000	5
5	Taw-myin –bar-kan	Soil Embankment	5800	5
6	Letpan-pin	Soil Embankment	280000	24
7	Phaung-kataw	Soil Embankment	290000	25
8	Thae-sae-kan	Soil Embankment	860000	75
9	Chay-yar-taw	Soil Embankment	710000	62
10	Sin-tae	Soil Embankment	1170000	88
11	Htan-koe-myaung	Soil Embankment	650000	100
12	Htan-yone-pyitawthar	Soil Embankment	580000	50
13	Ywar-htaung	Soil Embankment	650000	60
14	Pauk-pin	Soil Embankment	1040000	90
15	Lin-taw	Soil Embankment	580000	50
16	Ywar-palae	Soil Embankment	920000	80
17	Kyawe-pone	Soil Embankment	1000000	87
18	Pyin-myaung	Soil Embankment	130000	11
19	Toke-kine	Soil Embankment	580000	50
20	Taw-mon-kan	Soil Embankment	480000	42
21	Mee-laung-ywar	Soil Embankment	800000	70
22	Twin-laee	Soil Embankment	710000	62
23	Yawr-palae	Soil Embankment	290000	25
24	Wutt-toe	Soil Embankment	1520000	149
25	Poe-ti-myaung	Soil Embankment	750000	65
26	Tha-pyae-pin	Soil Embankment	575000	50
27	Kadat-pin	Soil Embankment	180000	15
28	Akyee-sar	Soil Embankment	880000	76
29	Aine-ma	Soil Embankment	170000	15
30	Pyi-taw	Soil Embankment	110000	95
31	Shaw-kan	Soil Embankment	460000	40
32	Thayet-myint	Soil Embankment	860000	75
33	Phaung-kar	Soil Embankment	1030000	90
34	Pone-gyi	Soil Embankment	970000	84
35	Ma-din-kan	Soil Embankment	330000	130
36	Ponenar	Soil Embankment	70000	180
37	Hta-min-yae-kan	Soil Embankment	750000	53
38	Pyin-htaung	Soil Embankment	50000	65
39	U Tun Min Dam	Soil Embankment	170000	64
40	Kyee-pin-chaung	Soil Embankment	870000	77
41	Tat-dam	Soil Embankment	170000	42
42	Taw-mon-kan (2)	Soil Embankment	130000	76
43	Tu-lu-dam	Soil Embankment	580000	15
44	Pate-thalane	Soil Embankment	480000	95
45	Lane-taw-dam	Soil Embankment	800000	40
Total			**74,280,000**	**2,785**

The Thayet Land use areas and data are detailed in **Table 5-28**.

Table 5-28: Thayet Land use

No	Description	Area (AC)
1	Total agricultural land	52983
	(a) paddy land	16933
	(b) farm land	29833
	(c) alluvial land	4994
	(d) garden land	616
	(e) Taungya land	607
2	Total omitted land	-
	(1) farm land	-
3	Pastureland	-
4	Industrial land	16095
5	City land and village land	17334
6	Other land	-
7	Reserved/Public Forest land	13390
8	Wild forest	-
9	Wild land	193927
10	Agricultural land that cannot grow	33429
Total		**293729**

5.5.10 Transportation

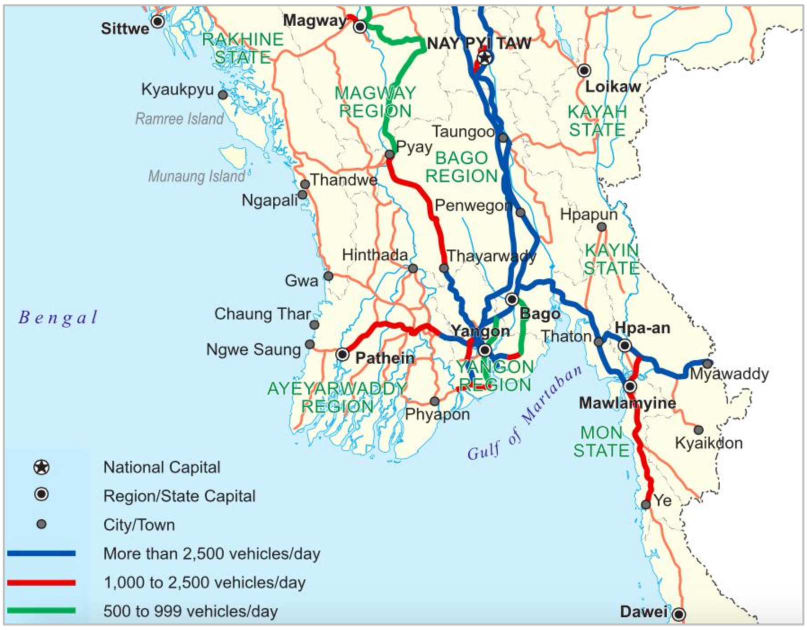
Central Myanmar has a relatively well-developed transport system compared to other parts of Myanmar, including road, air, rail, and water. Due to its geography, central Myanmar, particularly Mandalay acts as the central hub for transport of people and goods with destinations further north, east and west in the country, as well as to China and India.

5.5.10.1 *Roads*

The major mode of transportation in central Myanmar is roads. Out of the six major highways in Myanmar, three are in Magway and Mandalay Regions. As a result, central Myanmar has a sizable road transport network with Mandalay as the major hub. From Mandalay, the network extends into upper Myanmar to Kachin State and China (through Muse in northern Shan State), and to western Myanmar and India, and south to Yangon.

Traffic-related deaths rates are increasing in Myanmar. The rate of fatalities each year increased to 1,853 in 2008, 2,496 in 2011, 3,721 in 2013, and then to 4,313 in 2014. The 4,887 total deaths from 17,384 traffic accidents in 2016 is similar to the 4,375 deaths in 15,859 traffic accidents in 2015.[26] The absolute level of fatalities in Myanmar is still moderate when compared with that of similar countries. The rate of fatalities per 100,000 people was estimated to be 2.5 in 2006. It reached 8.4 in 2014. Despite the increase, this is not currently considered a high rate per 100,000 people on an international comparative basis. In 2010, the Philippines had a fatality rate of 8.3, Indonesia 17.7, Cambodia 17.6, and Thailand experienced a very high rate of 38.8.[27]

The traffic load for Myanmar roadways is shown in **Figure 5-43**. The transportation route will use a variety of roads with traffic levels of over 2,500 vehicles /day near Yangon, and then reducing to below 500 vehicles /day near the project area.



Source: Source: ADB estimates based on Ministry of Construction highway traffic data. 2013

Figure 5-43: Traffic Load on Myanmar Roadways

26 Myanmar Transport Brief, Issue 21, 11 May 2017
27 Asian Development Bank. Myanmar transport sector policy note: Road safety. Mandaluyong City, Philippines: ADB, 2016.

The 2014 Census shows that in Thayet Township 49%t of the households have cart (bullock) as a means of transport and it is the highest proportion, followed by 34% of households having motorcycle/moped. (**Table 5-29**)

Table 5-29: Response of Thayet Township in Block MOGE-3 regarding mode of transportation

Vehicle type	quantity	%
Car/Truck/van	240	1
Motorcycle/moped	8,747	30
Bicycle	7,035	24
4-Wheel tract	99	0
Canoe/ Boat	232	1
Motor boat	223	1
Cart (bullock)	12,614	43
Total	29190	100

Source: Modified from the 2014 Myanmar Population and Housing Census

The Yangon-Pyay- Mandalay and Yangon-Pyay-Kanma-Thayet roads are the best road to access the project area. The roads in the townships allow the truck carried-weight for only 13 tons and in village road allow 6 tons respect to the timber built bridges. Heavy cargo more than 13 tons can use the Yangon-Pyay-Mandalay old road and district connected roads. Major roads are good in surface conditions and village road are earth based and four wheel-drive motor cars are suitable for such kind of roads.[28] (**Figure 5-44**)

5.5.10.2 *Railroad*

Railroads in Myanmar generally run south to north with branch lines to east and west, with the Central Railway Station in Mandalay as a major hub. The main rail line for passenger and cargo is between Yangon and Mandalay. From Mandalay, the railroads branch east to Shan State, and west to Magway Region and continuing north to Kachin State.

5.5.10.3 *Air*

Central Myanmar has two international airports – Mandalay International Airport, and Naypyidaw International Airport. Similar to the road and rail transport network, these two airports serve as a central hub from which many flights to the east (Shan State) and north (Kachin State) are taken.

5.5.10.4 *River Transport*

Water transport in middle Myanmar is on the Ayeyarwady River. Mandalay has a major port where passengers and goods, including rice, beans, pulses, cooking oil, pottery, bamboo and teak are frequently transported to the towns and cities located along the Ayeyarwady River.

28 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

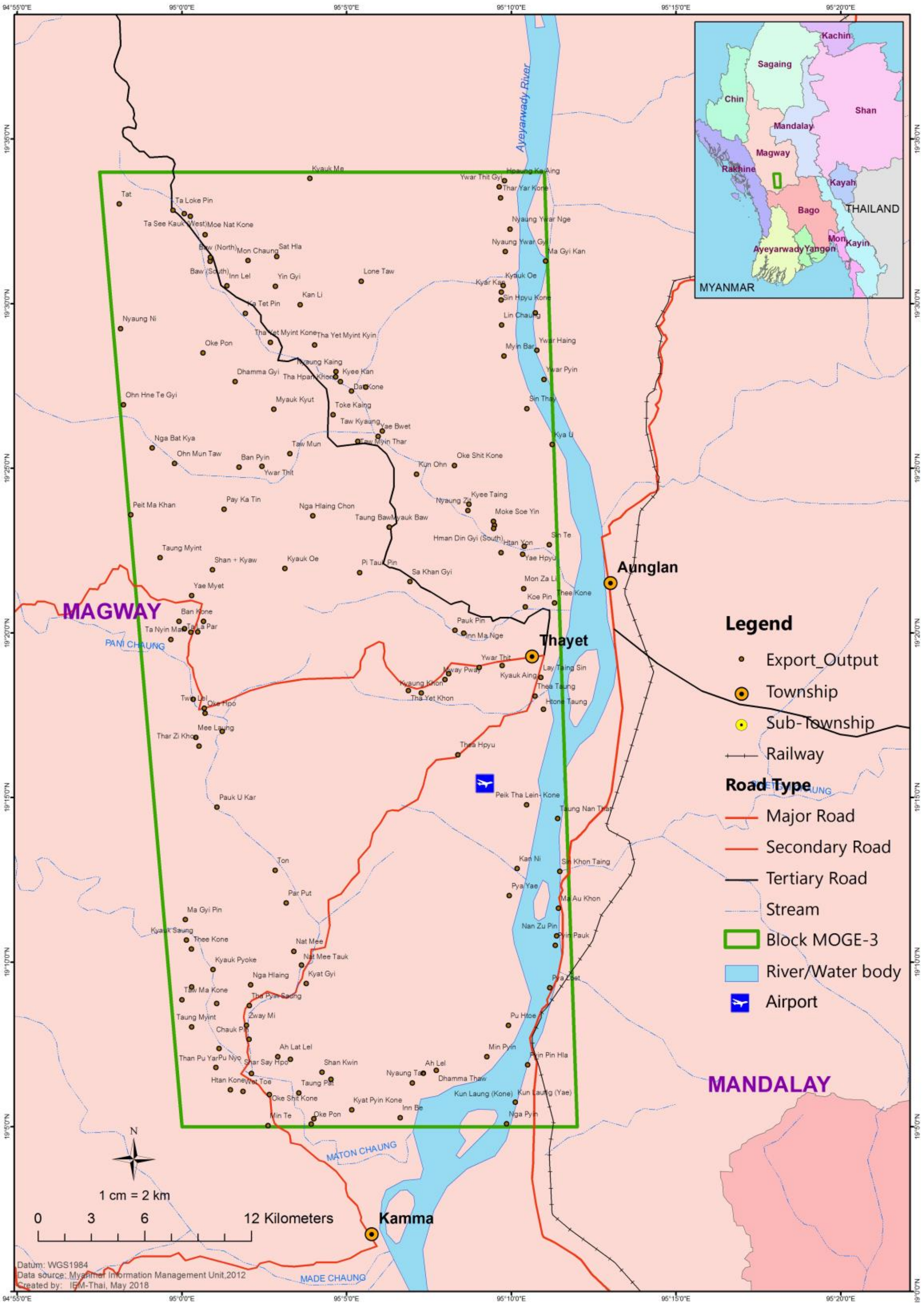


Figure 5-44: Transportation Routes in Block MOGE-3

5.5.11 Power Supply & Electricity

Installed capacity in Myanmar grew by a factor of four during 2000–2014 and reached 4,422 MW in 2014.[29] The Ministry of Electricity and Energy (MOEE) has pledged to provide an additional 3,600 megawatts of electricity within the next four years.[30]

Magway Region has 57 conserved dams/lakes, three dams/lakes that are not conserved by Irrigation Department, and 1102 small dams/lakes, with 30 river water pumping stations. The Kyeeohn Kyeewa multi-purpose dam and hydropower station are located at Mone Creek near Wunlo Village. The Kyeeohn Kyeewa multi-purpose dam can store 463,000 acre feet. Still water storage of the dam is 35,350 acre feet and area is 10,860 acres. It is 3280 feet long and 164 feet high. (Ministry of Agriculture and Irrigation, 2010). By storing water from Mone Creek Dam and from between the two dams, 74 megawatts of electricity will be generated. The Mezali Diversion Weir will irrigate 96,000 acres of farmland for monsoon paddy cultivation.

The major source of lighting in Thayet Township is from candle (30%), followed by Electricity (25%), Generator (20%), Battery (12%), Solar system (9%) and other source of lighting (3%). For household cooking, most of the interviewees either cook with firewood (91%) or Electricity (9%).[31] The Power Supply & Electricity sources in the region are shown in **Table 5-30**.

Table 5-30: Power Supply & Electricity Sources

Source of Lighting								
Electricity	Kerosene	Candle	Battery	Generator	Water mill	Solar system/	Other	Total
6,467	197	7,703	3,213	5,200	15	2,293	884	25,972
25	1	30	12	20	0	9	3	100%
Type of cooking fuel								
Electricity	LPG	Kerosene	Bio Gas	Firewood	Coal	Straw/Grass	Other	Total
2,251	2	9	9	22,767	12	8	49	25,972
9	0	0	0	91	0	0	0	100%

Source: Modified from the 2014 Myanmar Population and Housing Census.

5.5.12 Communications

The communications in Thayet Township shows that mobile phones are used by (28%) and phone line is used by only 2%.[32]

29 ADB - Power Sector Development in Myanmar, 2015
30 News Article, Govt moves to complete five power projects, Access from http://www.elevenmyanmar.com/local/13159 on March 23, 2018
31 2014 Myanmar Population and Housing Census (2014 MPHC)
32 2014 Myanmar Population and Housing Census (2014 MPHC)

5.5.13 Local Socio-Economic Context

Data for the socio-economic baseline of the Project area, IEM conducted stakeholder engagement with local officials for Thayet Township and conducted with focus group meetings and socio-economic surveys in 34 villages within the Thayet Township that are located closest to the potentially affected area of the survey footprint 1km buffer zone distributed throughout the block as well as review of various technical reports, government, and internet research.

Magway Region contains about seven percent of Myanmar's population. The economy depends on agriculture, mining, and petroleum industries; Located in central Myanmar, Magway Region is bordered by Sagaing Region to the north, Mandalay Region to the east, Bago Region to the south and Rakhine and Chin States to the west. The region is relatively stable and safe compared to other regions in Myanmar as the state authority has not been challenged and the region has not experienced any armed conflict, ethnic tension, or major natural disaster recently.[33] Magway Region's social development indicators such as poverty, education and immunization, safe drinking water and sanitation are comparable to the national averages.

The principal product of Magway Region is petroleum. It produces most of the oil and naturalgas in Myanmar. The following oil fields are located in the Magway Region: the Mann, Yenangyaung, Chauk, Kyauk-khwet, Letpando and Ayadaw oil fileds (Myanmar Ministry of Information, 2002).

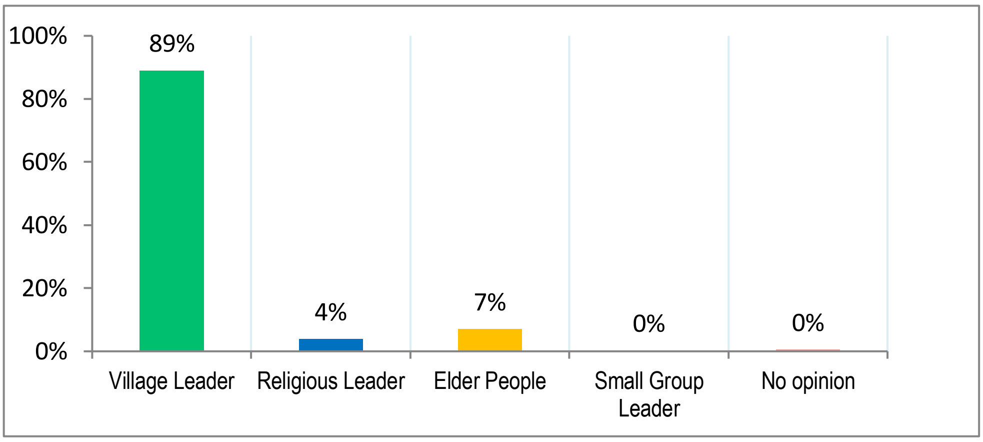
Agriculture is also important. The major crops are sesame and groundnut. Other crops grown are rice, millet, maize, sunflower, beans and pulses, tobacco, toddy, chili, onions, and potatoes. Famous products of the Regions include: Thanaka (*Limonia acidissima*) and Phangar (*Chebulic myorobalan*) fruit. Oil seed crops are grown as sole, however, in most areas, monsoon sesame or peanut is broadcast between pigeon pea rows. After the harvest, mung bean or cowpea were planted between the rows as the sequential crops. Farmers are heavily dependent on products from the natural forest, especially fuel wood, pole, post and fodder to support their living and livestock. Poorer farm families and agricultural labourers supplement their incomes by cutting fuel wood or making jiggery (palm liquor), which contributes to overexploitation of forest resources and deforestation. Many landless people are working as seasonal farm labourers, migrating to urban regions during non-planting time to find temporary employment.

5.5.13.1 *Community Decisions*

At the community level, local villagers identified the elected Village Leader is responsible for most (89 %) of community decision making. (**Chart 5-6**)

33 UNDP Local Governance Mapping – The State of Local Governance: Trends in Magway Region

Chart 5-6: Responsibility for community decision making in Block MOGE-3



5.5.13.2 *Household Characteristics*

In the Block MOGE-3 age structure of the respondent's families indicated that the majority approx. (34%) of household members are between 40-50 yrs. of age followed by those in the range of 50-60 and 30-40 yrs. of age (**Chart 5-7**); 33% came from households with 4 family members followed by approximately 22% from 3 person families and 20% from 5 family members. (**Chart 5-8**)

Chart 5-7: Age structure of Population in Block MOGE-3

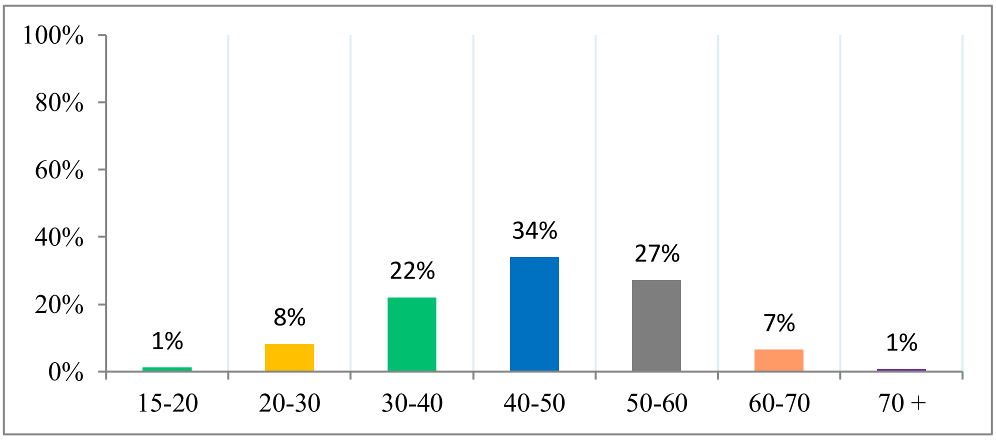
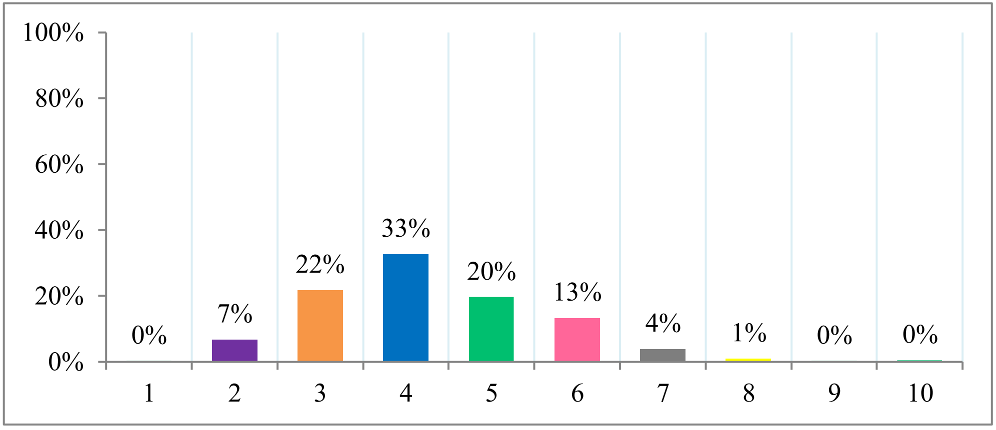


Chart 5-8: Number of household member reported in Block MOGE-3



5.5.13.3 *Land & Housing Ownership*

The conditions of housing units are important characteristics that indicate the quality of life of the population. The 2014 Census showed that about four out of five households in Myanmar are owners of their housing unit. In urban areas, 66% of households own the housing units where they reside, 20% are tenants while 7% live in housing provided by the Government. In rural areas, 93% of households own the housing units where they reside and 2.4% are tenants. In the village surveys for this EIA, Most households surveyed (98%) own their land where they live. (**Chart 5-9**) They show ownership in varied ways: 54% of villagers have documents, 43% have permission but do not have documents, and 4% have neither document nor permission. (**Chart 5-10**)

Chart 5-9: House lot ownership reported in Block MOGE-3

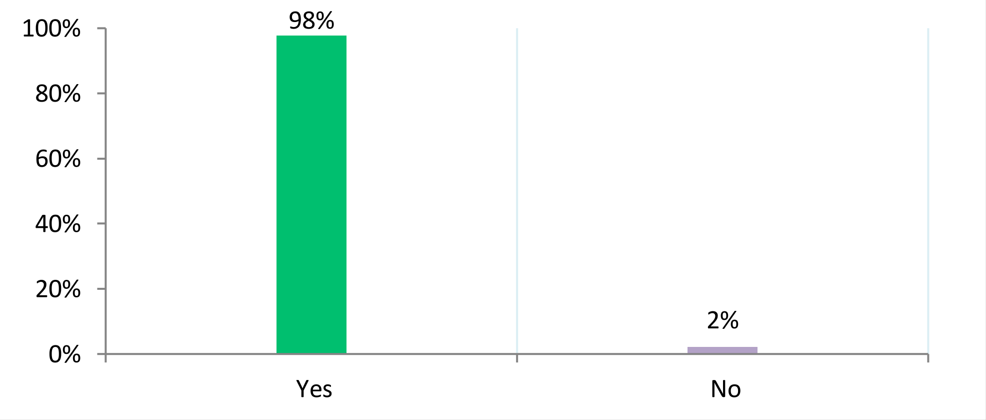
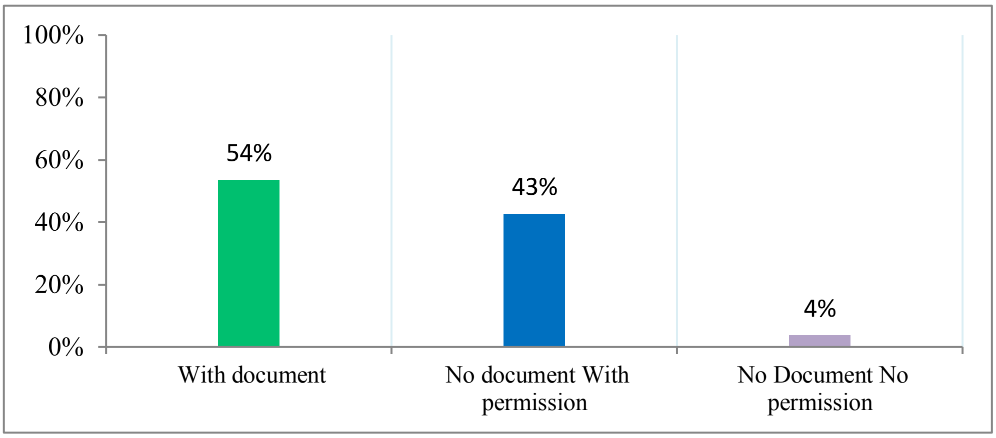


Chart 5-10: Ability to demonstrate land ownership in Block MOGE-3



5.5.13.4 *Housing*

From baseline information of Ministry of Immigration and Population showed that approximately 55% live in wooden house, 33% of them live bamboo house, 5% live in semi-pacca house and 7% live in apartment/condominium or other buildings. For Roof type is an indicator of wealth. In this region, 65% use corrugated sheet, while 31% use Dhani/ Theke/ in leaf for roofing and 4% use other materials such as bamboo, wood ect.

5.5.13.5 *Farmland Ownership*

Land ownership patterns vary in central Myanmar. In some cases lack of rain has impoverished farmers with the result that lands may be sold and farmers and family members are forced to become tenants and or labour on other larger land holdings simply for survival. Within Block MOGE-3 approximately 98% of the household owners own farmland. (**Chart 5-11)** Approximately 58% of the farmers in Block MOGE-3 own or lease greater than 3 acres of land, while 31% of farmers own 2- 3 acres of land and 12% of farmers own less than 2 acre. (**Chart 5-12)**

Chart 5-11: Farmland ownership by households reported in Block MOGE-3

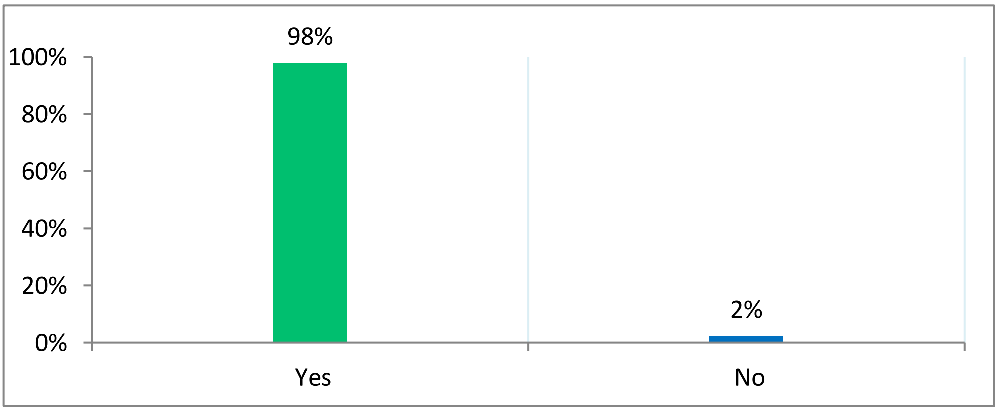
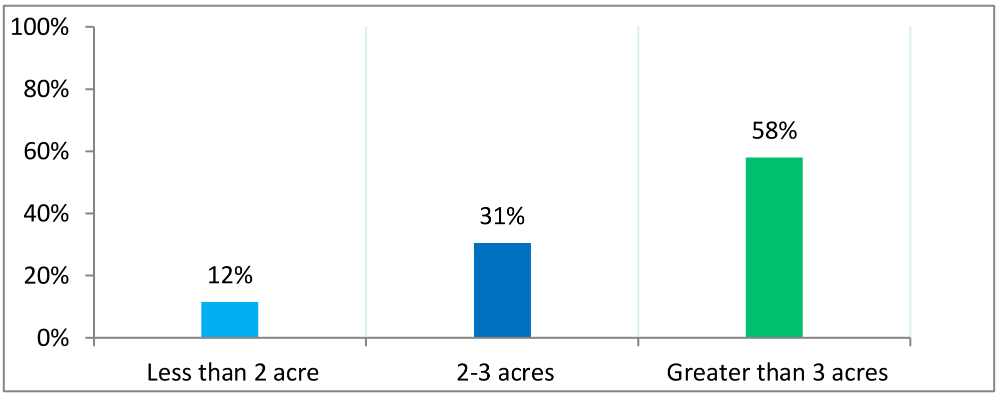


Chart 5-12: Area of farmland owned by households reported in Block MOGE-3

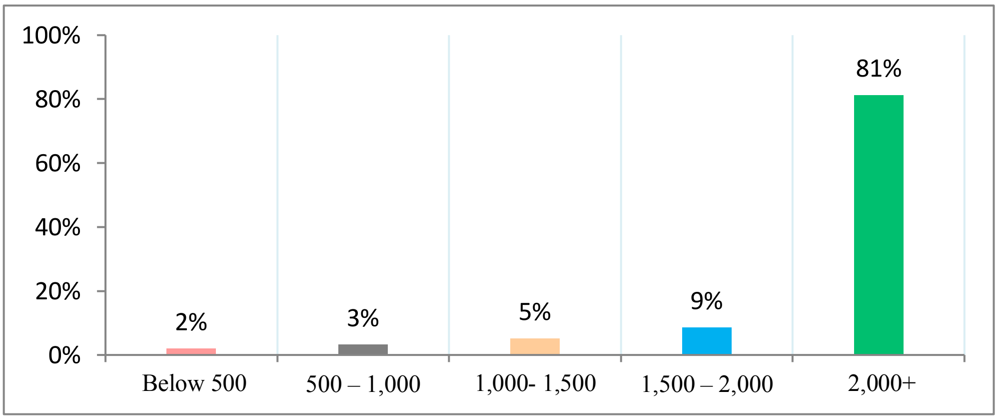


5.5.13.6 *Income and Employment in Project Area*

The IEM team surveyed a total of approximately 412 households in 34 communities is Block MOGE-3 in regard to income, employment and labour.

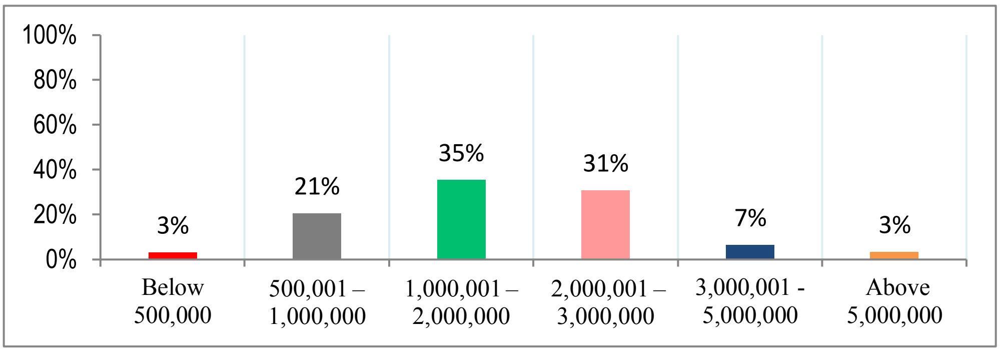
In the villages surveyed, 81% are paid an average daily wage of 2,000+ kyat, while 9% are paid an average daily wage of 1,500-2,000 kyat followed by 5% are paid an average daily wage of 1,000-1,500 kyat and 3% 500 -1,000 kyat. (**Chart 5-13**)

Chart 5-13: Average daily income reported in Block MOGE-3



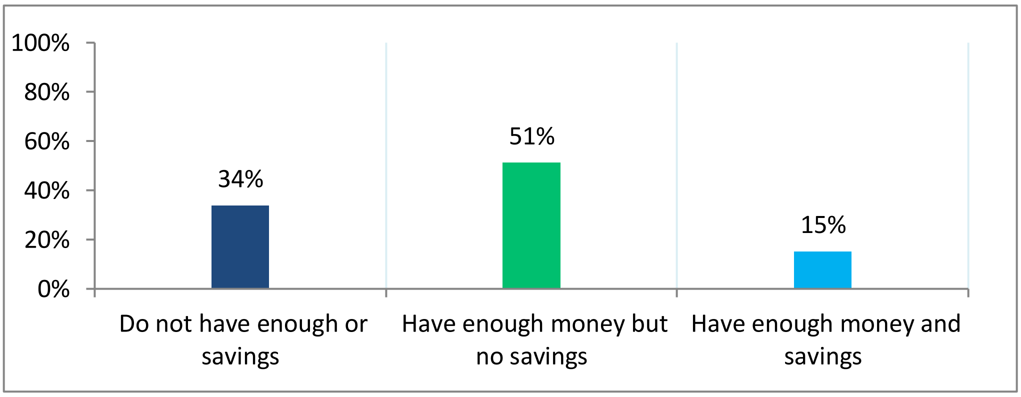
The survey group indicated that 35% had an annual income of 1,000,001-2,000,000 kyat and 31% with an annual income of 2,000,001-3,000,000 kyat. (**Chart 5-14**)

Chart 5-14: Annual household income reported in Block MOGE-3



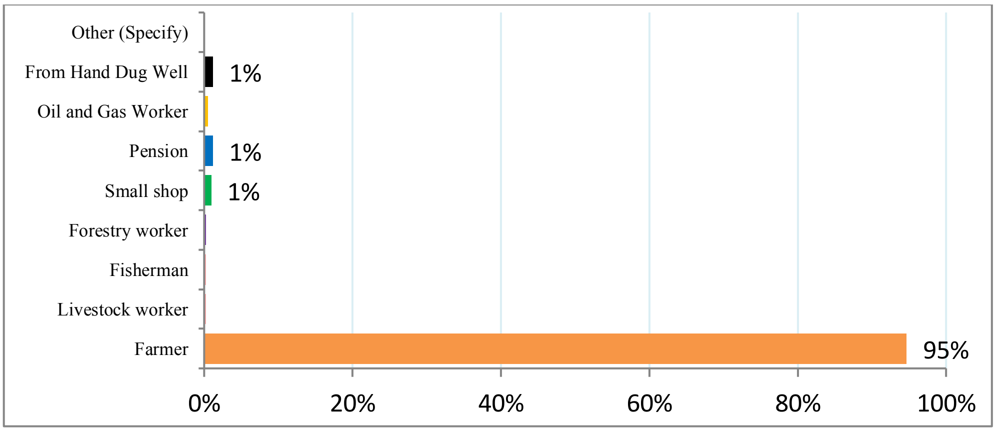
When asked whether they felt they had sufficient money respondents in Block MOGE-3 51% of respondents indicated that had sufficient income to cover expenses another but no savings, 34 % have money problems, only 15% of respondents had sufficient income to cover expenses and savings. (**Chart 5-15**)

Chart 5-15: Personal monetary situation reported in Block MOGE-3



Over 95% of respondents described their primary occupation as "farmer" with the remainder of occupations typically accounting for about 5% or less of local employment. (**Chart 5-16**)

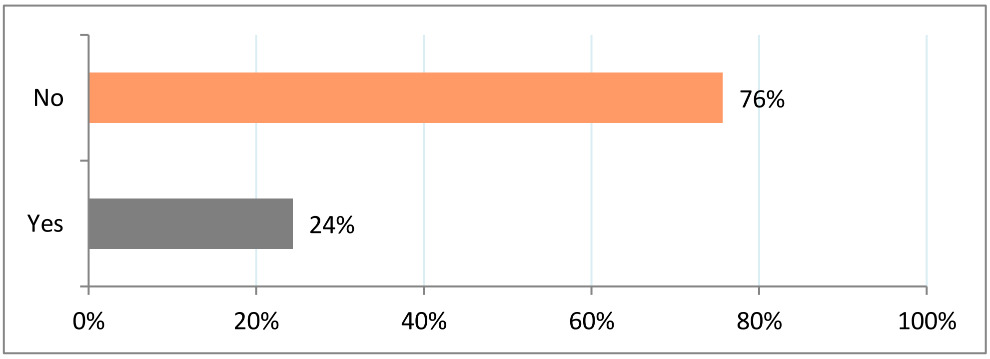
Chart 5-16: Primary occupation reported in Block MOGE-3



5.5.13.7 *Labour and Migration*

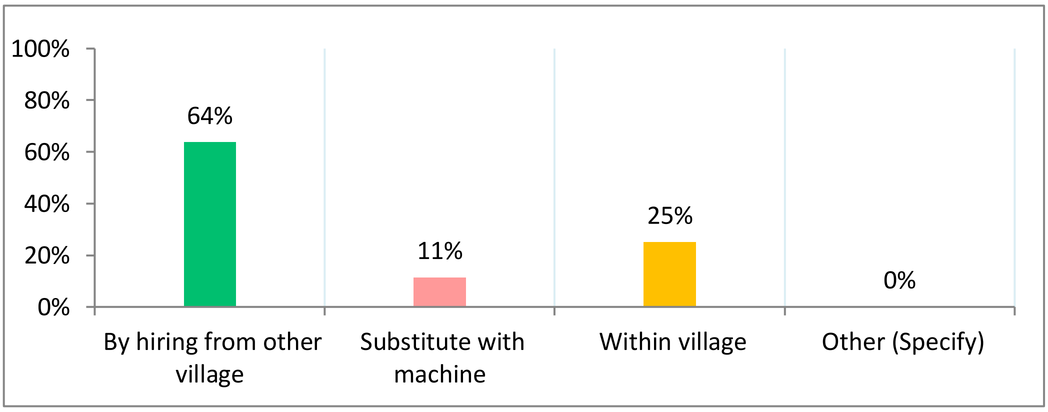
The 2014 Census shows that in Thayet District, 75.5% of persons living aboad were male. The chart below indicates that 76% of those surveyed felt that larger projects (including oil and gas and infrastructure projects) had not affected labour availability for traditional businesses. (**Chart 5-17**)

Chart 5-17: Perceived influence of oil and gas activity on labour reported in Block MOGE-3



Of particular interest was the observation that by far the majority of farm labour appears to come from other communities than the ones being interviewed. In 64% of the cases respondents said labourers come from other communities, the next most labourers (25%) within village. (**Chart 5-18**)

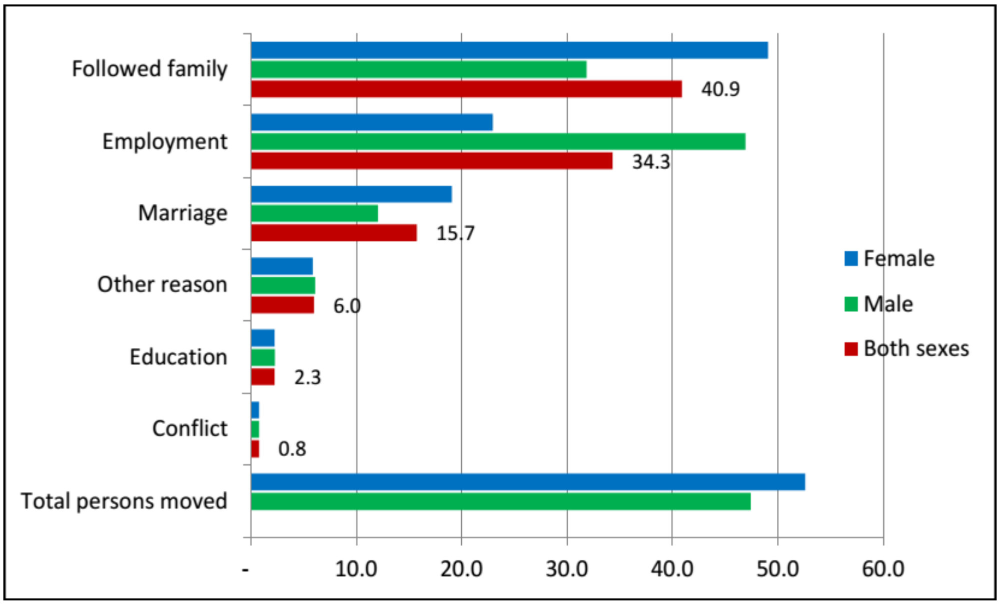
Chart 5-18: Source of labourers reported by respondents Block MOGE-3



The Census shows that 53 percent of all persons who moved from their previous place of usual residence within Myanmar were female. The main reason for movement for both sexes was "following family" and "employment/seeking employment." As shown in (**Chart 5-19**), females were more likely to follow family (49%) than males (32%); and males migrated more for reasons of employment (47%) than females (23%).

Information collected from households during the census shows that there are approximately 2 million former household members living outside of Myanmar. Of these, about 1.2 million are male, representing 61% of the total population reported to be living out of the country. About 70 % of those living outside Myanmar were reported to be living in Thailand, while 15% were in Malaysia. The census further shows that out of the approximately 2 million people reported to be living abroad, about 1.7 million are between the ages of 15 and 39 (83%) and up to 1.1 million in this age bracket are male.

Chart 5-19: Proportion of Migrants by Reason for Movement by Sex

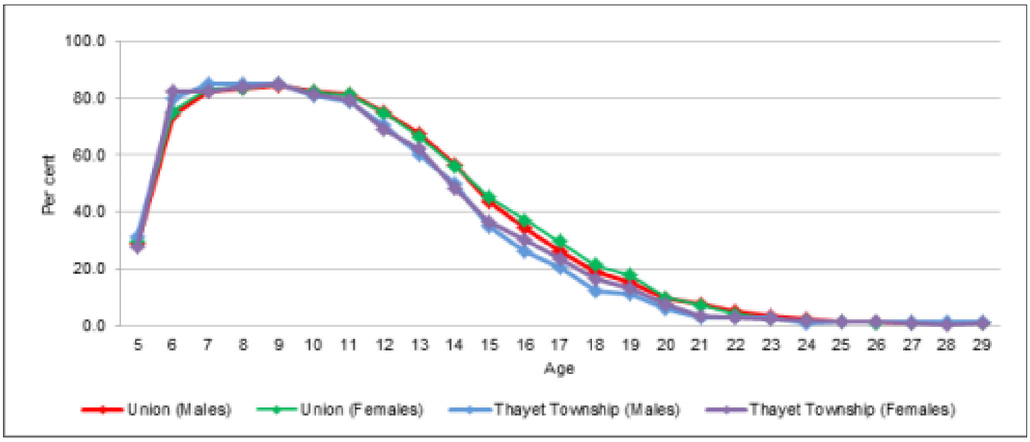


Source: The 2014 Myanmar Population and Housing Census

5.5.13.8 *Education*

The 2014 Census shows the official entry age for primary education in Myanmar is 5 years. Out of a population of 43,517,147 persons aged 5 years and over living in conventional households, 8,461,477 are currently attending school. Of those currently attending school 3.4 million. Comparing male and female school attendance, the proportion of males and females are similar up to the age of 15. After the age of 15, more males are at school than females. For school attendance in Thayet Township drops after age 11 for both males and females. Compared to the Union, the school attendance of both males and females in Thayet Township is lower than that of the Union after age 11 onwards. (**Chart 5-20**)

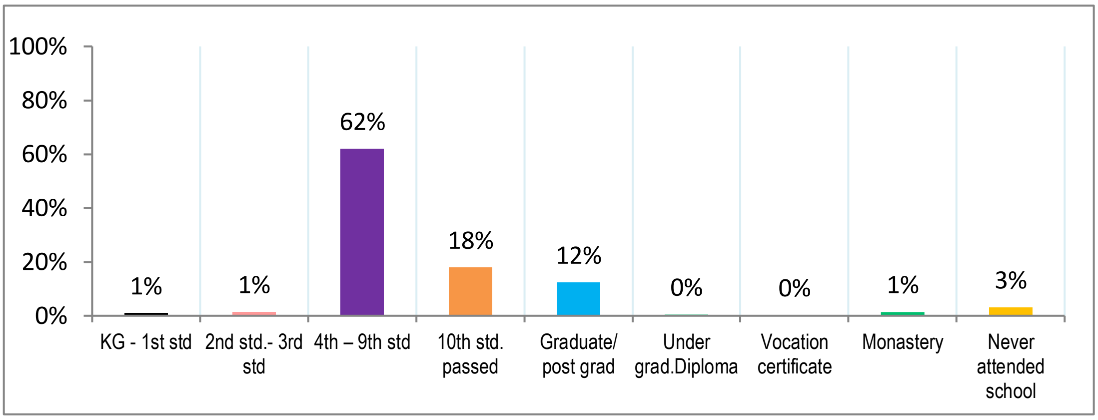
Chart 5-20: Availability of access to education reported in Thayet Township



Source: From the 2014 Myanmar Population and Housing Census

Over 62% of those surveyed had an educational level between Grade 4-9. (**Chart 5-21**)

Chart 5-21: Education level reported in Block MOGE-3



5.5.13.9 *Public Health*

The information on disability in the 2014 National Census included four categories (seeing, hearing, walking and remembering/mental) and the degree of difficulty a respondent experienced for each type. In the Thayet Township (4.2%) have at least one type of disability. The most common type of disability is seeing, followed by walking and hearing.[34]

In general villagers in Block MOGE-3 did not suffer from high incidence of serious health issues or disability. Health care services in most communities were very basic and in most cases involved a midwife only. Midwives also performed at least some basic dental services. Myanmar experienced 0.723 malaria cases per 1000 people in 2016 (HMIS, Dept. of Health Planning, Ministry of Health, 2016).

5.5.13.10 *Health Care*

The 2014 census collected information on births and deaths that showed that for every 1,000 children born in Myanmar, 62 die before reaching their first birthday. This rate is higher in rural areas (68) than in urban areas (41). The Ayeyawady Region has a rate of 89 deaths per 1,000 live births, which is the highest in the country. The Under-5 Mortality Rate for Magway Region is also the highest in the country at 108 deaths per 1,000 live births. The Union level Under-5 Mortality Rate is 72.[35] In 2013, in Magway Region the leading causes of mortality in the under-fives were “All other causes” (51%) “Heart failure” (5%), and “Pneumonia, organism unspecified” (5%).[36]

In 2013, the total numbers of Hospitals in Magway Region increased to 82. The closest government hospital to Block MOGE-3 is the Thayet Hospital with 100 sectioned beds and total available beds of 130.

The hospital resources in the region are shown in **Table 5-31**.

Table 5-31: Availability and Utilization of Hospital Resources in Magway, 2013

Total number of hospitals	Sanctioned beds	Available beds	Admissions	Number of deaths	Hospital death rate	Out-patient attendances
82	2673	2872	123880	1592	1.3	298125

Source: Annual Hospital Statistics Report, 2013

34 2014 MPHC Census
35 2014 MPHC Census
36 Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

5.5.13.11 *Sanitation*

The 2014 Census shows that in Thayet Township the main sources of drinking water are protected well/spring (30%), River/Stream/ Canal (25%) and other source drinking (15.6%). The main type of toilet facility in Thayet Township is improved pit latrine (water seal) at 89% of households surveyed. It is important to note that 11% of households in the Township reported that they do not have their own toilet facility. [37]

During IEM's comprehensive project socio economic, health and opinion surveys of approximately 412 households in 34 communities in Block MOGE-3, questions were asked in regard to water source, availability and quality. The main source of drinking water used by the household for the past 12 months comes from protected dug well/ pond/ spring/ rain water (43%), tube well (36%), unprotected dug well and river/stream (16%). (**Chart 5-22**)

In regard to water quality and quantity, most villagers (93%) indicated that water quality and quantity has remained the same. (**Chart 5-23** and **Chart 5-24**)

Chart 5-22: Trends in Drinking Water Coverage in Block MOGE-3

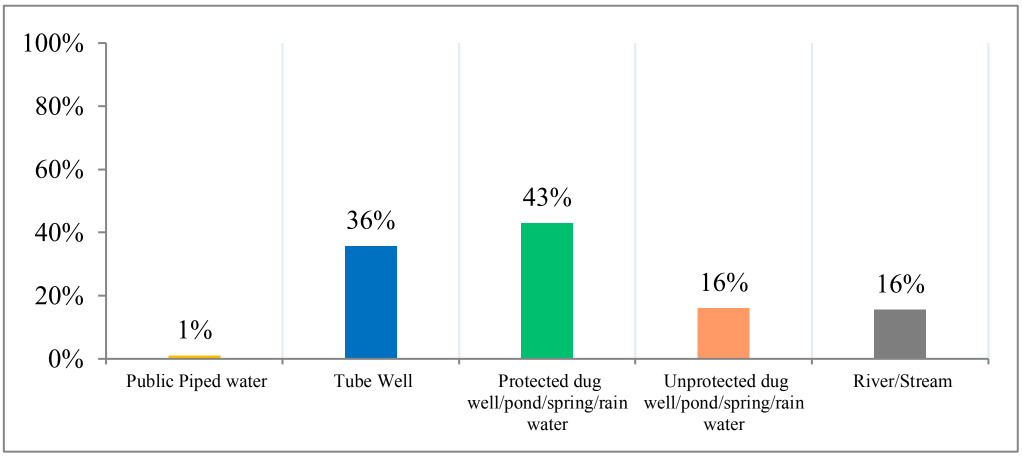
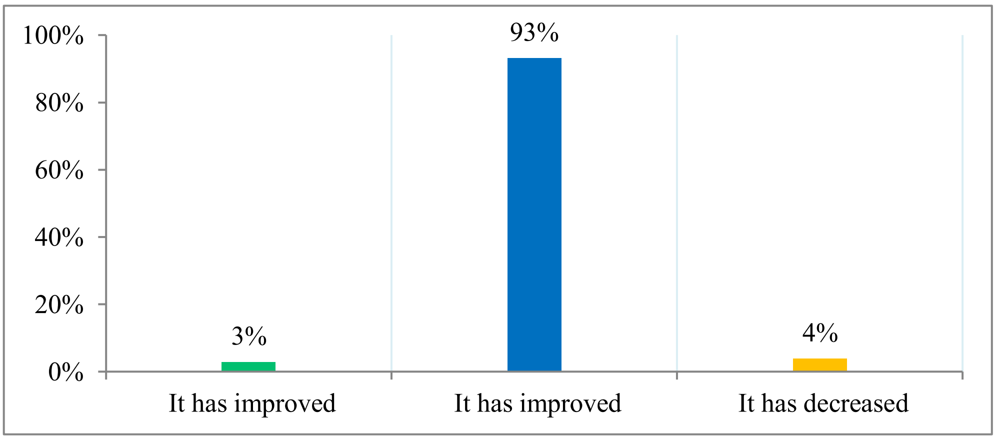
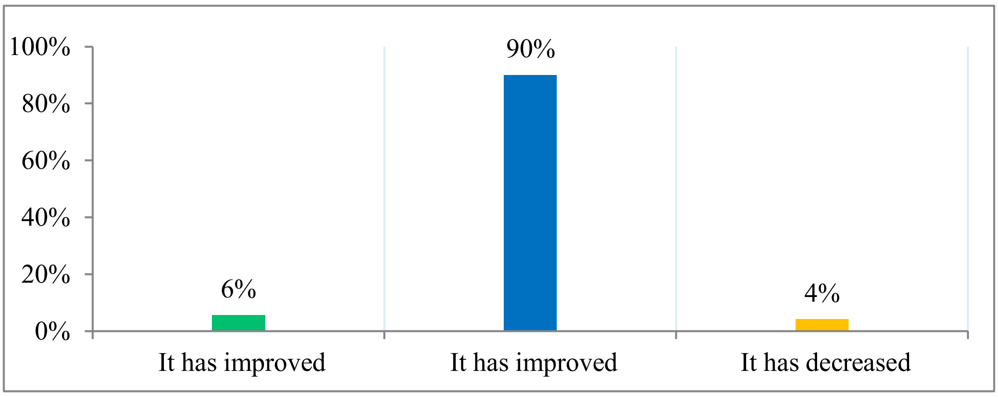


Chart 5-23: Responses for villagers in Block MOGE-3 to whether water quality had changed over time.



37 2014 MPHC Census.

Chart 5-24: Response of villagers to whether water quantity was perceived to have changed.



The survey group indicated that most (70%) had access to drinking water less than ¼ mile, 17% within ¼ mile and 13% had to go within 1 mile. (**Chart 5-25)** Water treatment was reported by 78% of respondents did not treat water before drinking only 22% of them treat water before drinking. (**Chart 5-26**) Which 79% of respondents boil their drinking water to make it safe while 12% use ceramic/sand filter and 9% let it stand (sedimentation). (**Chart 5-27**)

Chart 5-25: Response of villagers in Block MOGE-3 to the distance travelled to obtain drinking water.

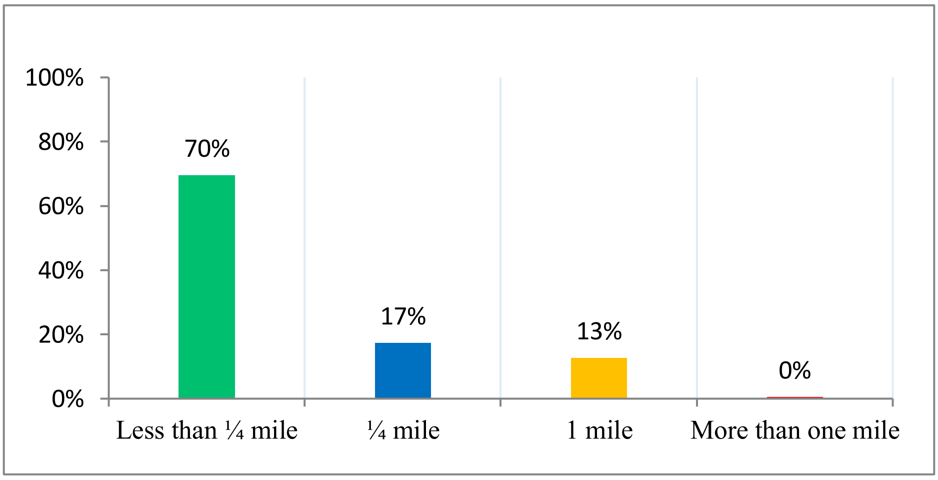


Chart 5-26: Response of villagers in Block MOGE-3 to whether their drinking water was treated.

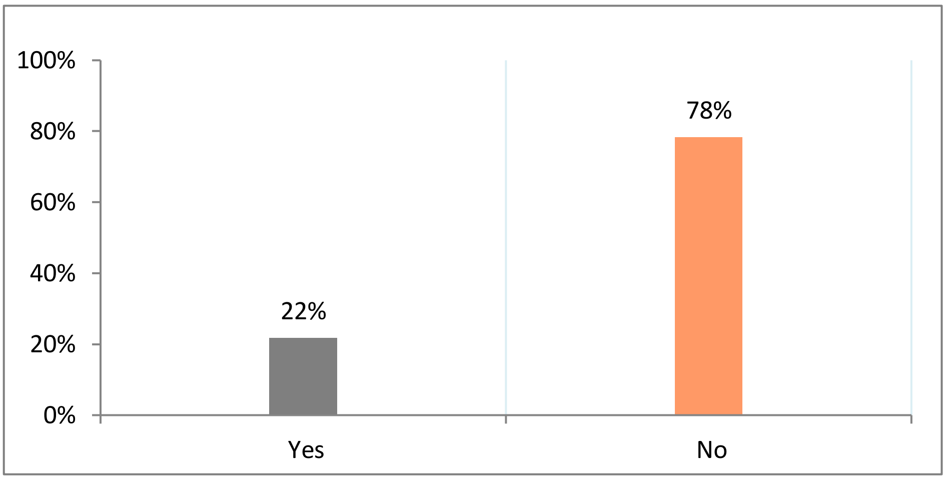
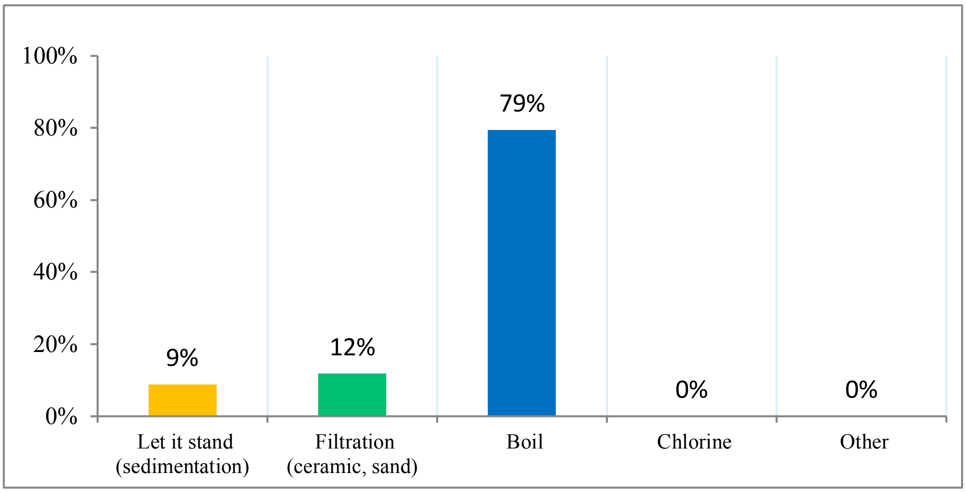


Chart 5-27: Response of villagers in Block MOGE-3-1in regard to how they treat their drinking water.



5.6 Cultural Components

5.6.1 Cultural Traditions and Historical, Archaeological Resources

The government and people of Myanmar place a very high degree of importance on their cultural traditions, religious and historic sites. Many active Buddhist sites are managed by trustees, sometimes with input from government authorities. Gazetted archaeological sites, such as Bagan, are managed by the Department of Archaeology, National Museum and Library, which is a division of the Ministry of Culture.

The ministry states in part that its mission is:

> "*to love and cherish the country and the people by taking pride in our traditions as well as by preserving, exposing and propagating Myanmar cultural heritage ... to help develop unity, nationalistic spirit and patriotism among the people.*"

The Archaeology Department employs conservators and engineers to maintain and repair buildings and their contents, as well as research officers, who conduct excavations. The following information on historical and archaeological sites was obtained from previous field surveys and literature search conducted by expert Myanmar historians.

In Yesagyo, the easternmost township of Magway Region, the wooden Pakhangyi monastery on brick foundations was constructed by King Mindon in 1886 and restored ion 1992. (Asterism, 2004) In 1992 the Pakhangyi Archaeological Museum was opened there. In 1996 Myanmar applied for World Heritage Site status for the site

Beikthano, situated in the irrigated Minbu region (near present-day Taungdwingyi) with direct land access to the well-watered Kyaukse plains to its northeast, is the oldest urban site so far discovered and scientifically excavated site. Remains include structures, pottery, artifacts, and human skeletons with dates from 200 BCE to 100 CE.

A pair of Buddha's Footprints are located in Settawya, a forest retreat 34 miles west of Minbu on the opposite bank of Magway, which is 331 miles from Yangon by road. The Footprints are well preserved and shrines were constructed nearby.

During the archeological and historic site assessment for the project area, the Township Administrator from Thayet GAD confirmed that there is no Archaeological or Historic Department in Thayet and no archaeological or historic sites are present in the Thayet Township. The well site is located on agricultural and secondary forest land and no historic or archaeological sites are located near the planned project. Although there is no Heritage area and Archaeological zone approved by government in block MOGE 3, some ancient pagodas which are in good condition and decayed stage could be found in many places within project area.[38]

During the field program for the present project local residents were canvassed in regard to their cultural activities and cultural sites. The most important cultural focus in the communities of those interviewed was local festivals (55%), temples/archaeology (35%) and custom (18%). (Chart 5-28) Villagers interviewed indicated that 70% of them know of the important cultural, historic and religious sites around their community and Villagers felt that local cultural, historic and religious sites are not adequately protected (52%). (**Chart 5-29** and **Chart 5-30**)

38 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

Chart 5-28: Response of villagers on their most important cultural tradition in Block MOGE-3

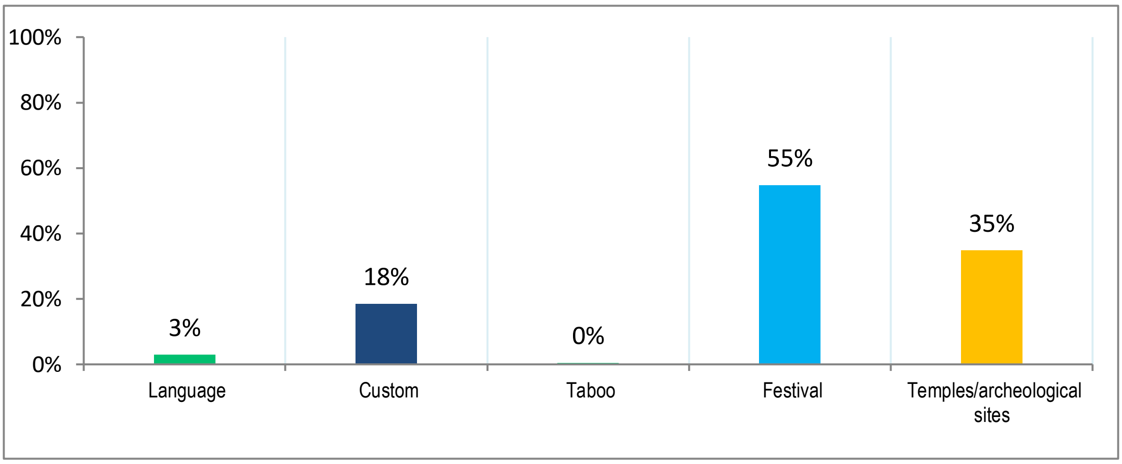


Chart 5-29: Awareness of proximate archaeological sites reported in Block MOGE-3

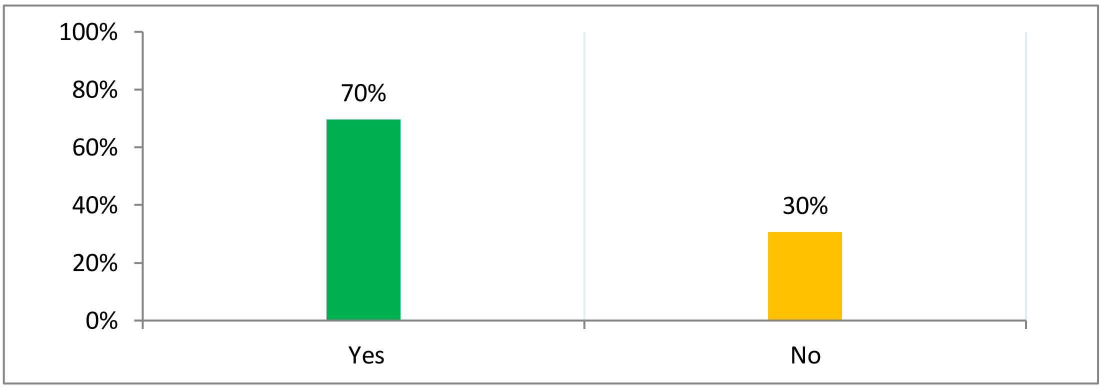
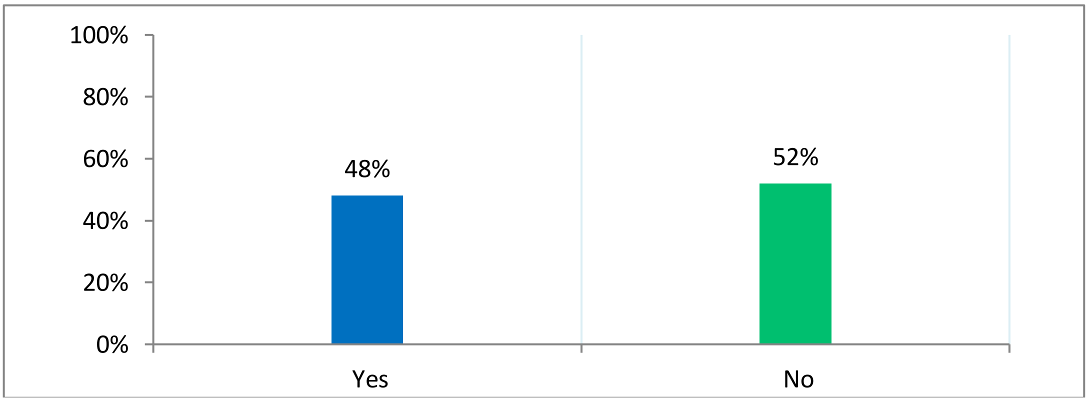


Chart 5-30: Perspectives on adequacy of protection of historic sites proximate to project area



5.6.2 Land Use Summaries

The REM, 2015[39] and MMRD, 2017[40] conducted land use surveys for the areas with information from the village tract administrator. A summary of key information is provided in the following section.

5.6.2.1 *Thayet District*

Thayet District is a district of the Magway Region of central Myanmar. The administrative center is the town of Thayet. The district has an area of 4750 square kilometers, On the west is the Rakhine Yoma range, and on the east the Bago Yoma and the face of the country, where it does not rise into mountains, is everywhere broken by low ranges of hills, many of which are barren and lack vegetation. The greater part of the district is wooded, and the mountains to the east and west are covered with forests. The chief river is the Ayarwady River, which traverses Thayet from north to south. The drainage finds its way to the Ayeyarwady River by three main streams on the west, and by two on the east. Thayet has several salt and hot springs; petroleum has been found (they were found unprofitable and abandoned), and extensive lime quarries exist a few miles south of the town of Thayet Town. The chief products are rice, cotton, oil-seeds and tobacco; cutch is also very abundant, as is the manufacture of dye-stuff. In addition to limestone, coal has been found in the district, and a few shallow oil wells are in use. There are 403 square kilometers of reserved forest. (REM, 2015)

5.6.2.2 *Thayet Township*

Thayet Township is situated in the middle part of Myanmar in Magway Region, Thayet District. Merely a few portion of the land is plain and the area is mostly covered by hills and valleys. Kanma has the area of 293,729 acre width, or 458.95 in square miles. Its location sits between N-19° 19.281’ and E-095° 11.000’. Thayet Township is bounded by Aunglan Township on the East, Mindon Township on the West, Kanma Township on the South and Min Hla and Sin Paung Wel Townships on the North.

The town is mostly Bamar and some Chinese who are Buddhists are living in 8 different wards of the town. Some other people in the town are Chin (A Sho) ethnic who are Christians, Indian who are Hindu and Muslims who believe in Islam religion. The seasonal festivals of the town are as follow; Paying Homage to the Aged and Thingyan festival in April, PathanaPali reciting festival at Shwe Yin Aye Pagoda, Kathina festival, (Dakkkhinawutt monastery) Light floating festival and Greasy pole climbing competition in November, Phaung Daw Oo pagoda and Pathana Pali reciting festivals in January, Robe offering festival in July, PathanaPali reciting and pagoda festivals at Zay Ward in February, July and August, Hindu fire walking festival is also celebrated in February. The township pagoda festival is celebrated at Thadda Htar Na Pagoda compound in northwest ward from the 8th Pyartho up to full moon day according to Myanmar calendar yearly. The township has 4,081 households.

There is no rural health care or sub-healthcare center in each ward of the town but there are three private clinics in town. A midwife from Pyi Daw Aye Ward take care of the maternal and child healthcare in the down. Locals with serious injuries and illnesses go to take treatment at Thayet, Station Hospital.

There are 10 primary schools, 1 sub-secondary school and 2 high schools.

Among 8 different wards in the town, the is no agricultural land in Shwe Bon Thar ward, Zay ward, Min Tel (North) ward and Northwest ward. There are 19 acres of paddy fields in Yone ward own by

39 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015
40 MMRD, 2017, Land User Survey & Field information from village tract administrator, February, 2017

correctional department and the yield crops are used only for departmental staff and prisoners, 11 acres of garden fields in Taung Min Te ward that are used to grow cabbage, salad and mustard. There also has 19 acres of Kai land but they cannot be used for plantations because of the flood from Irrawaddy River into that land. In Ah Nauk Yat Myauk Pie ward, there are 14 acres of paddy land own by correctional department and the 80 acres of farmlands in Ah Nauk Yat Taung Pie ward are used to grow onion and some portion of pigeon pea and chick pea for domestic use.

The typical crops in Thayet are Pigeon pea and chick pea are sold at wholesale market places in Northwest ward. Chrysanthemum (Gandamar flower), cabbage, mustard and salad from Min Tel (South) ward are sold within the wards or at Thayet Market.

The Perennial trees are trading in Zay ward and Min Tel (South) ward. The perennial crops include coconut palm, mango and Tamarind. Concerning the livestock, Chicken, pig, cow and goat are bred in a small scale. There is no livestock farming in Shwe Bon Thar ward, Zay ward and Myauk Min Te Ward.

In 2016, people from Yone ward and Pyi Daw Aye ward suffered from Irrawaddy flood and some houses along the river bank were destroyed. The Irrawaddy flood usually covers the south, east and west parts of Min Tel (South) ward, the south part of Lanmadaw and Strand roads, Than Kyoe Chan street, Pan Bel street, Lan Shay street, Chan Gyi Su portion, the east and west parts of Mee Thway Phote groups.

5.6.2.3 *Thayet Township, Koe Pin Village Tract, Koe Pin Village*

Koe Pin village is in the western part of Thayet Town and the area of the village is 13 acres. The village is on the plain area and it is between N19°20.517' and E095°10.454'. The inhabitants in Koe Pin village are Bamar and their religion is Buddhist. In Koe Pin village, the seasonal festival are 7-days meditation center during Thingyan water festival in April, lighting festival and Kahtina robe donation ceremony in November. The village has 134 households.

There is no health care center at Koe Pin village. The inhabitants in Koe Pin village go and take health care services at rural health center at Sin Tae village or take health care services at public district hospital or private hospital in Thayet Town.

There is only one primary school at Koe Pin village. There are 19 male and 19 female students. There are 1 male and 4 female teachers. The students who passed primary school attend middle school and high school in Thayet Town.

The following table describes the name of crops and acres of farm land in the village. The main crops grown in the village are paddy, chick pea, and green gram. Moreover, Lablab and pigeon pea are also grown for small scale for family consuming only. The main business is agriculture and there is no big industry in the village.

Table 5-32: Crop and Acres of Farm Land for Koe Pin Village

No	Type of crops	Total cultivation acre
1	Paddy (Manaw Thuka)	70
2	Chick pea	150
3	Pigeon pea	
4	Green gram	
5	Lablab bean	

Source: MMRD field information from village tract administrator in February, 2017

The village has some perennial mango trees. The mangoes grown in Koe Pin village were carried and sold at Thayet Town. There is one poultry farm of hens especially for eggs in the village. The eggs produced in the poultry farm was brought and sold at near-by villages and Thayet Town. Moreover, there are also small scale livestock of breeding pigs. The small scale livestock of breeding cows are especially to use at farms. The non-farm business in the village includes 4 grocery tores, 3 mills for beans / pulses, 5 brick kilns, 2 three-wheeled motorbikes and 1 Middleman in trading of Cows.

The significant physical infrastructures includes A Lin Yaung Library, Ooredoo telephone tower and a cemetery

5.6.2.4 *Thayet Township, Koe Pin Village Tract, Mon Za Li Village*

Mon Za Li village is in the North-West of Thayet Town and the area of the village is 10 acres. The village is on the plain area and it is between N19°21.300' and E095°10.345'. The inhabitants in Mon Za Li village are Bamar and their religion is Buddhist. In Mon Za Li village, the seasonal festival are 7-days meditation center during Thingyan water festival in April, lighting festival and Kahtina robe donation ceremony in November. The village has 83 households.

There is no health care center at Mon Za Li village. However, the inhabitants in Mon Za Li village go and take health care services at rural health center at Sin Tae village in Ma Din village tract or take health care services at public district hospital or private hospital at Thayet Town.

There is only one primary school at Mon Za Li village. There are 7 male and 18 female students. There 5 female teachers at the school.

The following table describes the name of crops and acres of farm land in the village. The main crops grown in the village are paddy, chick pea, and green gram. Moreover, Lablab and pigeon pea is also grown small scale for family consuming only. Total cultivated area of paddy land (low land) is 98 acres and the area of farmland/upland (chick pea/ green gram and lablab bean) is 130 acres.

Table 5-33: Crop and Acres of Farm Land for Mon Za Li Village

No	Type of crops	Total cultivation acre
1	Paddy(Manaw Thuka)	98
2	Green gram	130
3	Lablab bean	
4	Chick pea	

Source: MMRD field information from village tract administrator in February, 2017

The perennial trees in the village include tamarind. The middleman in Htone Taung village come and buy the tamarind crops in Mon Za Li village.

Concerning the livestock, there is one goat farm in the Mon Za Lin village and there were 30 goats. The middlemen in Thayet Town come and buy the goats in Mon Za Li village. There are also small scale livestock of breeding pigs. The small scale livestock of breeding cows are especially to use at farms. The main business is agriculture and there is no big industry in the village. The non-farm business in the village includes 2 grocery stores, 2 mills for beans / pulses, and 2 Three-wheeled Motorbike.

The physical infrastructure includes the Lu Ngal Arr Mhan Library, Monastery(Mon Za Li), Shwe Bone Pwint pagoda, a cemetery and Wat Thoe Dam.

Figure 5-45: Mon Za Li Monastery, Mon Za Li village

5.6.2.5 *Thayet Township, San Aint Village Tract, Oke Hpo Village*

The village is in the North East part of Thayet Town which is 4 miles far away from the village. The area of the village is 60 acres. The village is on the plain area and it is between N19°35.487' and E094°59.658'. There is Ayeyarwaddy River in the eastern part of the village and Nga-Law-Ka stream in the western part of the village. The Nga-Law-Ka stream flows into the Ayeyarwaddy River. The inhabitants in village are Bamar and their religion is Buddhist. In Oke Hpo village, there is Zar Li Taung pagoda festival in January and Padamyar Taung pagoda festival in March. Moreover, there are Thingyan water festival in April, lighting festival and Kahtina robe donation ceremony in November. The village has 205 households.

There is auxiliary midwife in the village. Moreover, another midwife from Sin Tae village visit and provide health care services at Oke Hpo village. There is no health care center in the village and thus the inhabitants in Oke Hpo village go and take health care services at Thayet and Aunglan Town.

There is only one sub middle school at Oke Hpo village. There are 71 male and 67 female students. There are 4 male and 7 female teachers. The students who passed middle school attend high school in Aunglan Town.

The following table describes the name of crops and acres of farm land in the village. There are 55 acres of farmland (paddy filed) and 140 acres of Chick Pea and 40 acres of onion. Although there is orchard land in the village, no trees are grown yet.

Table 5-34: Crop and Acres of Farm Land for Oke Hpo Village

No	Type of crops	Total cultivation acre
1	Paddy	55
2	Chick pea	140
3	Onion	40

Source: MMRD field information from village tract administrator in February, 2017

The perennial trees in the village are tamarind. There was flood in July, 2016 in the village and the flood destroyed other perennial trees in the village. The ripe tamarind are brought by boat to Aunglan Town and sold there.

Concerning the livestock, there is no livestock business in the village.

The non-farm business in the village include 10 grocery stores, three-wheeled motorbike and multiple big and small boats with engines.

The area has three monastery (Ta Khon Tai Su Chapel, Site Pyoe Yae Su Chapel, Oak Hpo Su Chapel), three pagoda (Pa Ta Myar, Mya Khal Taung, Aung Myay) and the Oak Hpo Cemetery.

There was flood in Oke Hpo village in July, 2016. The flooded area is far east of Saik-Pyo-Yay-Su and far west of Ta-Gu-Taing Su and the whole area Oke-Pho Su.

Figure 5-46: Aung Myay pagoda, Oke Hpo village

5.6.2.6 *Thayet Township, Moe Nat Kone Villge Tract, Ta Loke Pin Village*

Ta Loke Pin Village of Moe Nat Kone Village Tract is situated at the west of Thayet and the area of the village is (3) acres. It is on plain between (N-19 32.869') and E-095 59.725'). The residents of the village are Bamar and Buddhists. The seasonal festivals of the village are Kahtein Ceremony held in November, Lighting Festival held in October and Thingyan held in April. There is no other ceremony in the village. The village has 90 households.

There is a mid-wife from Baw Village in the village. Persons who are hurt or suffer serious diseases go to the hospital of Thayet District that is about (25) miles far from the village. The village has one primary school which is attended by the children of Ta Zee Kauk (West). Middle and high school students attend the high school in Baw Village.

The following table describes the name of crops and acres of farm land in the village. Major crops of the village are sesame, pigeon pea and lablab bean. Paddy is only grown for home consumption.

Table 5-35: Crop and Acres of Farm Land for Ta Loke Pin Village

<table>
<tr><th>No</th><th>Name of Crop</th><th>Total Acre</th></tr>
<tr><td>1</td><td>Paddy</td><td>142</td></tr>
<tr><td>2</td><td>Sesame</td><td rowspan="3">198</td></tr>
<tr><td>3</td><td>Pigeon Pea</td></tr>
<tr><td>4</td><td>Lablab bean</td></tr>
</table>

Source: MMRD field information from village tract administrator in February, 2017

Long term trees of the village are a few tamarind and mango but those are not sold. Concerning the livestock, chicken and pigs are bred in small scale. Being a small village, there are a few snack shops so necessary commodities are bought from Baw Village and Thayet.

The physical infrastructures include 1 monastery and 1 cemetery

Figure 5-47: Ta Loke Pin monastery, Ta Loke Pin village

5.6.2.7 *Thayet Township, Moe Nat Kone Village Tract, Ta See Kauk (East) Village*

Ta See Kauk (East) Village of Moe Nat Kone Village Tract is situated at the northwest of Thayet and the area of the village is (3) acres. It is on plain between (N-19 35.374') and E-095 18.905'). The Residents of the village are Bamar and Buddhists. The seasonal festivals of the village are Kahtein Ceremony held in November, Lighting Festival held in October, Thingyan held in April. There is no other event in the village. The village has 74 households.

In the village, there is a mid-wife from Baw Village. Persons who are hurt or suffer serious diseases go to the hospital of Thayet District that is about (25) miles far from the village.

As Ta See Kauk (East) Village has no school, children have to attend the primary school of Ta See Kauk (West). Middle and high school students have to attend the high school of Baw Village.

The following table describes the name of crops and acres of farm land in the village. Major crops of the village are sesame, pigeon pea and Lablab bean but paddy is grown a little.

Table 5-36: Crop and Acres of Farm Land for Ta See Kauk (East) Village

No	Name of Crop	Total Acre
1	Paddy	63
2	Sesame	121
3	Pigeon Pea	
4	Lablab bean	

Source: MMRD field information from village tract administrator in February, 2017

Long term trees of the village are a few tamarind and mango so those are not sold. Concerning the livestock, cows (for Dairy and Farming) are bred in commercial scale but chicken and pigs are bred in small scale. Being a small village, it has a few snack shops. Necessary stuff is bought from Baw Village and Thayet. The village has 1 cemetery

5.6.2.8 *Thayet Township, Moe Nat Kone Village Tract, Ta See Kauk (West) Village*

Ta see Kauk (West) village is in the North-West of Thayet Town and the area of the village is 2 acres. The village is on the plain area and it is between N19°32.686' and E095°00.043'**.** The inhabitants in Ta See Kauk (West) village are Bamar and their religion is Buddhist. In Ta See Kauk (West) village, the seasonal festival are lighting festival and Kahtina robe donation ceremony in November. The village has 25 households.

The midwife from Baw village provides health care services in Ta See Kauk (West) village. There is no any health care center in the village and therefore the inhabitants in the village go and take health care services at Public District Hospital in Thayet Town which is 25 miles far away from Ta See Kauk (West) village.

There is only one primary school at Ta See Kauk village. There are 12 male and 21 female students. There 2 male and 4 female teachers at the school.

The following table describes the name of crops and acres of farm land in the village. The main crops grown in the village are paddy, pigeon pea, Lablab bean and sesame (red). Total cultivated area of paddy land (low land) is 24 acres and the area of farmland/upland (pigeon pea/ lablab bean and sesame (red))is 42 acres. Pigeon pea, lablab bean and sesame (red) are the main crops in the village. The farmers grow paddy for household consumption only.

Table 5-37: Crop and Acres of Farm Land for Ta See Kauk (West) Village

No	Type of crops	Total cultivation acre
1	Paddy	24
2	Pigeon pea	42
3	Lablab bean	
4	Sesame(red)	

Source: MMRD field information from village tract administrator in February, 2017

There were just a few mango and tamarind trees in Ta See Kauk village and the villagers do grown and sell the products of perennial trees for commercial scale. The non-farm business in the village includes a snack shop and a motorbike repair shop. There are just a few households in Ta See Kauk (West) village and therefore there are no big shops or other non-farm business. However, the inhabitants in Ta See Kauk (West) go and buy their necessary accessories at Baw village or Thayet Town. The Ta See Kauk village has 1 monetary and 1 cemetery in the village area.

Figure 5-48:Ta See Kauk monastery, Ta See Kauk village

5.6.2.9 *Thayet Township, Yae Myet Village Tract, Yae Myet Village*

Yae Myet village is in the West of Thayet Town and the area of the village is 16 acres. The village is on the plain area and it is between N19°21.154' and E094°00.309'. Yae Myet village is 14 miles far away from Thayet Town. The inhabitants in Mon Za Li village are Bamar and their religion is Buddhist. In Yae Myet village, the seasonal festival novice ceremony and the competition of cooking stick rice in traditional way in group during Thingyan water festival in April, lighting festival and Kahtina robe donation ceremony in November. The village has 107 households.

There is only auxiliary midwife who provides health care services in the village. There is no any health care center in Yae Myet village and therefore, the inhabitants who suffer sever illness or accident go and take health care services at Public Station Hospital (16 bedded) at Ta La Par village or Public District Hospital in Thayet Town.

There is only one primary school at Yae Myet village. There are 19 male and 26 female students. There 1 male and 5 female teachers at the school. The students who passed primary school attend middle school and high school at Ta La Par village. Only the children from rich family can go and attend middle school and high school in Thayet Town.

The following table describes the name of crops and acres of farm land in the village. The main crops grown in the village are paddy (Ma Naw Thukha), sesame, green gram, black gram, and pigeon pea, chickpea, groundnut and lablab bean. Total cultivated area of paddy land (low land) is 81 acres and the area sesame/green gram/ pigeon pea/ black gram is 80 acres. Moreover, the cultivated area of chick pea, groundnut and lablab bean is 80 acres. However, the farmers grown paddy for household consumption only. They mainly grow beans and pulses and sesame for commercial scale.

Table 5-38: Crop and Acres of Farm Land for Yae Myet Village

No	Type of crops	Total cultivation acre
1	Paddy(Ma Naw Thukha)	81
2	Sesame	80
3	Green gram	
4	Pigeon pea	
5	Black gram	
6	Groundnut	
7	Lablab bean	
8	Chick pea	

Source: MMRD field information from village tract administrator in February, 2017

The average yield of mango is 400 fruit per tree and MMK 100 per fruit. The average yield of tamarind is 20 viss per tree and the price is MMK 20,000/ 30,000 for all tamarind of a tree per season. The inhabitants in Yae Myet village sell their perennial crops in their village. Concerning the livestock, there is no livestock breeding business in the village. The non-farm business in the village include 6 grocery stores, 1 tea house and 2 motorbike workshops

The Yea Myet village has 1 monetary and 1 commentary and 1 pagoda in the village area

5.7 Visual Components

5.7.1 Tourist Attractions and Recreational Area

In the Magway region compared with Mandalay Region on the eastern shore of the Ayeyarwady River, tourism plays a much lesser role in the local economy. Although pagodas, monasteries, museums and pilgrimage destinations (Buddha footprints) attract some internal visitors, international tourists rarely visit the Region.[41] The Thayet Township is not a popular Tourist or Recreational Area. In Myanmar, tourism is a relatively recent and developing sector, but the number of visitors is increasing yearly, and the government has been encouraging tourism. The total number of tourists arriving in Myanmar during 2015-2017 is shown in **Table 5-39**.

In the 2016-2017 fiscal years, 3,079,272 tourists visited Myanmar.

Table 5-39: Number of International Tourist Arrivals in Myanmar, 2015-2017

Year	Tourists			
	Total	by Air	by Sea	by Land
2015-2016	4,722,045	1,244,192	315,700	3,162,153
2016-2017	3,079,272	1,254,536	350,253	1,474,483

Source: Central Statistical Organization, Ministry of National Planning and Economic Development, http://www.csostat.gov.mm/

Magway Mya Thalun Pagoda and Minbu Shwesettaw are famous destinations of Magway Region. The latpanphyu, a very rare white silk cotton tree, has been sighted in Outo village in Yesagyo Township in Magway Region, and has become a tourist attraction, with people coming to see it regularly. Thayet Township has a golf course that was established by the British in 1887 and an old war fort.

There are no tourist attractions of note in Block MOGE-3.

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6. IMPACT AND RISK ASSESSMENT & MITIGATION MEASURES

6.1 Impact and Risk Assessment Methodology

An Environmental Impact Assessment (EIA) seeks to identify and, to the extent possible, quantify the potential negative impacts and positive benefits of a proposed project with respect to the environment (physical, ecological, human use, quality of life, and health values). Once these impacts have been identified, prevention, mitigation, and monitoring measures are proposed to prevent and/or mitigate possible negative impacts, and enhance positive impacts. An Environmental, Social, and Health Impact Assessment process incorporates a number of key steps as shown in **Figure 6-1** and discussed in detail in the following sections:

- Exploration Drilling Project – **Chapter 4**
- Environmental, Social and Health Setting – **Chapter 5**
- Stakeholder Involvement – **Chapter 9**
- Screening and Scoping – **Chapter 6**
- ESH Impact Assessment – **Chapter 6**
- Prevention & Mitigation Measures – **Chapter 6**
- Environmental, Social and Health Management Plan – **Chapter 8**

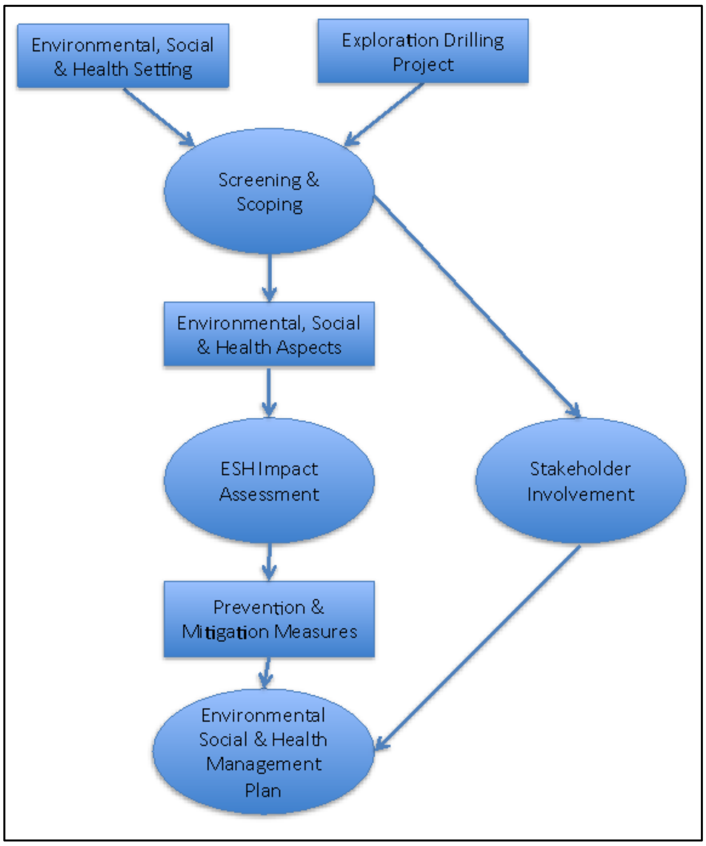


Figure 6-1: Method for Environmental, Social, and Health Impact Assessment

The assessment approach is risk-based, with the objective to make a conclusion on the level of risk development activities will pose to environmental, socio-economic and health receptors. This section describes the impact assessment process undertaken to evaluate the level of risk to environmental, socio-economic and health receptors from activities associated with the planned exploration drilling program. This description provides an account of the identification of potential impacts and benefits and the evaluation of their significance (scale of Risk Ranking). The EIA methodology applied is modified from Adapted from Nigel Rossouw (2003); Sippe (1999); and United Nations University (2007).

Activities associated with exploration drilling program are assessed to systematically identify potential impacts and the associated level of risk. This process assists in prioritising the development of management measures to achieve an overall acceptable level of risk.

Environmental Impact Assessment Terminology

Defining Impacts

Direct (or primary) – impact that results from a direct interaction between some feature of a planned action and the receiving environment (e.g. between an effluent discharge and receiving water quality)

Secondary – impact that follows on from the primary interactions between the project and its environment as a result of subsequent interactions within the environment (e.g. loss of part of a habitat affects the viability of a species population over a wider area)

Indirect – impact that result from other developments or activities that are encouraged to happen as a consequence of the original development (e.g. a new development stimulates a requirement for improved road access).

Cumulative – impacts that act together to affect the same environmental resource or receptor. Several types can be identified:

i. **Temporal**: a series of impacts that occur year in year out, that in themselves are not important, build up to the point that they become important.

ii. **Accumulative**: the overall effect of different types of impact (e.g. air pollution + noise + traffic + visual blight) on a single receptor (e.g. a community or a habitat) where each singly may not be important but combined they are.

iii. **Additive**: where impact from the planned activity occurs at the same time as impact from activities being undertaken by other parties (these may be already occurring, committed developments for the future or developments that may happen in the foreseeable future).

iv. **Interactive**: where two different types of impact (which may not in themselves be important) react with each other to create a new impact (that might be important).

v. **Synergistic**: where two impacts interact together (e.g. changes in air quality with respect to two different pollutants) to create an impact that is greater than the sum of their parts.

Permanent: Impact that occurs once in the development of a project and causes a permanent change in the affected receptor or resource (e.g. the felling of old growth forest as a result of occupation of a site, the diversion of a watercourse).

Short-term: impact that is predicted to last only for a limited period (e.g. during construction, seismic studies, drilling or decommissioning) but will cease on completion of the activity, or as a result of mitigation/ reinstatement measures and natural recovery.

Long-term: impact that will continue over an extended period (e.g. noise from operation of a development, impact from operational discharges or emissions). This includes impact that may be intermittent or repeated rather than continuous over an extended time period (e.g. repeated seasonal disturbance of species as a result of well operations, impact results from annual maintenance activities).

Non-normal Impact: impact that result from unplanned events – incidents – within the project (e.g. breakdowns, failures) or in the external environment affecting the project (e.g. flood, seismic activity, landslip). In these cases the assessment should take into account of the probability of the event.

Local: impact that affects locally important environmental resources or a single habitat/biotype.

Regional: impact that affects regionally important environmental resources or is felt at a regional scale as determined by administrative boundaries, habitat type.

National: impact that affects nationally important environmental resources or affects an area that is nationally important or protected.

International: impact that affects internationally important environmental resources such as areas protected by International Conventions.

Trans-boundary: impact that is experienced in one country as a result of activities in another.

Source of impact – as an interaction between the proposed activity and an Environment, Social or Health component

Negative impact – negative change from the existing situation due to the above interaction

Benefit – any positive change from the existing situation due to the above interaction

Mitigation – the actions undertaken by Project Proponent to maximize benefits and to minimize any potential negative impact.

Activity - Work associated with the Development during construction, commissioning, operation and decommissioning. For exampling: drilling, road construction

Aspect - Associated with each activity are a number of aspects (or stressors). These are components of an activity that may have a potential to impact on the biological, socio-economic or cultural environment. For example: emissions, waste, noise.

Significance/Risk Ranking - The level of impact associated with an aspect.

Likelihood - The probability or frequency of an environmental impact actually occurring.

Residual significance/risk level - The level of significance/risk after the application of preventative and mitigation measures.

Risk - The chance of something happening that will have an impact on objectives.

6.1.1 Screening

Screening of issues is an important first step in an EIA. The purpose of the screening step is to review all proposed project activities in order to identify potential environmental, social and health issues.

This screening step enables the detailed impact assessment component of this EIA to focus on the key issues that are relevant to people and the environment.

In this report, a matrix checklist was used to screen key issues of environmental, social and health impacts both in a normal situation for each project phase (preparation phase before drilling phase, drilling phase and well abandonment phase) and emergency situation for unplanned events.

6.1.1.1 Screening Methodology

In order to ensure a systematic evaluation of project activities and their possible impact on the environment, a thorough listing of project activities and environmental, social and health elements was obtained by the following means:

- ✓ Consultations with the PTTEP SA planning the project activity;
- ✓ Applying International guidelines for onshore oil and gas exploration;
- ✓ Applying International guidelines for health impact assessment;
- ✓ Applying the World Bank checklist for onshore oil and gas development;
- ✓ IFC Environmental, Health, and Safety General Guidelines (2007);
- ✓ IFC Performance Standards on Environmental and social Sustainability (2012); and
- ✓ IEM's experience with similar projects.

Each of the activities carried out during the phases of the project was screened against each resource value, to determine if any impact may occur and therefore requires a more detailed assessment of impact.

6.1.2 Scoping of Environmental, Social, and Health Impacts

The Scoping of the proposed project:

- defines the study area, area of influence, time boundaries, project phases, and potential stakeholders;
- starts the process of understanding the applicable regulations and standards, and their context for Project design and completion of the EIA;
- makes a provisional identification of Environmental Impacts, focusing in particular on the environmental, social and health issues that need to be addressed in subsequent EIA studies;
- provides an indication of the depth and breadth of the subsequent EIA investigations including what baseline data and information are required, what further studies and investigations must be carried out, and how such data collection, studies and investigations shall be undertaken;
- provides an opportunity for consultants, relevant authorities, project developers, and interested and affected parties to express their views and concerns regarding the proposal before an EIA proceeds; and
- identifies potentially affected communities and other stakeholders with an interest in the Project.

6.1.3 Environmental Impact Assessment

6.1.3.1 Assessment of Potential Environmental and Social Impacts

The impacts that result from routine (planned) activities are assessed, as are those that could result from credible accidental or unplanned events within the project scope (e.g. a fuel spill) or in the environment affecting the project.

The approach to assess the significance of potential impacts is discussed briefly below.

Assessment of the level of impact significance requires consideration of the impact level (i.e. magnitude of the environmental effect, its geographical scale and duration) in relation to the receptor sensitivity (i.e. the key receptors and resources considered).

The overall significance is presented through a matrix of sensitivity of the **Receptor Sensitivity** and the **Impact Level**, as shown in **Table 6-1**.

Table 6-1: Significance Matrix for Environmental Impacts

Receptor Sensitivity	Impact Level		
	Low	Medium	High
Low value/sensitivity receptor or resource, impact disturbs degraded area or slightly disturbs area with value for conservation, causes small changes in species and diversity, within standards, small local change in human use and quality of life values over a short-term duration, reversible over short-term.	Negligible	Low	Medium
Medium value/sensitivity receptor or resource, Impact disturbs an area that has a value for conservation or causes change in species diversity. Impact important on a local or regional level, within standards, moderate change in human use and quality of life values at moderate level over a long-term duration, reversible over medium-term.	Low	Medium	High
High value/sensitivity receptor or resource, rare or endangered species or habitat impacted on a national or international level, exceeding standards, large permanent change in human use and quality of life values at a regional level, long-term or no reversible.	Medium	High	High

The impact assessment is based on four categories of impact significance level, as described in **Table 6-2**. These inform the level of mitigation that is considered appropriate to be applied for a given impact.

Table 6-2: Categories of Impact Significance

Significance Level	Definition
High	Impact is classified as high and can cause numerous effects. Major impacts affect an entire population or species in sufficient magnitude to cause a decline in abundance and /or change in distribution. Large permanent change in human use and quality of life values at a regional and national level. Fatality from an accident or occupational illness. Impacts cannot be managed or resolved by any mitigation measures.
Medium	Impact may result in changes that affect the value of resources and environment. Moderate impacts affect a portion of a population and may bring about a change in abundance and / or distribution but does not threaten integrity of population. Impact may affect moderate change in human use and quality of life values at a local and regional level over a long-term duration. Major injury or health effects (including Permanent Partial Disability). Mitigation measures are required to manage or reduce the potential impacts and monitoring measures are required to determine effectiveness of mitigation measures.
Low	Impact may result in changes in resources and environment but this change does not decrease value of these resources and environment. Minor impacts affect individuals within a population over a short period of time. Local change in human use and quality of life values over a short-term duration. Minor injury or health effects (Lost Time Injury). Impact can be managed and resolved by implementation of general mitigation measures.
Negligible	Impact has no effect.

Source: Adapted from Rossouw (2003) and Sippe (1999).

The degree of significance (categories as defined in **Table 6-2**) depends upon the level (i.e. magnitude, extent and duration) of impacts and the sensitivity of the resource value that they may impact. The criteria used to inform the significance ranking of impacts on a qualitative basis, are provided in **Table 6-3**.

Table 6-3: Criteria used to determine Impact Significance

Criteria	Score	Detail
Extent	3 2 1	• **High –** Are of impact is beyond 5 km and impact extends to regional and national level. • **Medium -** Area of impact is beyond the project area but is in a limited area of 1 - 5 km. • **Low -** Area of impact is in the project area within a radius of 1 km.
Duration	3 2 1	• **Long Term** - Permanent impact**,** Impact will remain after well abandonment. Impact occurs in long-term duration (> 5 yr.). • **Medium** - Impact can be reversible overtime (1 – 5 yr.), period of impact occurrence is within the project period, Impact occurs over mid-term duration (1 – 5 yr.). • **Short term** - Impact can be quickly reversible (< 1 yr.), Period of impact occurrence is less than the project period, Impact occurs in short-term duration (< 1 yr.).
Magnitude	3 2 1	• **High –** Exceeds regulatory standards, changes the original structure of the environmental or social system or ecosystem. • **Medium –** Within regulatory standards, but changes some factors in the environmental or social system or ecosystem but does not change the structure. • **Low –** Within regulatory standards, with small changes in some factors for the environmental or social system or ecosystem but does not change the structure. • **Negligible –** no detectable impact on the environment or socio economic conditions. • **Positive –** Impact has a positive effect on the environment or socio economic conditions.
Receptor Sensitivity	3 2 1	• **High** – High value/sensitivity receptor or resource, rare or endangered species or habitat impacted on a national or international level, exceeding standards, large permanent change in human use and quality of life values at a regional level, long-term or no reversible. • **Medium** – Medium value/sensitivity receptor or resource, Impact disturbs an area that has a value for conservation or causes change in species diversity. Impact important on a local or regional level, within standards, moderate change in human use and quality of life values at moderate level over a long-term duration, reversible over medium-term. • **Low** – Low value/sensitivity receptor or resource, impact disturbs degraded area or slightly disturbs area with value for conservation, causes small changes in species and diversity, within standards, small local change in human use and quality of life values over a short-term duration, reversible over short-term.. • **Negligible** – no detectable sensitivity.

Source: Adapted from Nigel Rossouw (2003); Sippe (1999); and United Nations University (2007)

The above Matrix Method is used to consider the Impact Level and Receptor Sensitivity as follows:

Significance = Impact Level x Receptor Sensitivity

Note: Impact Level is determined using magnitude, extent, and duration of impacts. Receptor Sensitivity is determined using the values of resources and environment that are lost or decreased as a result of the project activities.

Stage 1: Analysis of Impact Level

Analysis of impact level is determined using the sum of magnitude, extent, and duration of the impact.

Impact Level = Magnitude + Extent + Duration

Total Score for Impact Level	Impact Level	Score
7-9	High	3
4-6	Medium	2
1-3	Low	1

Stage 2: Receptor Sensitivity Ranking

Impact Level	Score
High	3
Medium	2
Low	1

Stage 3: Impact Significance Evaluation

Significance Level of Environmental Impact			Impact Level		
			Low	Medium	High
			1	2	3
Receptor Sensitivity	Low	1	Negligible (1)	Low (2)	Low (3)
	Medium	2	Low (2)	Medium (4)	Medium (6)
	High	3	Low (3)	Medium (6)	High (9)

6.1.4 Identification of Management Measures

The first priority of environmental management is always to **prevent adverse impacts**, thereafter management measures with other objectives are considered. Environmental management measures can be varied and the measures themselves can have a variety of objectives.

World Bank guidelines for a best practice approach to the management of environmental and social impacts are presented in **Table 6-4**. Many of the recommendations set out in the design component are designed to meet the criterion for 'avoidance'.

Table 6-4: Primary objectives of mitigation measures for adverse environmental impacts.

First priority is avoidance of negative impacts; the objectives are listed in decreasing order of priority

Avoidance	▪ Avoiding activities that could result in adverse impacts. ▪ Avoiding resources or areas considered as sensitive.
Prevention	▪ Preventing the occurrence of negative environmental impacts and / or preventing such an occurrence having negative environmental impacts.
Preservation	▪ Preventing any future actions that might adversely affect an environmental resource. Typically achieved by extending legal protection to selected resources beyond the immediate needs of the project.
Minimisation	▪ Limiting or reducing the degree, extent, magnitude or duration of adverse impacts. This can be achieved by scaling down, relocating, redesigning elements of a project.
Rehabilitation	▪ Repairing or enhancing affected resources, such as natural habitats or water sources, particularly when previous development has resulted in significant resource degradation.
Restoration	▪ Restoring affected resources to an earlier (and possibly more stable and productive) state, typically 'background / pristine' condition.
Compensation	▪ Creation, enhancement or protection of the same type of resource at another suitable and acceptable location, compensating for lost resources.

Source: The World Bank. Environment Department. January 1999. Environmental Management Plans. Environmental Sourcebook Update. Number 25

For activities where the risk level is higher than low, management measures are required to prevent or mitigate the risk to an acceptable level. Prevention measures are put in place to prevent a hazard or event from occurring such as avoidance or reduction at source and pollution control equipment. Mitigation measures are put in place to prevent or minimise the actual impact. This can include spill response plans, monitoring and offsets.

Measures to prevent or mitigate (reduce) the severity of potentially significant impacts will be developed and linked back to the related activities, and an Environmental Management Plan (EMP) will be prepared. The EMP brings together the environmental, social and health management requirements needed to prevent or reduce potential impacts from activities and accidental events, and will form part of the EIA Report and company commitment to the project.

6.1.5 Residual Impact Significance

Following the identification of potential environmental and social impacts, their significance is assessed, taking into account those proposed mitigation measures already incorporated into the design of the project and, where appropriate, any further mitigation measures that are considered feasible and justified. Mitigation measures are applied to eliminate or reduce the extent, duration and or magnitude of a potential impact to an acceptable level. These remaining impacts are described as residual impacts.

One objective of the IEE/EIA is to understand the significance of these residual impacts that will remain after mitigation measures have been designed into the intended activity and if some form of monitoring or measurement might be justified.

6.1.6 Risk Determination for Unplanned Events

The significance of risk of unplanned events is determined by assessing the potential impact of an activity on the environment, social or health conditions and the likelihood of that risk occurring with effective management measures in place. The residual risk is an indication of the significance of an environmental, social or health impact and the probability of the event occurring, after application of management measures.

Where no meaningful measurable environmental, social or health impact can occur, a rating of negligible has been given. Where a positive impact has been identified a rating of positive impact has been given.

The probability of a specific event occurring can be determined either in terms of historical precedence or by calculation.

The potential Risk Ranking of an event occurring is determined according to the following themes:

- Environment (physical and ecological);
- Social;
- Health;

Impact Risk Ranking levels for each of these has been defined above.

The level of risk is identified using a matrix evaluating probability against impact severity; see Risk Ranking (**Table 6-5**). The risk level can be separated into three levels: low, medium, or high (**Table 6-6**). For each aspect identified a residual risk ranking will be defined.

If the risk is determined to be “medium” or “high”, it needs to be managed to reduce the frequency of occurrence or to mitigate any potential risks to achieve a risk that is low, or if it cannot be mitigated to a low level, to a level that is “As Low As Reasonably Possible” (ALARP). If the risk is determined to be “high” (i.e. unacceptable), specific actions must be developed to reduce the risk, which may involve a full Quantified Risk Assessment (QRA).

Table 6-5: Risk Assessment Matrix

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

Table 6-6: Risk Ranking

Risk Level	Definition
Low	Low level risk does not require additional management
Medium	The risk must be controlled to prevent increased risk
High	The risk must be managed/ reduced

6.2 Environmental Screening

The Screening Matrix (**Table 6-7**) and Results of Screening (**Table 6-8**) identifies Environmental, Social and Health impacts by project phase that may occur as a result of planned project activities and unplanned events.

Each of the potential impacts was assessed qualitatively based on our screening methodology. All project activities were identified and potential impacts on the environment, social or health systems was defined.

Table 6-7: Screening Matrix

Environmental Parameters		Physical Resources								Biological Resources		Social							Cultural		Health	
Project Activities/Events		Topography	Air Quality / GHG emissions	Noise	Heat and Light	Surface Water Hydrology	Surface Water Quality	Ground Water Quality	Soil Quality	Flora & Fauna	Aquatic Flora and Fauna	Land Use	Transportation	Water Supply	Power Supply	Drainage and Flooding	Waste Management	Socio-economic	Cultural-Archaeological	Visual Aesthetics / Tourism	Public Health	Occupational Health and Safety
	Construction/Installation																					
1	Access Road and Site Construction	X	P	P		X	P		P	P	P	X	X			X		P	X	X	P	P
2	Vehicle and Equipment Use		X	P						P			X								P	P
3	Site Runoff and Drainage						P		P	P	P					X	P				P	P
4	Handling of Materials and chemicals						P	P	P	P	P							P			P	P
5	Use of Public Utility													X				P				P
6	Hazardous/Non-hazardous waste management						P	P	P	P	P		X				P	P			P	P
7	Labour and Accommodation									P			X					X			P	P
	Drilling																					
8	Rig Move		X	P						P			X					P			P	P
9	Drilling Wells		P	P	X			X		P				X				P			P	P
10	Vehicle and Equipment Use		X	P						P			X								P	P
11	Site Runoff and Drainage						P		P	P	P						P				P	P
12	Hazardous/Non-hazardous waste management						P	P	P	P	P		X				P	P			P	P
13	Use of Public Utility													X	X			P				P
14	Handling of Materials and chemicals						P	P	P	P	P							P			P	P
15	Labour and accommodation									P			X					X			P	P
	Well Testing																					
16	Flaring		X	P	X					P										P	P	P
17	Vehicle and Equipment Use		X	P						P			X								P	P
18	Site Runoff and Drainage						P		P	P	P										P	P
19	Handling of Materials and chemicals						P	P	P	P	P						P	P			P	P
20	Hazardous/Non-hazardous waste management						P	P	P	P	P		X				P	P			P	P
21	Use of Public Utility																	P				P
22	Labour and accommodation									P			X					X			P	P
	Well Abandonment and Site Restoration																					
23	Shut in Well																					P
24	Vehicle and Equipment Use		X	P						P			X								P	P
25	Site Runoff and Drainage						P		P	P	P						P				P	P
26	Hazardous/Non-hazardous waste management						P	P	P	P	P		X				P	P			P	P
27	Handling of Materials and chemicals						P	P	P	P	P							P			P	P
28	Use of Public Utility																	P				P
29	Site Restoration	X	P	P		P			P	P	P	X	X					P			P	P
30	Labour and accommodation									P			X					X			P	P
	Unplanned Events																					
31	Well Blowout		X	X	X				X	P	P									X	P	X
32	Fire or Explosion		X	X	X				X	P	P			X						X	P	X
33	Chemical/Hazardous Waste Spill						X	X	X	X	X	P					P				P	X
34	Transportation Accidents												X								X	X
35	Earthquake																				P	P

Symbol	
(blank)	No Impact
P	Potential Impact
X	Probable Impact

Table 6-8: Results of Screening Environmental, Social, and Health Impacts for Exploration Drilling

Indicator	Source of impact		Detail/Reason
	Phase	**Activity**	
Physical Resources			
Topography	Construction Phase	Access road and Site Construction	Disturbance to local topography
	Drilling Phase	None	None
	Testing Phase	None	None
	Abandonment Phase	Access road and Site abandonment and restoration	Disturbance to local topography
	Unplanned Event	None	
Air Quality/ Climate	Construction Phase	Access Road and Site Construction Vehicle and Equipment Use	Deterioration of air quality from dust and vehicle emissions Greenhouse Gas
	Drilling Phase	Rig Move Vehicle and Equipment Use	Deterioration of air quality from fuel combustion and release of hydrogen Sulfide during the drilling phase Greenhouse Gas
	Well Testing Phase	Flaring of excess gas Vehicle and Equipment Use	Deterioration of air quality from fuel combustion and flaring emissions
	Abandonment Phase	Vehicle and Equipment Use, Site Restoration	Deterioration of air quality from dust, vehicle emissions and Greenhouse Gas
	Unplanned Event	Blowout, Fire and explosion	Release of pollutants to air from blowout or explosion
Noise	Construction Phase	Access road and Site Construction Vehicle and Equipment Use	Noise and vibration from machines and equipment
	Drilling Phase	Rig Move Drilling Wells Vehicle and Equipment Use	Increased noise and vibration
	Well Testing Phase	Flaring Vehicle and Equipment Use	Increased noise from flaring stack and equipment transportation
	Abandonment Phase	Vehicle and Equipment Use Site Restoration	Increased noise and vibration from machines and equipment
	Unplanned Event	Blowout, Fire or Explosion	Increased noise level from blowout and fire or explosion
Heat and Light	Construction Phase	None	None
	Drilling Phase	Drilling Wells	None
	Well Testing Phase	Flaring	Increased light and heat emitted from gas flaring
	Abandonment Phase	None	None
	Unplanned Event	Blowout, Fire and explosion	Increased light and heat emitted from blowout or fire/explosion
Soil	Construction Phase:	Access road and Site Construction Site Runoff and Drainage Handling of Materials and chemicals Hazardous/non-hazardous waste management	Soil contamination Erosion, soil disturbance, soil compaction
	Drilling Phase:	Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and chemicals	Soil contamination from accidental releases
	Well Testing Phase:	Site Runoff and Drainage	Soil contamination from accidental

Indicator	Source of impact		Detail/Reason
	Phase	**Activity**	
		Handling of Materials and chemicals Hazardous/non-hazardous waste management,	releases
	Abandonment Phase	Site Runoff and Drainage Handling of Materials and chemicals Hazardous/non-hazardous waste management, Site Restoration	Soil contamination Return of soil to original state
	Unplanned Event	Well Blowout Fire or explosion Chemical /Hazardous Waste spills	Soil contamination
Surface Water Hydrology	Construction Phase	Access road and Site Construction	Change in water surface flow direction Flow rate of run-off water
	Drilling Phase	None	None
	Testing Phase	None	None
	Abandonment Phase	Site restoration	Return to pre-construction condition
	Unplanned Event	None	None
Surface Water Quality	Construction Phase	Access road and Site Construction Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Increase in erosion and potential contamination from spills or wastewater drainage to nearby water bodies
	Drilling Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals	Potential contamination from spills or wastewater drainage to nearby water bodies
	Testing Phase	Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Potential contamination from spills or wastewater drainage to nearby water bodies
	Abandonment Phase	Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Potential contamination from spills or wastewater drainage to nearby water bodies
	Unplanned Event	Chemical spills	Potential contamination from spills
Groundwater Quality	Construction Phase	Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table during an unplanned event
	Drilling Phase	Drilling wells Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table Drilling impacting groundwater quality
	Testing Phase	Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table during an unplanned event
	Abandonment Phase	Site Runoff and Drainage	Degradation of groundwater quality

Indicator	Source of impact		Detail/Reason
	Phase	Activity	
		Handling of materials and chemicals Hazardous/non-hazardous waste management	from spills or leaks leaching into water table Well abandonment & restoration impacting groundwater quality
	Unplanned Event	Chemical/Hazardous waste spills	Degradation of groundwater quality from spills leaching into water table
Biological resources			
Flora & Fauna	Construction Phase	Access road and Site Construction Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Labour and Accommodation	Degradation or destruction of natural habitat Harvesting of plants and animals by Human activity
	Drilling Phase	Rig Move Drilling wells Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Labour and Accommodation	Harvesting of plants and animals by human activity
	Testing Phase	Flaring of Gas Vehicle and Equipment Use Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management Hazardous/non-hazardous waste management Labour and Accommodation	Harvesting of plants and animals by human activity
	Abandonment Phase	Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Site Restoration Labour and Accommodation	Degradation or destruction of natural habitat Harvesting of plants and animals by human activity
	Unplanned Event	Blowout, Fire and explosion, Chemical/hazardous waste spills,	Degradation or destruction of natural habitat
Social			
Land Use	Construction Phase	Access road and Site Construction (Change from agricultural to industrial area)	Change in land use (Loss of agricultural activity)
	Drilling Phase	None	

Indicator	Source of impact		Detail/Reason
	Phase	Activity	
	Testing Phase	None	
	Abandonment Phase	Site restoration	Restoration of land use
	Unplanned Situation	Chemical/Hazardous waste spill	Contamination could restrict land use options
Transportation	Construction Phase	Access Road Construction and Site Construction Vehicle and Equipment Use Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic
	Drilling Phase	Vehicle and Equipment Use Rig Move Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic
	Testing Phase	Vehicle and Equipment Use Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic
	Abandonment Phase	Vehicle and Equipment Use Hazardous/Non Hazardous waste management Site Restoration Labour and Accommodation	Increased traffic
	Unplanned Event	Transportation Accidents	Potential disruption to traffic in case of accident
Water & Power Supply	Construction Phase	Use of public utility	Increased water consumption
	Drilling Phase	Drilling Use of Public Utility	Increased water consumption Increase or decrease of available power for local community
	Testing Phase	None	
	Abandonment Phase	None	
	Unplanned Event	Fire and Explosion	Increased water consumption
Drainage and Flooding	Construction Phase	Access road and Site Construction Site Runoff and Drainage	Change in hydrology resulting in a potential increase in surface flow.
	Drilling Phase	None	
	Testing Phase	None	
	Abandonment Phase	None	
	Unplanned Event	None	None
Waste Management	Construction Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure
	Drilling Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure
	Testing Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure
	Abandonment Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure
	Unplanned Event	Chemical/Hazardous Waste spills	Increased stress on local infrastructure
Economic			
Socio-Economic	Construction Phase	Access road and Site	Increased employment/income and

Indicator	Source of impact		Detail/Reason
	Phase	Activity	
		Construction Handling materials and Chemicals Use of Public Utility Hazardous/non-hazardous waste management Labour and accommodation	procurement opportunities for people, business and services in surrounding area Labour in-migration causing conflict with local communities
	Drilling Phase	Rig Move Drilling wells Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation	Increased employment/income and procurement opportunities for people, business and services in surrounding area
	Well Testing Phase	Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation	Increased employment/income and procurement opportunities for people, business and services in surrounding area
	Abandonment Phase	Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation Site Restoration	Increased employment/income and procurement opportunities for people, business and services in surrounding area
	Unplanned Event	None	None
Cultural			
Historical/Archaeological Sites	Construction Phase	Access road and Site Construction	Archaeological/ fossil finds within project area.
	Drilling Phase	None	None
	Testing Phase	None	None
	Abandonment Phase	None	None
	Unplanned Event	None	None
Visual			
Attractions/Recreational Areas	Construction Phase	Access road and Site Construction	Change in local environment
	Drilling Phase	None	Disturbance and reduction of tourism and recreational experience
	Testing Phase	None	Visual eye sore
	Abandonment Phase	None	None
	Unplanned Event	Blowout, Fire and explosion	Visual eye sore
Health			
Public and Occupational Health	Construction Phase	Access road and Site Construction Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.
	Drilling Phase	Rig Move Drilling Wells Vehicle and Equipment Use	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills,

Indicator	Source of impact		Detail/Reason
	Phase	Activity	
		Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.
	Testing Phase	Flaring of Gas Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.
	Abandonment Phase	Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Site Restoration Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.
	Unplanned Event	Well Blowout Fire or Explosion Chemical /Hazardous Waste Spill Transportation Accidents Earthquake	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.
Occupational Health and Safety	All Phases and activities	All activities	All components and phases of the project have some potential to impact occupational health and safety, due to accidents, exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, concern and stress about accidents, spills, wastes, noise, etc.

The assessment of each aspect addressed in this EIA will include the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- Determinations of the residual significance or risk after management measures are included.
- A summary assessment table with residual significant/risk rankings.

The study area for the environmental impact assessment includes the area within a 1 km and up to a 5 km radius of the project site(s). The study area for the social impact assessment includes the project stakeholders and communities near the project site(s). For the health impact assessment, workers employed for construction, drilling, testing and abandonment, as well as people who live in close proximity to the project site(s), and available health services are included in the assessment.

For each resource value a summary impact evaluation table will be provided as follows (**Table 6-9**):

Table 6-9: Example Impact Evaluation Table

Resource Value	Impact Description				
	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High
Residual Significance	Positive	Negligible	Low	Medium	High

6.3 Sensitive Receptors

The sensitive receptors for each of the proposed well sites have been identified in the Figures below. The sensitive receptors identified in Block MOGE-3 include:

- Villages (Schools, Pagodas, Cemeteries, etc.)
- Streams / Canals
- Rivers
- Protected Area / Reserved Forests

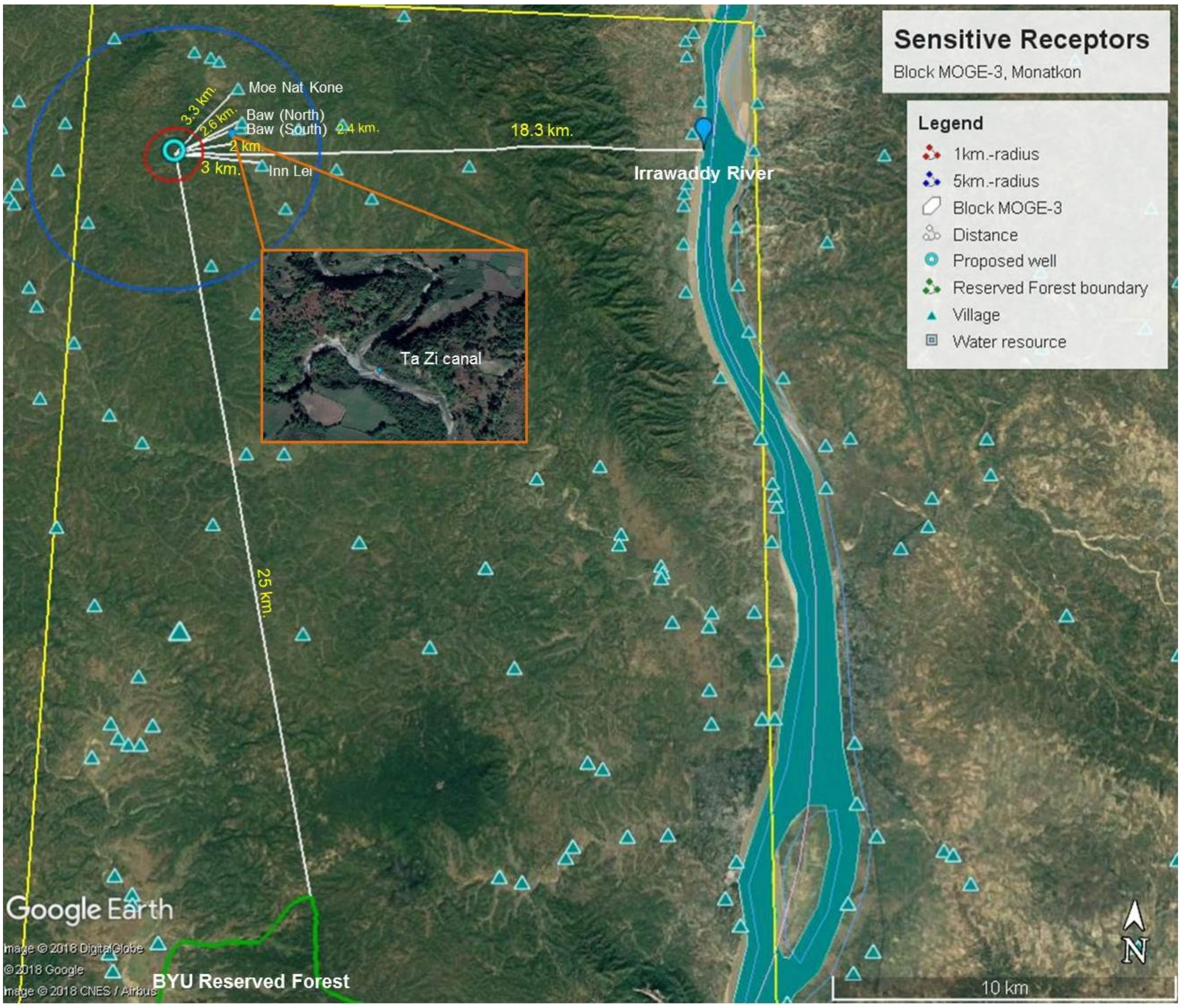


Figure 6-2: Wellsite 01 Monatkon Sensitive Receptors

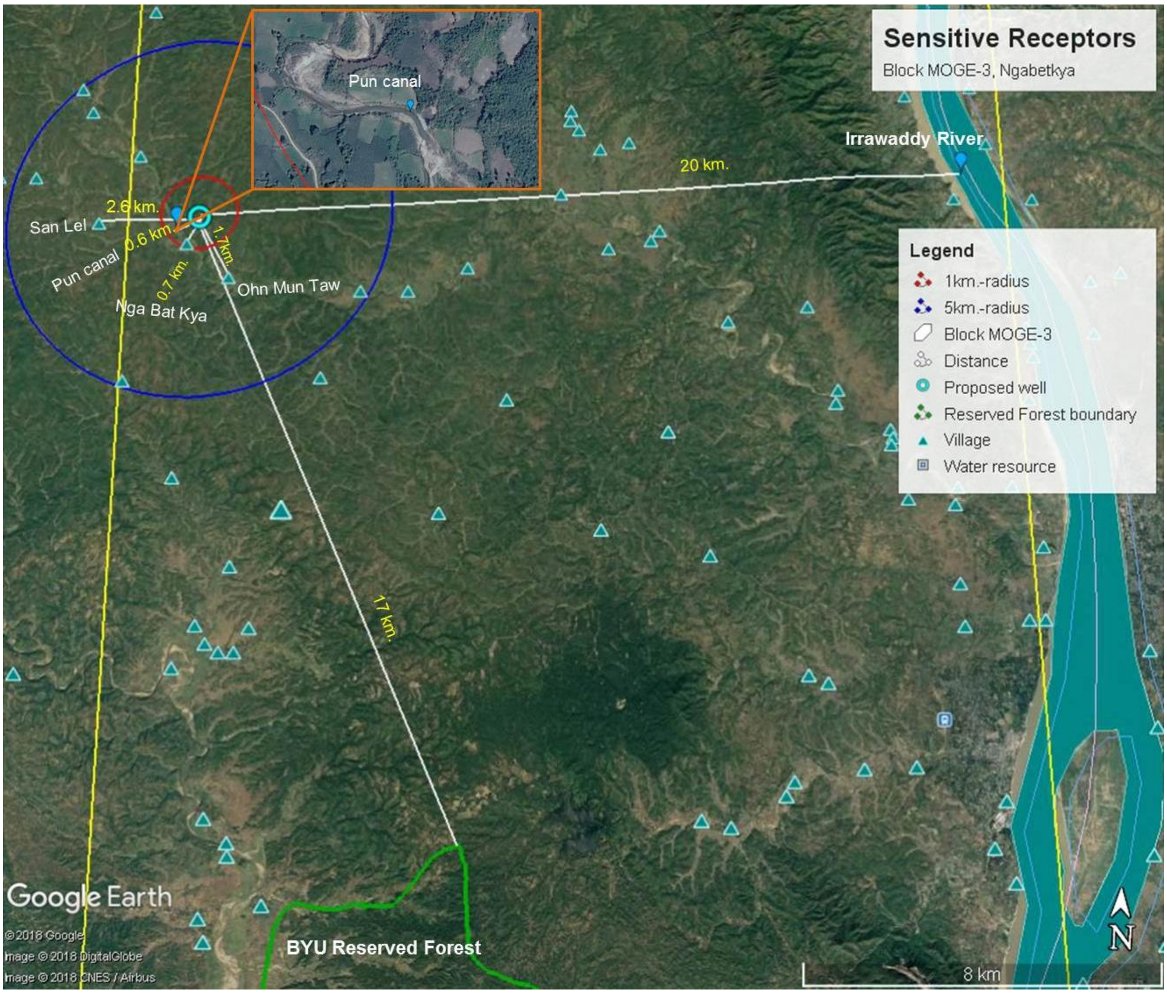


Figure 6-3: Wellsite 02 Ngabetkya

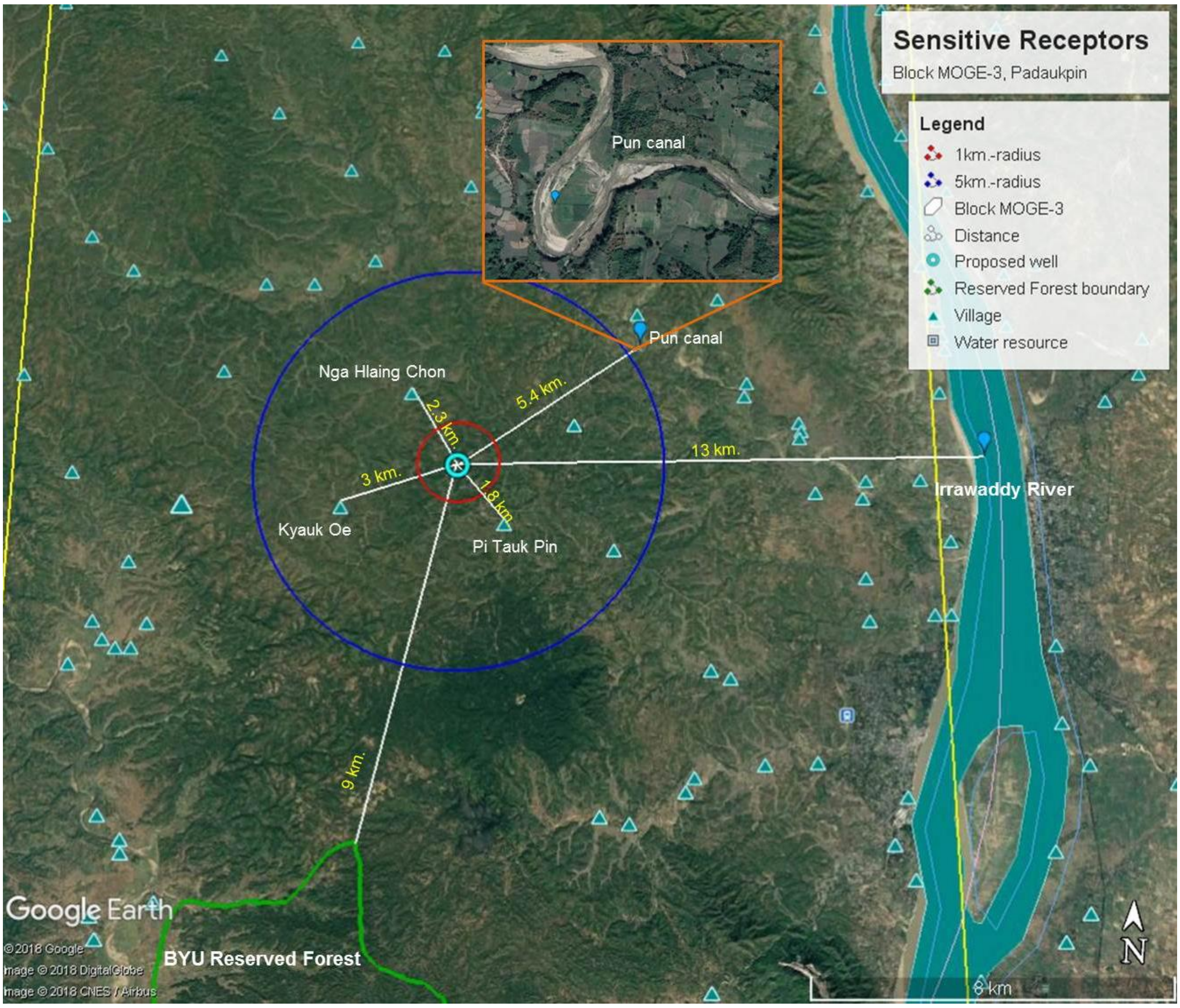


Figure 6-4: Wellsite 03 Padaukpin Sensitive Receptors

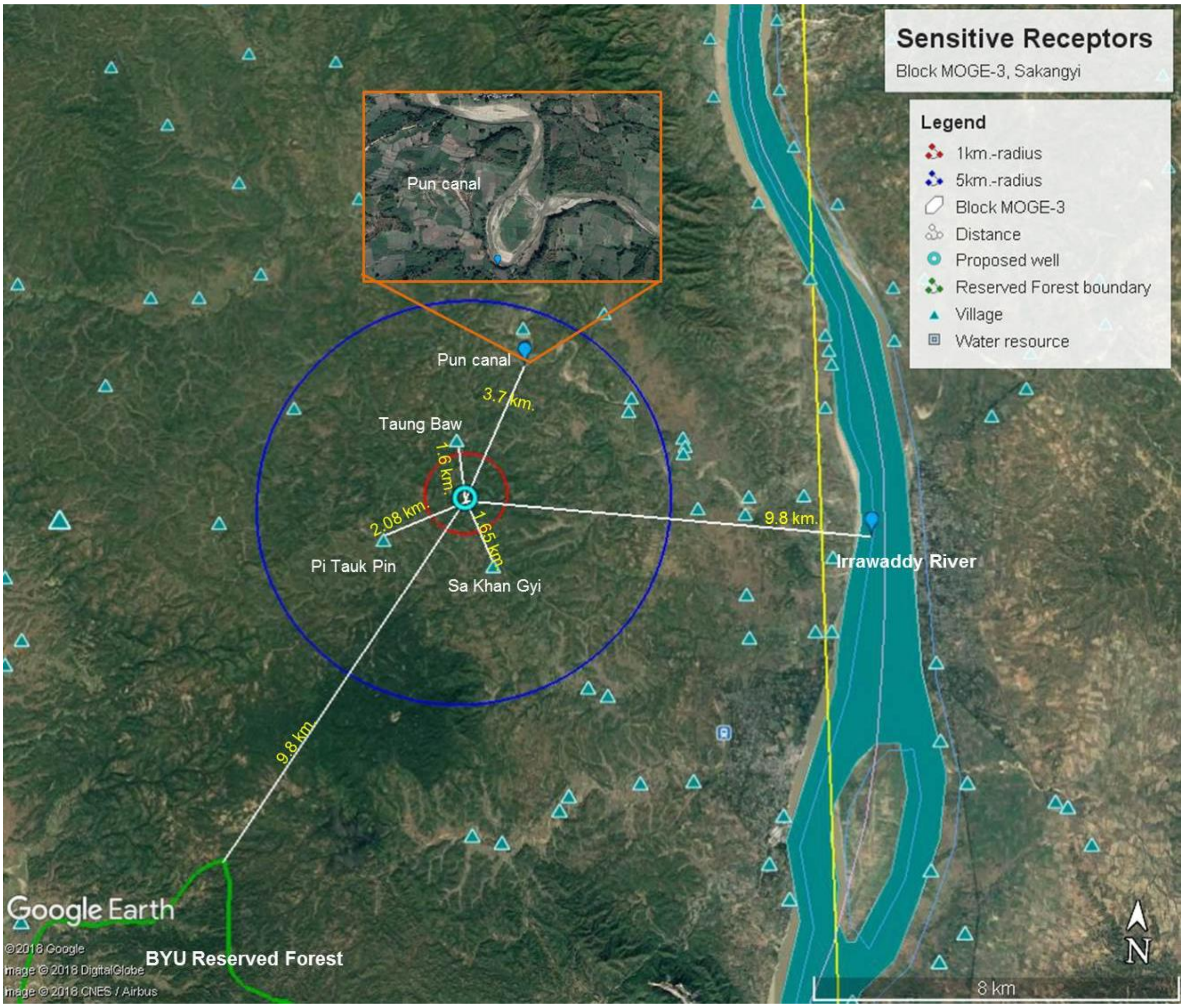


Figure 6-5: Wellsite 04 Sakangyi Sensitive Receptors

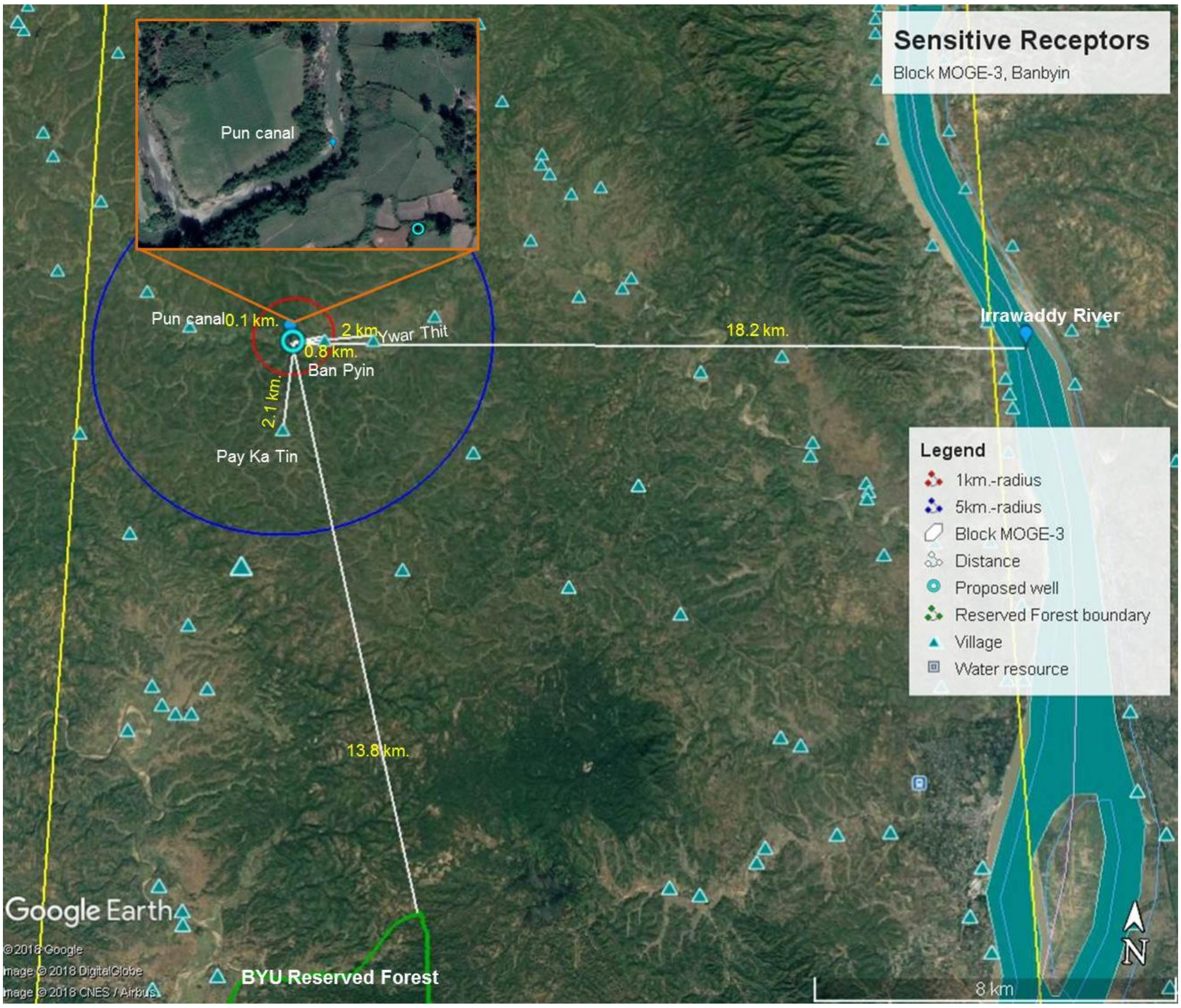


Figure 6-6: Wellsite 05 Banbyin Sensitive Receptors

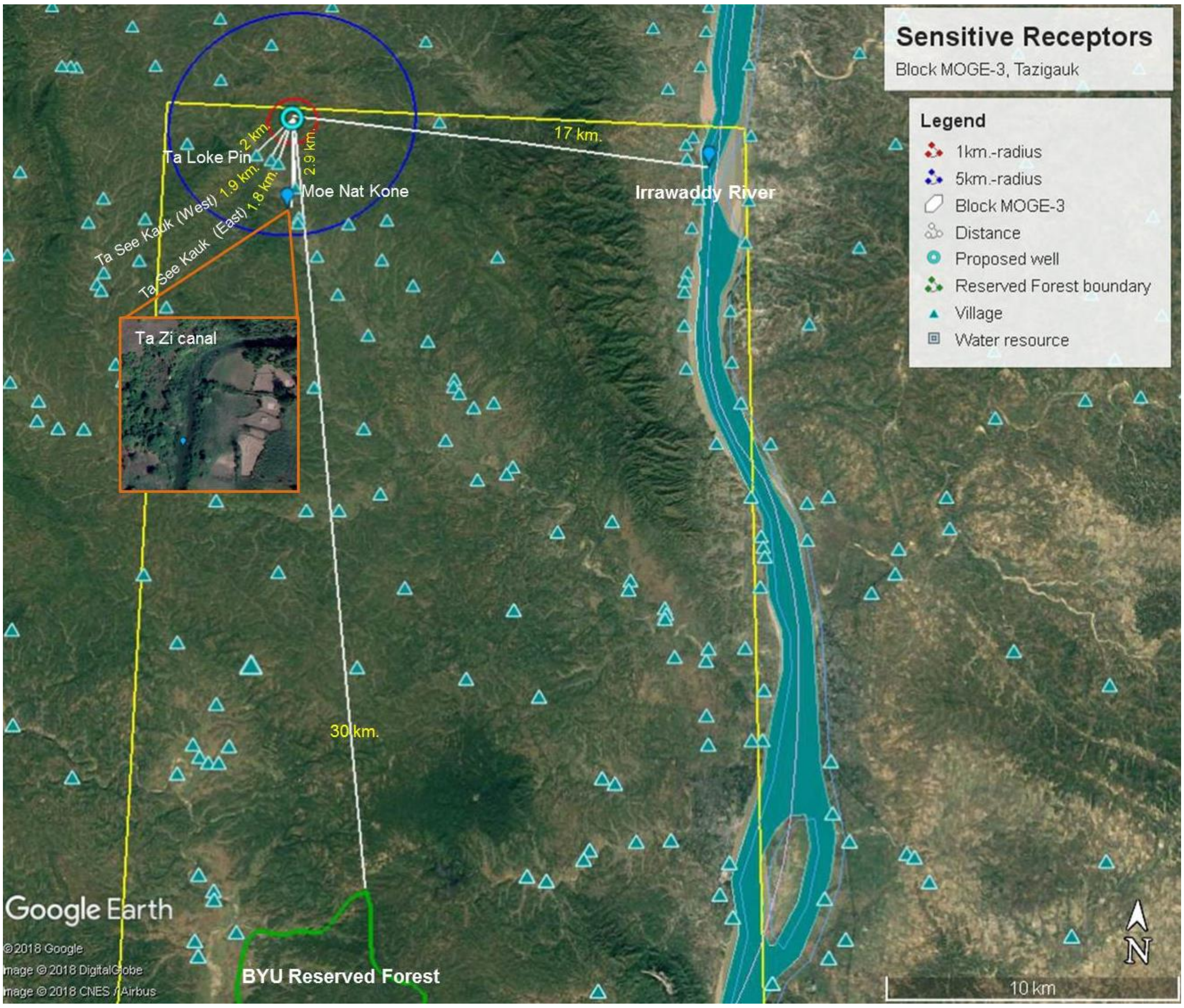


Figure 6-7: Wellsite 06 Tazigauk Sensitive Receptors

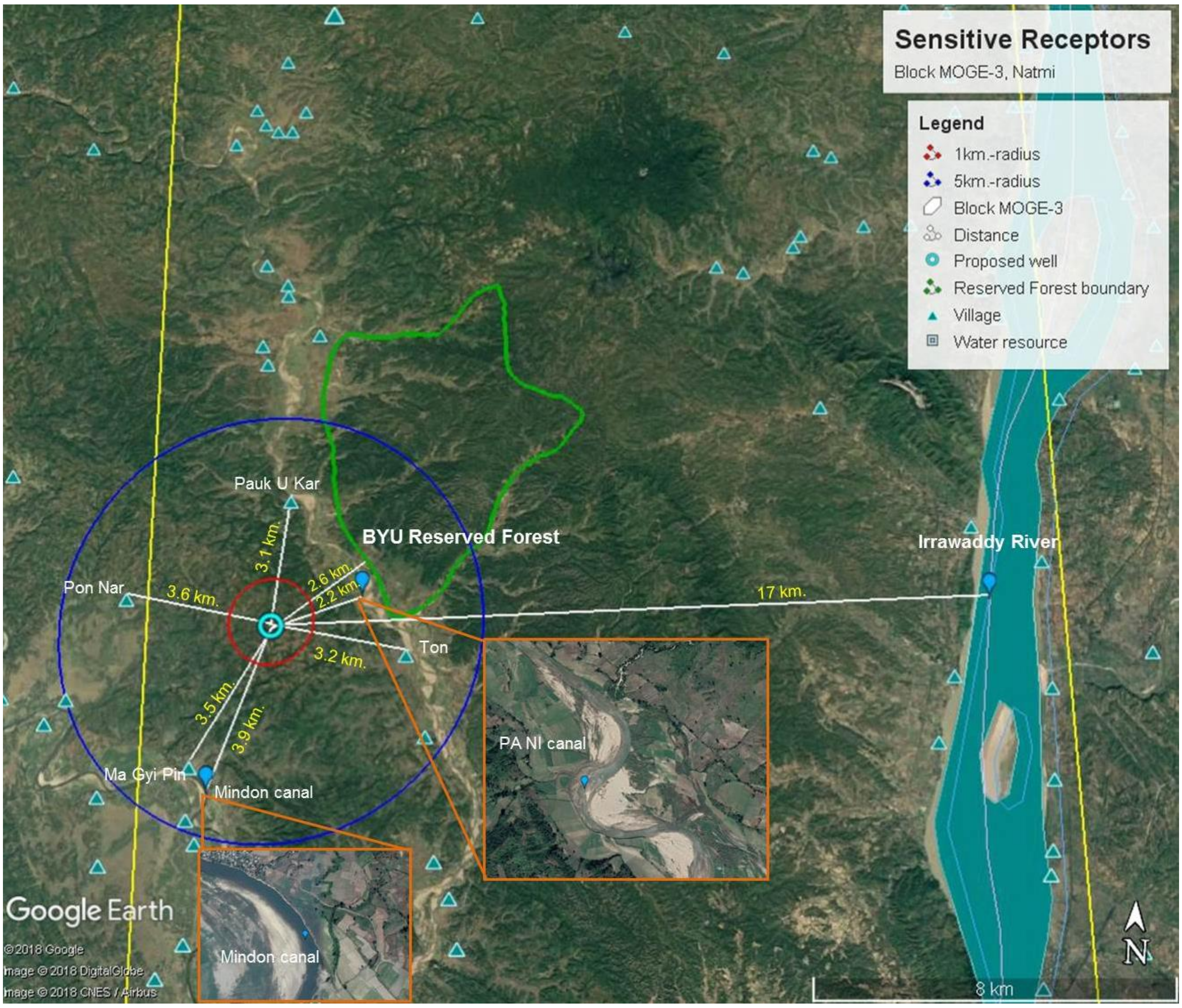


Figure 6-8: Wellsite 07 Natmi North Sensitive Receptors

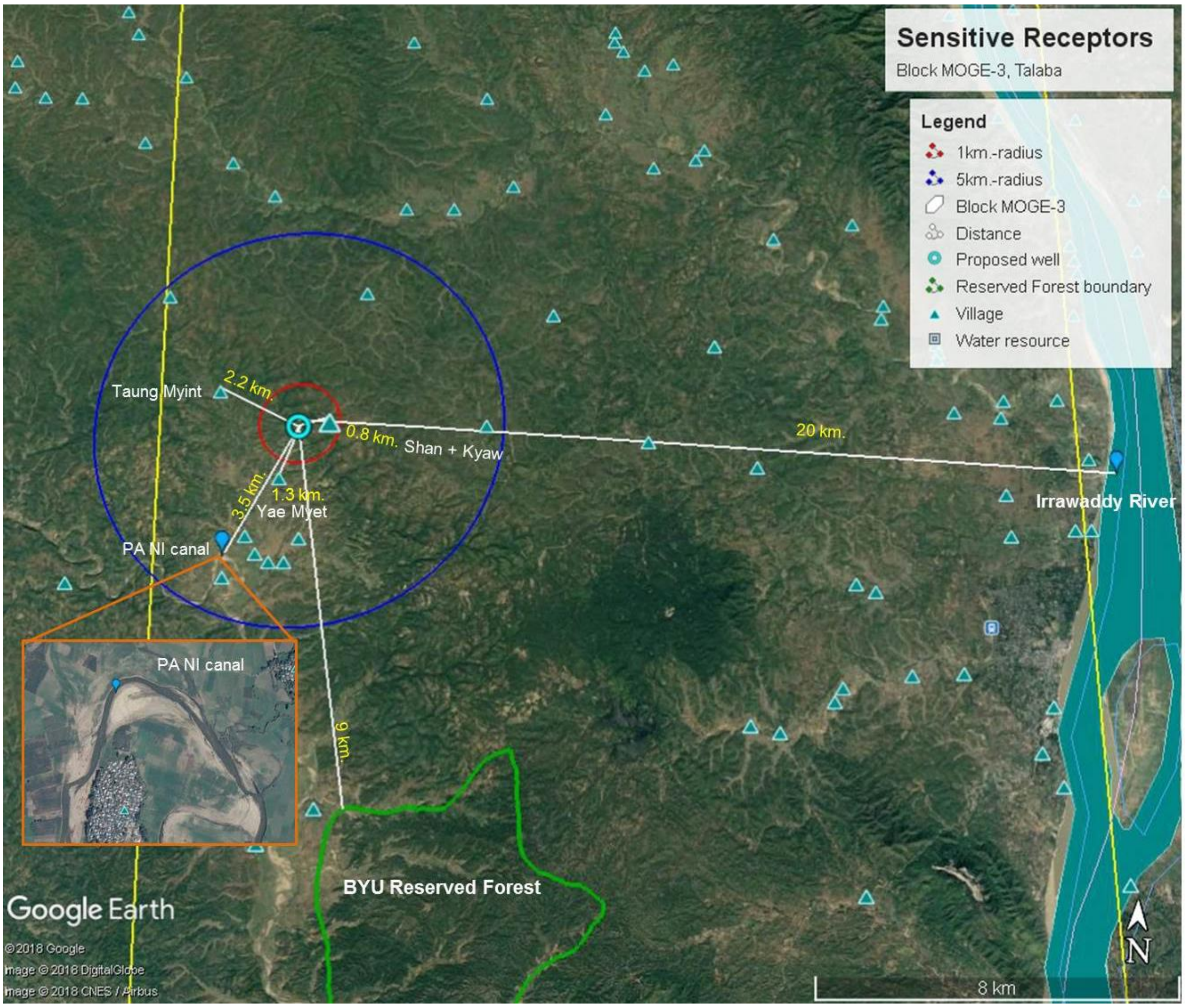


Figure 6-9: Wellsite 08 Talaba Sensitive Receptors

6.4 Environmental Impact Assessment during Construction Phase

From the screening process the following must be assessed to determine their impacts during the construction phase:

- Topography
- Air quality
  - Dust
  - Air Emission
  - Greenhouse Gas
- Noise
- Surface Water Hydrology
- Surface Water Quality
- Groundwater Quality
- Soil Quality
- Flora and Fauna
  - Habitat Disruption
  - Aquatic Ecology

6.4.1 Assessment of Impacts to Topography

6.4.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Topography	Construction Phase	Access road and Site Construction	Disturbance to local topography

6.4.1.2 Assessment of Impacts from Access Road and Site Construction

The source of impact from the site preparation is caused by soil excavation/filling and construction of access road/well pad activity. The project area mainly consists of farming, agricultural and forested areas with agriculturally dominated communities and access roads. The agriculture areas are used to grow rice, beans/pulses, corn and sesame.

Each well site will have similar construction plans. The estimated well site area will be 240 x 200 m for a total area of 48,000 m^2 per well site. This may vary slightly due to local topography. All new earth access roads will need upgraded to construct as required. The roads will be constructed with a 5 m wide top and 1.5 m side slope with a height of approximately 20 to 30 cm before compaction with granular fill. The earth road distances required for each location are; Central Campsite (CCS) 0.25km, Tazigauk 1.6 km. Monatkon 3.1 km, Ngabetkya 14 km, Padukpin 1.4 km, Sakangyi 0.25 km, Natmi 10 km. The maximum area impacted would be Ngabetkya well site with a road length of 14 km (see **Figures 6-2 to 6-7**).

The well site and accommodation campsite near by Thayet Township will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted laterite pad will be 500 mm thick.

The project will cause changes to the topography of the well site and surrounding areas. The effect will be limited to the construction areas and access road. The topography of the area within a 5-km

radius of the exploration well site will be largely unaffected, because the construction areas for the well site and access road consist of only 0.2 % of the total area.

6.4.1.3 Significance of Impacts

Without mitigation measures, the impact on topography from soil excavation/filling and construction of access road/well pad activity will be medium in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the impact significance to Topography is determined to be a medium.

The Significance Ranking of impacts to topography from soil excavation/filling and construction of access road/well pad activity is rated as **Medium**. (**Table 6-10**)

Table 6-10: Sigificance Ranking of impacts to topography

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.1.4 Impact and Risk Mitigation Measures

Impacts from construction activities on topography can be mitigated through the use of the following measure:

Environment Impact Assessment –Construction and Installation Phase			
1. Topography	1.1 Well Site and Camp Construction	1.1.1 Disturbance to local topography	1.1.1.1 Limit construction activities to well sites and access roads only.

6.4.1.5 Residual Impacts and Risks

With these management measures, the extent and magnitude of impacts from a change to topography from soil excavation/filling and construction of access road/well pad activity will be reduced resulting in a residual significance ranked that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.2 Assessment of Impacts to Air Quality

6.4.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Air Quality/ Climate	Construction Phase	Access Road and Site Construction Vehicle and Equipment Use	Deterioration of air quality from dust and vehicle emissions Greenhouse Gas

6.4.2.2 Assessment of Dust Impacts from Site and Road Construction

Vehicle and Equipment Use

During the construction phase, transport of materials and personnel, site preparation, excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind may generate fugitive dust.

Vehicles driving on laterite roads or off road will disperse dust: vehicles grind dust into finer particles, and tire rotation and eddy air currents lift particles into the air (Hesketh *et al.*, 1983). Dust dispersion will also be caused by filling and compaction during construction.

According to AP-42 of U.S.EPA (Compilation of Air Pollution Emissions Factors, 1977):

"The level of dust dispersion normally depends on working characteristic, soil humidity, wind speed, and construction period. On site construction with medium activities, 30% of silt and 50% of Precipitation Evaporation Index generates **1.2 tons/acre/month**[1] **of dust dispersion on average (or 36kg / acres/ day).** These particles **(greater than 10 micron)** will disperse following wind direction and will fall off in the **distance of 6-9 meters from construction site**".

Well site (well site and camp site construction)

There would be no communities located within a radius of 500 m from the project well sites. For particulate matter smaller than 10 microns, the dispersion distance could be greater than this, and the sensitive receptors are considered to be those within a 2 km radius of the well sites.

The emission rate (Q) and dust concentration (C) can be estimated as follows:

Emission Rate (Q)

The dust emission rate can be estimated according to **Equation 6-1**:

$$Q\left(\frac{mg}{s}\right) = \frac{36\,(kg/arces/day) * \; area\,(acre) * 10^6 \left(\frac{mg}{kg}\right)}{24 * 60 * 60\,(\frac{s}{d})} \qquad \textbf{Equation 6-1}$$

The well site covers an area of **48,000 m^2** for **well pad and campsite (200 x 240 m)**. In addition, the access road needs to be constructed.

On the basic of above equation, emission at source would be **2,743.1 mg/s**

Q = 5486.2 mg/s, Area = 48,000 m^2

Dust Concentration (C)

The dust concentration is estimated by using **Equation 6-2**:

[1] http://www.epa.gov/ttn/chief/old/ap42/3rd_edition/ ap42_3rdsup 1_7_aug 1977.pdf

$$C\ (mg/m^3) = \frac{Q\ (mg/s)}{d\ (m) * W\ (m/s) * M\ (m)}$$ **Equation 6-2**

Where C = Dust Concentration (mg/m^3)
Q = Emissions at Source (mg/s)
d = Width (the smallest dimension is used for worst case scenario) (m)
W = Average maximum wind speed (m/s)
M = Mixing Height (m)

The mixing height data is not available yet in the Meteorology Department in Myanmar. Therefore, this measurement is adopted from the atmospheric simulation models (European Commssion, n.d.). The use of simple default values related to wind speed and stability class as in **Table 6-11**.

Table 6-11: Default Mixing Heights related to Wind Speed and Stability Class

Atmospheric Stability	Horizontal wind speed, m/s	Default Mixing Height, m
A very unstable	0.5-2	2000
B unstable	0.5-2	1500
C slightly unstable	2-10	1000
D neutral	3-10	750
E stable	2-5	300
F very stable	0.5-3	250
G extremely stable	0.5-1	250

Source: European Commission, n.d.

For this dust impact assessment, the **stable condition** is selected as the **worst case scenario.**

Q = 5486.2 mg/s

d = 200 m

W= 2 m/s (stable wind)

M=300 m (stable wind)

Access Road Construction

All new earth access roads will need upgraded or constructed as required. The roads will be constructed with a 5 m wide top and 1.5 m side slope with a height of approximately 20 to 30 cm before compaction with granular fill. The earth road distances required for each location are; Tazigauk 1.3 km. Monatkon 3.2 km, Ngabetkya 14 km, Banbyin 4.5 km, Padukpin 1.4 km, Sakangyi 0.5 km. The maximum area impacted would be Ngabetkya wellsite with a road length of 14 km. The roads will be constructed in segments at 100 m lengths. **Table 6-12** shows the distance and area for the upgraded road per construction length.

Table 6-12: The access road to be constructed for the well site

Off-road to well site(m)	d (m)	Area (m^2)	Area (Acre)
100	10	1,000	0.25

Table 6-13 shows the dust construction emitted from the one well site using the equations **Equation 6-1** and **Equation 6-2**.

Table 6-13: Dust Concentration from Well Site associated Road Construction (one well-site)

Location		Area (m^2)	Area (acre)	Q (mg/s)	d (m)	C (μg/m^3)	Ambient PM-10 (μ g/m^3)*
Well	1 Well site	48,000	11.86	5486.2	200	45.7	**(68 - 127)**

Drive way (between Off-road and the well site)							
Access road (constructed and upgraded)	Off-road leading to well site	1,000	0.63	115.2	10	19.2	**(68 - 127)**

* Ambient PM-10 concentrations are 24hr average baseline values measured at the total (8) locations in the whole proposed project area. The findings are more detailed in ambient air baseline section.

The dust concentration resulting from the well site and access road construction is added to the ambient concentration. **The highest combined dust concentration** would be during **construction of the well site area**. However the increase would be temporary and would not emit all dust emission at the same time.

6.4.2.3 *Significance of Impacts*

Without mitigation measures the impacts to air quality from nuisance dust are expected to be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts to air quality from nuisance dust is rated as **Medium**. (**Table 6-14**)

Table 6-14: Sigificance Ranking of impacts to Air Quality from Nuisance Dust

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

In general, the potential impact is estimated for a worst case scenario; in reality vehicles and equipment will only be used intermittently. Therefore, the emissions will be less than presented above.

Based on the ranking, nuisance dust from the construction phase is considered as medium. Dust emissions from the construction activities are expected to potentially deteriorate the existing status of air quality around the project area especially during the dry season and when winds blow from the construction site to nearby communities.

The impacts would be short-term and limited to localized areas. But, if there were no mitigation measures, dust emissions can cause nuisance close to the construction sites, so would potentially affect construction workers, villagers and the environment.

6.4.2.4 Assessment of Impacts from Vehicle and Equipment Use

During construction, combustion products will be released from vehicles transporting personnel and equipment and construction machinery. Air pollutants come from various sources: fugitives and exhausts, fuel combustion, etc.

Potential concerns are:

- personnel safety
- global greenhouse effect
- ozone depletion
- fire hazards

Gaseous emissions may not deteriorate local air quality, but may contribute to the global problems of greenhouse warming and ozone depletion. The primary gaseous emission concerns are hydrocarbons, nitrogen oxides, sulphur oxides and carbon monoxide, and the contribution they will make to onshore levels of those gases or to existing problems, e.g., photochemical smog. Mercury vapour, sulphur dioxide and carbon monoxide in confined space present serious personnel health threats, while combustible gases may constitute fire hazards.

Fuel use for construction activities causes emission of pollutants. Emissions include CO, CO_2, NO_X and SO_2. Potential impacts of these and engine emissions are summarized in .

Table 6-15: Potential Impacts of Combustion Emissions

Emission Species	Environmental Impact
CO	Contributes indirectly to climate change by enhancing low-level of ozone formation.
CO_2	A GHG. Contributes to climate change.
NO_X	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
SO_2	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
CH_4	A GHG. Contributes to climate change. Reactant of ozone. Impact on respiratory system and circulatory system of living creature
N_2O	A GHG. Contributes to climate change.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane. Estimated carbon dioxide emissions are discussed under Greenhouse Gases in **Section 6.4.2.6** below.

6.4.2.5 Significance of Impacts

Without mitigation measures, the impact from air pollutants will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from air pollutants is ranked **Medium**. (**Table 6-16**)

Table 6-16: Sigificance Ranking of impacts from Air Pollutants

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.2.6 Impacts from GHG Emissions

Fuel combustion of the machinery during construction and installation phase and transportation of materials and equipment. The sensitive receptors for greenhouse gas emissions are the same as those listed for dust emissions.

The GHG emissions are estimated following the Tier 1 approach of IPCC (2006). GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O). The estimated GHG emissions for the project is shown in **Table 6-17**.

Total greenhouse gas emissions during for the construction and installation phase of the project (4 exploration wells) amounts to 123.2 ton eq CO_2. When compared with available data on Myanmar's national CO_2 equivalent GHG emissions of 184,710,000 tonnes in 2012, including land use change (World Resources Institute, Climate Analysis Indicators Tool (CAIT)), the GHG emissions arising from the proposed activities are insignificant (approximately 0.00007 %), and therefore will not significantly impact the environment.

Table 6-17: Estimated GHG Emissions per Well during Construction and Installation

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Site Preparation	Granular Fill Transport	6.0
	Drilling rig mobilization	24.8
Total per well		30.8

6.4.2.7 Significance of Impacts

Without mitigation measures, the impact from greenhouse gas emissions during construction are considered to be a global issue, local in extent, short-term in duration, reversible and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from GHG emissions is **Low**. (**Table 6-18**)

Table 6-18: Sigificance Ranking of impacts from GHG Emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
			■		

6.4.2.8 Impact and Risk Mitigation Measures

Potential impacts from dust dispersion can be mitigated by application of the following measures:

Environment Impact Assessment –Construction and Installation Phase			
2. Air Quality	2.1 Well Site and Camp Construction	2.1.1 Deterioration of air quality due to dust.	2.1.1.1 Minimize land clearance to a minimum especially during the dry season.
			2.1.1.2 Limit vehicle speed on access road and site site to minimize dust formation.
			2.1.1.3 Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.
			2.1.1.4 Spray water on roads when needed to keep dust down. At least 1 time/day especially during dry season
			2.1.1.5 Clean tires of the vehicles before leaving site if needed.
			2.1.1.6 Provide personal protective equipment to exposed field workers.
			2.1.1.7 Use vehicles with dust flaps to prevent dust during driving.
	2.2 Equipment use during Site and Road Construction	2.2.1 Deterioration of air quality due to vehicle emissions.	2.2.1.1 Ensure all machinery and vehicles are properly checked and inspected.
	2.3 Equipment use during Site and Road Construction	2.3.1 GHG Release contributing to climate change	2.3.1.1 Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.

6.4.2.9 Residual Impacts and Risks

With these management measures, the magnitude of impacts to air quality from nuisance dust, air pollutants and GHG emissions will be reduced resulting in a residual significance that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.4.3 Assessment of Impacts to Noise

6.4.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Noise	Construction Phase	Access road and Site Construction Vehicle and Equipment Use	Noise from machines and equipment

6.4.3.2 Assessment of Noise Impacts from Vehicle and Equipment Use

This section assesses the potential impacts of noise from the construction phase to sensitive receptors. The level of noise from project activities that is audible to a receptor (received level) will depend on the following:

- Background (ambient) noise.
- Noise level generated by an activity at the source (source level).
- The distance the receptor is from the noise source (range), and the level of transmission loss between the noise source and the receptor.
- The hearing threshold and frequency sensitivity of the receptor.

During the construction phase, noise will be primarily generated from project vehicles and construction equipment. Maximum noise levels generated by the various pieces of equipment during construction and drilling are listed in **Table 6-19**.

Table 6-19: Noise Level from Construction, Drilling and Testing Equipment

Source	Maximum (Db) at source (dB (A))	Number of Sources at one time
Dump Truck	84	1
Excavator	83	1
Roller Compactor	80	1
Bulldozer	75	1
Grader	75	1
Jack-Hammer	75 – 80	1

Source: British Columbia Ministry of Transportation and Infrastructure, 2012, reference distance 50 ft (15.24 m); (http://www.th.gov.bc.ca/BCHighways/contracts/Reference_Material_Tenders/03901-0001/AW_CEMP_10%20Feb_2012.pdf)

In the construction and installation phase, the possibility to use all the equipment at one time is low. Therefore, noise will be evaluated from a maximum of 3 sources operating at one time (dump truck, excavator and roller compactor).

The impact assessment for noise from project activities evaluates impacts to fauna during the different phases of the project. Noise is expected to be greatest during construction and commissioning due to the higher number of vehicle movements and heavy machinery use.

Noise associated with decommissioning is expected to result primarily from the operation of the heavy machinery required to decommission the facilities and remove infrastructure. Noise impacts are anticipated to be similar to those from construction and commissioning activities. A decommissioning plan will be developed at the time of project decommissioning which will assess noise impacts of associated activities in more detail.

Like humans, the effect of noise on wildlife is highly varied and is dependent on the noise intensity, its frequency, and its duration; the sensitivity of the species or individual affected; and the environment in which the noise is perceived. Sounds exceeding 55 dB are known to cause physiological and behaviour changes in terrestrial fauna (Checker, 1980) and diminishes habitat value and disrupts terrestrial fauna activity (e.g. injury, energy loss, decreased food intake, habitat avoidance, and reproductive loss). Unusual, loud, and/or intermittent noise will generally startle and stress most species of wildlife, although they may quickly get used to continuous noise. They may avoid the area for varying lengths of time; once the noise ceases they will return. The area around the well sites provides habitat for many animals and birds temporarily disturbed by the noise of this operation.

Increased stress and/or movement during a critical period such as nesting or birthing will generally cause greater adverse effects to wildlife than the same stress outside of such critical times. If nesting birds leave the nest for even a short period of time, their nesting success may be reduced; if they abandon the nest, that nesting attempt will fail.

6.4.3.3 Noise Impacts from Construction

There will be a temporary increase in traffic levels and operation of heavy equipment, which will cause an increase in the noise levels and an increase in disturbance. This will have an impact on the surrounding wildlife (mainly birds), as they will tend to avoid the area.

Noise levels at various distances from these sources were calculated using **Equation 6-3**:

$$L_r = L_w - 20*Log_{10}(D/D_0) \qquad \text{Equation 6-3}$$

Where L_r = Sound level at distance D (dB(A))

L_w = Sound level at source D_0 (dB(A))

D = Distance from point source (m)

D_0 = Reference distance where the source noise emission level was measured

(Source: http://www.fhwa.dot.gov/environment/noise/highway/hcn03.htm)

The total noise level from several construction sources is calculated using **Equation 6-4**:

$$Lp_{Total} = 10 * Log_{10}\left(\sum_{i=1}^{n} 10^{Li/10}\right) \qquad \text{Equation 6-4}$$

Where $L_{p\ total}$ = Noise level from n sources

n = Number of sources

Li = Noise level from ith source, dB (A)

Not all construction equipment will be operating at the same time. Using data from **Equation 6-4** for the two noisiest construction machines (dump truck and bulldozer), the total construction noise can be estimated as:

$$Leq_{(Total)} = 10\ Log\ [(2)(10^{85/10}) + (1)(10^{88/10})] = 91.0\text{dB(A) at 50 feet from noise source}$$

The nuisance noise during construction activities is calculated using **Equation 6-5**.

Nuisance Noise = Specific Noise Level- Background Noise Level **Equation 6-5**

Construction noise levels at sensitive receptors using **Equation 6-3** are combined with ambient noise measurements taken within MOGE-3 had 24-hour equivalent noise levels ranged that from 37 dB (A) to 42 dB (A) using **Equation 6-4** into a specific noise level. The construction and specific noise levels at sensitive receptors are shown in **Table 6-20**.

Table 6-20: Noise Calculations from Construction Activities

Wellsite	Receptor	Distance (km)	Noise at Receptor	Specific Noise	Nuisance Noise
Monatkon	Baw (South)	2000	47.4	48.5	6.5
Ngabetkya	Nga Bay Kya	700	56.6	56.7	14.7
Padaukpin	Pi Tauk Pin	1800	48.4	49.3	7.3
Sakangryi	Taung Baw	1600	49.4	50.1	8.1
Banbyin	Ban Pyin	800	55.4	55.6	13.6
Taziquak	Ta see Kauk (East)	1800	48.4	49.3	7.3
Natmi	Pauk U Kar	3100	43.6	45.9	3.9
Talaba	Yea Myet	1300	51.2	51.7	9.7

The nuisance noise level during construction can exceed the nuisance noise standard of 10 dB (A) at Ngabetkya and Banbyin well sites. The estimated noise levels present an absolute worst-case condition. Not all equipment is likely to operate at the same time. In addition, the surrounding trees and other vegetation and the topography are expected to lead to a far more rapid attenuation of noise. Construction activities are expected to last approximately 150 days per well site; noise levels at the sensitive receptors will return to baseline levels upon cessation of construction activities.

6.4.3.4 Significance of Impacts

Without mitigation measures, impacts from noise from Construction to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

The Significance Ranking of impacts from Noise to sensitive receptors is rated as **Low**. (**Table 6-21**)

Table 6-21: Sigificance Ranking of impacts from Noise to Sensitive Receptors

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				(highlighted)	
Significance	Positive	Negligible	Low	Medium	High
			(highlighted)		

6.4.3.5 Impact and Risk Mitigation Measures

Impacts from noise can be mitigated through the use of the following mitigation measures:

Environment Impact Assessment –Construction and Installation Phase			
3. Noise	3.1 Use of machines/engines during construction and transportation	3.1.1 Increase in noise levels from machines/engines	3.1.1.1 Minimize vehicles and rig transportation from sensitive environmental areas. (eg. Forest, Archeology area, Heritage area etc…)
			3.1.1.2 Minimize construction activities and vehicle/rig movements in nighttime.
			3.1.1.3 Limit vegetation removal to a minimum at well site, camp site and access road.
			3.1.1.4 Turn equipment/machinery off when not in use.
			3.1.1.5 Use enclosures when possible to contain noise on site.
			3.1.1.6 Implement transportation plan to avoid traffic issue that make noise pollution.
			3.1.1.7 Materials should be lowered when practical and not dropped while transferring

6.4.3.6 Residual Impacts and Risks

With these management measures, the residual significance from the impact of noise to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			(highlighted)		

6.4.4 Assessment of Impacts to Surface Water Hydrology

6.4.4.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Hydrology	Construction Phase	Access Road and Site Construction	Change in water surface flow direction Flow rate of run-off water

6.4.4.2 Assessment of Impacts from Access Road and Site Construction

Vegetation removal, construction of campsites and access roads can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increase runoff and change local drainage patterns. Heavy rains can intensify changes in surface water hydrology; these changes are also enhanced on steep slopes.

Construction of the access roads, campsite and well sites for this project will result in some vegetation removal. The area of vegetation removal will be small and site preparation will be conducted on flat terrain. In addition, PTTEP SA will install culverts under the access roads if required in order to maintain natural drainage. No changes in surface water hydrology are therefore expected.

Runoff calculation

The calculation of water runoff in this report is conducted to evaluated the adequacy of the drainage system in the project area using the Rational Method, which is used to estimate the water runoff into the drainage system in urban areas and small watershed. ASCE (1992) recommended for areas smaller than 80 hectares[2] (500 acres), while WSDOT says the accuracy of the calculation by the Rational Method is high when applied to an area of 40 hectares (250 acres)[3].

Chu (2010) noted that the Rational Method estimates on the assumption that runoff collection period is equal to the period of rain (Time of concentration = Rainfall duration)[4]. Therefore, a small space has a high possibility that the total collection period is equal to the period of rain, therefore it has a higher accuracy than for a much larger area. The runoff from a single well site is calculated with **Equation 6-6;** which is valid for runoff areas not larger than 25 km^2.

In the project area the wettest month is June with a monthly rainfall of 234.8 mm. Therefore, runoff was calculated using rainfall intensity derived from a worst-case scenario of a month's equivalent of rain intensity in a ½-hr duration storm (234.8 mm/hr).

$$Q = 0.278 x 10^{-6} CIA$$ **Equation 6-6**

where:

Q	=	runoff, m^3/second
A	=	area, m^2
I	=	rainfall density, mm/hour
C	=	runoff coefficient (**Table 6-22**)

Table 6-22: Runoff Coefficient of Various Catchment Areas

Land Use	Coefficient (C)	Surface	Coefficient (C)
Business		**Streets**	
- Downtown area	0.70-0.95	- Asphalt or concrete	0.70-0.95
- Neighbourhood areas	0.50-0.70	- Bricks	0.70-0.85
Residential		**Roofs**	0.75-0.95
- Single family areas	0.30-0.50	**Lawns (sandy soil)**	
- Multi unit, detached	0.40-0.60	- Flat with 2%slope	0.05-0.10
- Multi unit, attached	0.60-0.75	- 2-7% slope	0.10-0.15

[2] American Society of Civil Engineers, .1992Design and Construction of Urban Stormwater Management Systems. "ASCE Manuals and Reports of Engineering Practice No. 77, WEF Manual of Practice FD- ".20New York, N.Y.
[3] WSDOT Training publication from http://www.wsdot.wa.gov/publications/fulltext/Hydraulics/hhtraining/section02.pdf
[4] Chu, V., 2010, A Self Learning Manual – Mastering Different Fields of Civil Engineering Works (VC-Q-A-Method) from http://www.iemauritius.com/upload/files/a_self-learning_manual_-_mastering_different_fields_of_civil_engineering_works_(vc-q&a_method).pdf

Land Use	Coefficient (C)	Surface	Coefficient (C)
- Suburban	0.25-0.40	- Over 7% slope	0.15-0.20
- Apartments	0.50-0.70	**Lawns (heavy soil)**	
Industrial		- Flat with 2% slope	0.13-0.17
- Light areas	0.50-0.80	- 2-7% slope	0.18-0.22
- Heavy areas	0.60-0.90	- Over 7% slope	0.25-0.35
Parks, cemeteries	0.10-0.25		
Playgrounds	0.20-0.35		
Railroad yard areas	0.20-0.35		
Unimproved areas	0.10-0.30		

Source: Kriangsak Udomsinrot (1994), Environmental engineer, Mitnarakanpim, Bangkok
Thongchai Pansawad (1995), Guideline for waste water treatment system and rainfall

Pre-Construction-Surface water drainage before the construction of a typical well site for the project can be calculated as follows:

$$Q \text{ (existing condition)} = (0.278\times10^{-6})\,(0.17)\,(234.8)\,(48{,}000)\,(1800)\ m^3/s$$

$$= 959\ m^3 \text{ for the ½ hr storm,}$$

with the following parameters inserted into **Equation 6-6**:

A = well site area 48,000 m^2

I = 234.8 mm/h (using a monthly rainfall storm).

C = 0.17 for garden (heavy soil), flat with 2% slope (**Table 6-22**)

Therefore, the volume of runoff for an extreme ½ hour duration storm before a typical well pad is constructed can be calculated with a cofactor of 0.17. The surface water drainage during construction of the project site can be calculated with **Equation 6-6** for construction with a runoff coefficient © of 0.30 for unimproved area. The well site area calculations are shown in **Table 6-23**.

Table 6-23: Construction Run-Off Calculations

No	Well site	Area (m^2)	Q (Existing) m^3/s	Q (Construction) m^3/s
1	Central Camp Site	10,000	200	352
2	Typical Well site	48,000	959	1,692
3	PDP	32,794	655	1,156
4	MNK	40,145	802	1,415
5	NBK	49,600	991	1,748
6	SKG	52,400	1,047	1,847

The distances to sensitive receptors are included in **Table 6-24**.

Table 6-24: Distances to Sensitive Receptors for Each Potential Well Site.

Well 01: Monatkon		Distance (km)	Direction	Well 02: Nga Bet Kya		Distance (km)	Direction
Village	Bow (S)	2.4	E	Village	Nga Bet Kya	0.7	SW
	Bow (N)	2.6	NE		Ohn Mun Taw	1.7	SE
	Inn Lel	3.0	E		San Lel	2.6	W
	Moe Nat Kone	3.3	NE				

River/ stream	Tazi canal	2.0	E	River/ stream	Pun canal	0.6	SW
	Ayayarwady R.	18.3	E		Ayayarwady R.	20.0	E
Forest	Thae Phyu RF	25.0	S	Forest	Thae Phyu RF	17.0	S
Well 03: padaukpin		**Distance (km)**	**Direction**	**Well 04: Sa Kan Gyi**		**Distance (km)**	**Direction**
Village	Pi Tauk Pin	1.8	SE	Village	Taung Baw	1.6	N
	Nga Hlaing Chon	2.3	NW		Sa Kan Gyi	1.65	SE
	Kyauk Oe	3.0	SW		Pi Tauk Pin	2.08	SW
River/ stream	Pun canal	5.4	NE	River/ stream	Pun canal	3.7	NE
	Ayayarwady R.	13	E		Ayayarwady R.	9.8	E
Forest	Thae Phyu RF	9.0	SW	Forest	Thae Phyu RF	9.8	SW
Well 05: Ban Byin		**Distance (km)**	**Direction**	**Well 06: Tazigauk**		**Distance (km)**	**Direction**
Village	Ban Byin	0.8	E	Village	Tazigauk (E)	1.8	SW
	Ywar Thit	2.0	E		Tazigauk (W)	1.9	SW
	Pay Ka Tin	2.1	SW		Ta Loke Pin	2.0	SW
					Moe Nat Kone	2.9	S
River/ stream	Pun canal	0.1	N	River/ stream	Tazi canal	2.9	S
	Ayayarwady R.	18.2	E		Ayayarwady R.	17.0	E
Forest	Thae Phyu RF	13.8	SE	Forest	Thae Phyu RF	30.0	S
Well 07: Natmi		**Distance (km)**	**Direction**	**Well 08: Talaba**		**Distance (km)**	**Direction**
Village	Pauk U Kar	3.1	NE	Village	Shan Kyaw	0.8	E
	Ton	3.2	SE		Yae Myet	1.3	SW
	Ma Gyi Pin	3.5	SW		Taung Myint	2.2	NW
	Pon Nar	3.6	NW				
River/ stream	Pani canal	2.2	E	River/ stream	Pani canal	3.5	SW
	Mindon Canal	3.9	SW		Ayayarwady R.	20.0	E
	Ayayarwady R.	17.0	E				
Forest	Thae Phyu RF	2.6	NE	Forest	Thae Phyu RF	9.0	S

Surface Water Runoff to Access Road

The overall landscape around the project well site is flat paddy agricultural lands and open disturbed forestlands. All access roads will be 5-m wide. In consultation with and approval from local authorities the existing earth road will be upgraded and the short access roads to the wellsite will be constructed. Any new access road will incorporate culverts to allow the flow of natural surface drainage and prevent any ponding of water around the earth roads. The earth road distances required for each location are; Central Campsite (CCS) 0.25km, Tazigauk 1.6 km. Monatkon 3.1 km, Ngabetkya 14 km, Padukpin 1.4 km, Sakangyi 0.25 km, Natmi 10 km. The maximum area impacted would be Ngabetkya well site with a road length of 14 km (see **Figures 6-2 to 6-7**).

Surface Water Run-off from Stream Crossings

The proposed access roads will require some stream crossings. The stream crossings have been designed based on the expected water volume. The crossing types and locations are described in **Table 6-25**.

The stream crossings may cause disturbance to water bodies and water flow including alteration of hydrology, possible sedimentation, the establishment of non-native invasive plant species and visual disturbance. The extent of the disturbance will depend on the activity along with the location and

characteristics of the existing vegetation, topographic features and waterways. The water crossings have been engineered with causeways, box culverts and 12” culverts. The Natmi well site will require a river crossing, however due to the size of the stream no permanent installation will be constructed and vehicles and equipment will complete a shallow river crossing to access the well site.

Table 6-25: Crossing the stream for Proposed Access Road

Description	Coordinate
MNK	
1. Culvert box	19°31'16.7"N 95°00'41.1"E
2. Causeway#4	19°31'11.2"N 95°00'41.6"E
3. Causeway#3	19°30'57.4"N 95°00'07.4"E
4. Causeway#2	19°30'53.4"N 94°59'58.5"E
5. Concrete pipe 12"	19°30'47.8"N 94°59'44.4"E
NBK	
1. Culvert box	19°25'13.5"N 94°58'56.7"E
2. Cause way	19°25'41.5"N 94°59'03.5"E
Natmi	
1. River Crossing	No installation required. Shallow River crossing will be carried out by equipment only.

6.4.4.3 Significance of Impacts

Without mitigation measures, impact on hydrology will be local in extent and transient, short term and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be a Medium.

The Significance Ranking of impacts from vegetation removal, construction of well sites and access roads on surface water hydrology is rated as **Medium**. (**Table 6-26**)

Table 6-26: Sigificance Ranking of impacts to Surface Water Hydrology

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High

Significance	Positive	Negligible	Low	Medium	High

6.4.4.4 Impact and Risk Mitigation Measures

Impacts from runoff can be mitigated through the use of the following measures:

Environment Impact Assessment –Construction and Installation Phase			
4. Surface Water Hydrology	4.1 Construction of roads and well / camp sites	4.1.1 Alteration of surface water hydrology	4.1.1.1 Avoid construction of well sites in areas that may cause obstacles to water drainage.
			4.1.1.2 Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant authorities.
			4.1.1.3 Limiting access road gradients to reduce runoff-induced erosion.
			4.1.1.4 Providing adequate road drainage based on road width, surface material, compaction, and maintenance.
			4.1.1.5 Depending on the potential for adverse impacts, installing free-spanning structures (e.g., course way) for road watercourse crossings.
			4.1.1.6 Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna
			4.1.1.7 For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water.
			4.1.1.8 Minimize areas to be cleared. Use hand cutting where possible, avoiding the use of heavy equipment such as bulldozers, especially on steep slopes, water and wetland crossings, and forested and ecologically sensitive areas.

6.4.4.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts from vegetation removal, construction of well sites and access roads to surface hydrology will be reduced resulting in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.5 Assessment of Impacts to Surface Water Quality

6.4.5.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Quality	Construction Phase	Access road and Site Construction Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Increase in erosion and potential contamination from spills or wastewater drainage to nearby water bodies

6.4.5.2 Assessment of Impacts from Access Road and Site Construction

Sources of impact on surface water quality from construction of access roads and well site, and site runoff and drainage are soil erosion in the construction area that might wash soil into surrounding surface water and contamination such as machine repairing and changing of lubricating oil.

Some erosion and soil loss are unavoidable during land-disturbing activities. While proper siting and design will help prevent areas prone to erosion from being developed, construction activities will invariably produce conditions where erosion may occur. However, the flat slope of the land and the timing of construction will limit downstream impacts.

6.4.5.3 Assessment of Impacts from Site Runoff and Drainage

Sources of impact on surface water quality during the construction phase include discharge of effluent from worker accommodations, soil erosion in the construction area that might wash soil into surrounding surface water, and contamination from machine repairing and changing of lubricating oil. Impacts from non-hazardous and hazardous wastes spills are discussed in **Section 6.16.4.**

Both runoff volume and suspended solids concentrations can increase during and after construction. For this project, the maximum runoff volume for an extreme rain event increases from 958.8 m^3 for pre-construction to 1691.2 m^3 during construction (detailed calculation are provided under Surface Water Hydrology, **Section 6.4.4**. The typical suspended solids (SS) concentration from different surfaces is provided in **Table 6-27**.

Table 6-27: Typical Suspended Solids Concentration in Runoff

Source Area	Suspended Solids Concentration
Landscaped area	500 mg/L
Construction site	10,000 mg/L
Unpaved parking	250 mg/L
Detention pond water	10 mg/L

Source: Pitt and Clark. 2002[5]

The overall suspended solids load during construction is substantially higher than before construction. Construction is expected to last 150 days for each well site area. The Actual maximum annual rainfall will be well below the worst case of a maximum month's equivalent rainfall event of 234.8 mm/hr used the calculate runoff from the project well site.

[5] Pitt, R. and S. Clark. 2002. Emerging stormwater controls for critical areas. Pp. 104-136. In Wet weather flow in the urban watershed. Technology and Management. Field, R. and D. Sullivan. (Eds)

The typical SS concentrations from different surfaces are combined with the rainfall intensity of a ½-hr duration storm with a return period of 10 years to determine the maximum runoff load in **Table 6-28**.

Table 6-28: Suspended Solids (SS) Runoff from the well site

No	Well site	Q (Existing)	Existing SS Load (kg)	Q (Construction)	Construction SS Load (kg)
1	Central Camp Site	200	100	352	3,525
2	Typical Layout	959	479	1,692	16,919
3	PDP	655	328	1,156	11,559
4	MNK	802	401	1,415	14,150
5	NBK	991	495	1,748	17,483
6	SKG	1,047	523	1,847	18,470

The calculations indicate that the runoff volume and levels of maximum suspended solids in runoff is potentially much higher during construction than before construction. It should be noted that the values calculated in **Table 6-28** are based on an extreme rainfall. The chance that this extreme event would happen within the construction window for this project is very small.

Any siltation from surface runoff generated during construction activities is unlikely to travel far. Sustained elevated turbidity levels from runoff can reduce transmission of sunlight, thus limiting photosynthesis. In turn, this can reduce the level of oxygen in the water. Organic matter introduced into a watercourse can lead to further deoxygenation as microorganisms decompose the organic matter and result in eutrophication. If oxygen levels fall below the natural DO variability in a system, flora phytoplankton, zooplankton and benthos diversity and abundance could decline.

Erosion from Stream Crossing Construction

The construction of the water crossing infrastructure could allow for mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters.

6.4.5.4 Significance of Impacts

Without mitigation measures, impacts to surface water quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on surface water quality and aquatic biota from land and habitat disturbance is **Medium**. (**Table 6-29**)

Table 6-29: Sigificance Ranking of impacts to Surface Water Quality and Aquatic Biota

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.5.5 Impact and Risk Mitigation Measures

Impacts to water quality and aquatic biota can be mitigated through the use of the following measures:

Environment Impact Assessment –Construction and Installation Phase			
5. Surface Water Quality	5.1 Construction of roads and well / camp sites and site runoff and drainage	5.1.1 Degradation of surface water quality from runoff/drainage	5.1.1.1 The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization.
			5.1.1.2 Provide drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil.
			5.1.1.3 Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.
			5.1.1.4 Avoid construction of the well pad in areas where such construction obstructs water drainage.
			5.1.1.5 Prohibit workers from cleaning machines/equipment in/near a water source.
			5.1.1.6 Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
			5.1.1.7 Provide a level storage area for construction materials (such as soil, sand, and stone) to limit soil erosion.
			5.1.1.8 Scheduling construction in dry season to avoid heavy rainfall periods suspending activities during extreme rainfall and high winds to the extent practical.
			5.1.1.9 Contouring the access road and causeway infrastructure to minimizing length and steepness of slopes
			5.1.1.10 Mulching and Re-vegetating slopes promptly to stabilize exposed areas
			5.1.1.11 Engineer Designing channels and ditches for post-construction flows

			5.1.1.12 Lining steep channel and slopes (e.g. use jute matting)
			5.1.1.13 Reducing or preventing off-site sediment transport through use of silt fences

6.4.5.6 Residual Impacts and Risks

With these management measures, the magnitude of impacts to *surface water quality and aquatic biota from land and habitat disturbance* will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			(highlighted)		

6.4.6 Assessment of Impacts to Ground Water Quality

Resource/Receptor	Project Phase	Activity	Impact
Groundwater Quality	Abandonment Phase	Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table

6.4.6.1 Assessment of Impacts from Site Drainage, Hazardous/Non-hazardous Waste Management and Chemical Management

Activities during construction that may affect groundwater quality include fuel spillage, hazardous/non-hazardous wastes and chemical spills. Contamination of groundwater from drained domestic waste and grey water may also leach into the water table.

During construction fuel will be stored in a bunded area and wastes will be separated and stored in a secure location in appropriate containers. Wastes will ultimately be sent for disposal at a permitted waste disposal facility. Chemicals will be placed on the water proof concrete cement base, with roof and over flow curve to contain any spills. Any spills will be immediately cleaned up using the spill kits provided on site.

The wastewater and sewage will be collected in a plastic-lined sewage pit with a capacity of 8 m^3 (8000 litres). It is estimated that some 7 m^3 (7000 litres) of combined sewage and waste water will be produced each day during maximum manned operations (100 people). A septic tank will be installed on all locations for preliminary wastewater treatment then overflow to infiltration field. The sewage sludge from the septic tanks will be left in the septic tank onsite.

6.4.6.2 Significance of Impacts

Without mitigation measures, impacts to groundwater quality are therefore expected to be local in extent, short-term in duration and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on groundwater from site drainage, hazardous/non/hazardous waste management and chemical management is **Medium**. (**Table 6-30**)

Table 6-30: Sigificance Ranking of impacts to Groundwater Quality

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.6.3 *Impact and Risk Mitigation Measures*

Impacts to groundwater quality can be mitigated through the use of the following measures:

Resource/Receptor	Project Phase	Activity	Impact
7 Groundwater Quality	7.1 Hazardous/Non Hazardous waste management and chemical handling	7.1.1 Contamination of groundwater from waste, chemicals and wastewater	7.1.1.1 Prohibit workers from cleaning machines/ equipment in unauthorized locations.
			7.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, or oil in unauthorized locations.
			7.1.1.3 Install septic tank on each well site for holding sewage and grey water.
			7.1.1.4 Store wastes and chemicals in a secure area that has a hard surface and closed drains.

6.4.6.4 *Residual Impacts and Risks*

With these management measures, the magnitude of impacts to groundwater from site drainage, hazardous/non/hazardous waste management and chemical management will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.7 Assessment of Impacts to Soil Quality

6.4.7.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Soil	Construction Phase:	Access road and Site Construction Site Runoff and Drainage Handling of Materials and chemicals Hazardous/non-hazardous waste management	Soil contamination Erosion, soil disturbance, soil compaction

6.4.7.2 Assessment of Impacts from Access Road and Site Construction

General construction activities have the potential to result in adverse impacts on soil resources as a result of soil loss due to erosion. Sources of impact on soil properties during construction include soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil.

The well pad area will be stripped of topsoil and levelled; the subsoil in the area will be covered with a compacted granular fill. If well testing indicates that the oil or gas reserves are not commercially viable to produce, the site will be restored to its original condition on site abandonment.

Without mitigation measures, well and camp site areas might erode during construction phase due to site runoff and drainage. Lower land might be consequently be washed away by soil erosion and surrounded agricultural area might be affected.

6.4.7.3 Significance of Impacts

Without mitigation measures, physical disturbance and soil erosion impacts from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil are expected to be low in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the impact significance is determined to be a medium impact for environment.

The Significance Ranking of impacts from soil disturbance and soil erosion from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil is rated as Medium. (**Table 6-31**)

Table 6-31: Sigificance Ranking of impacts to soil disturbance and soil erosion

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.7.4 Impact and Risk Mitigation Measures

Impacts to soils can be mitigated through the use of the following measures:

Environment Impact Assessment –Construction and Installation Phase			
6. Soil quality	6.1 Construction of roads and well / camp sites	6.1.1 Degradation of soil quality through compaction or erosion during construction.	6.1.1.1 Limit soil compaction only to well sites and access roads.
			6.1.1.2 Exposed site areas should be kept to a minimum during construction
			6.1.1.3 Provide effective construction site run-off control and design.

6.4.7.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts from soil disturbance and erosion from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil will be reduced, resulting in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.8 Assessment of Impacts to Flora & Fauna

6.4.8.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Flora & Fauna	Construction Phase	Access road and Site Construction Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Labour and Accommodation	Degradation or destruction of natural habitat Harvesting of plants and animals by Human activity

Sources of potential impact on flora and fauna include access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation. Soil compaction can inhibit root penetration and reduce water infiltration, which can increase runoff and erosion or cause ponding. These conditions limit or inhibit plant growth.

6.4.8.2 Assessment of Impacts from Site Clearing and Construction of Access Road and Site

The project area consists of agricultural (i.e., paddy field and crop) and scrubland & forested (i.e., grass and shrubs, mixed deciduous forest/disturbed deciduous forest, dry evergreen forest/disturbed evergreen forest, disturbed deciduous forest, deciduous dipterocarp forest, and dense deciduous forest). Access road and site construction will potentially destroy some flora and fauna habitat.

Each well site will have similar construction plans. The estimated well site area will be 240 x 200 m for a total area of 48,000 m^2 per well site. The well site and accommodation campsite near by Thayet Township will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders.

The source of impact from the site preparation is caused by soil excavation/filling and construction of access road/well pad activity. The project area mainly consists of farming, agricultural and forested areas with agriculturally dominated communities and access roads. The agriculture areas are used to grow rice, beans/pulses, corn and sesame.

The project will cause changes to local habitat of the well site and surrounding areas. The effect will be limited to the construction areas and access road. The habitat of the area within a 5-km radius of the exploration well site will be largely unaffected, because the construction areas for the well site and access road consist of only 0.2 % of the total area.

Clearance

The rented area that will used as well site will be cleared, covered with laterite to construct the well pad. Any potential loss of tree habitat will be compensated at that stage. The project site is out of the any Reserved Forest.

Physical Disturbance

Soil compaction can inhibit root penetration and reduce water infiltration, which can increase runoff and erosion or cause ponding. These condition limit or inhibit plant growth.

The construction area will be marked and contractors will be required to stay within the designated area, preventing compaction of soil beyond the access road and the site.

The activities of the project area may effect wildlife such as disturb to the animal habitat, the transportation will cause and increase in the noise levels and an increase in disturbance. The potential impacts from the movement of vehicles and drilling rigs associated with the exploration drilling campaign are:

- Disturbance leading to behavioral changes or displacement of fauna
- Increased likelihood of incidents

The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation. Some behavioral disturbance may occur for short periods if fauna are present or near access road and project site.

Human activity will be confined to the access road and well sites and will not constitute a new impact on the area, which is already regularly visited by people. Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife. In addition, hunting and

trapping will be specifically prohibited and violations are grounds for termination of contract and dismissal.

The well site area is an existing agricultural paddy areas and open forest areas with limited natural terrestrial flora. As standard practice, PTTEP SA will ensure that its staff and contractors will not cut trees or forage in the area surrounding the well sites during any phase of the project. No protected area or reserved forest area are located near the project sites.

6.4.8.3 Assessment of Impacts from Site Runoff and Drainage to Aquatic Biota

Clearance, construction of well site, upgrading of access road/well site and wastewater drainage could affect aquatic biota**.** Runoff water from the project area may affect the surface water quality which may affect the phytoplankton, zooplankton and benthos.

Runoff containing certain chemicals can cause water quality deterioration by increasing nutrient and/or organic matter loads (which can lead to eutrophication of water bodies from organic matter decomposition by micro-organisms), and by introducing toxic material into the water bodies. The potential for impacts from silt in runoff from the well site is minimal once the construction is complete; the suspended solid load following construction is practically identical to the pre-construction load.

The construction of the access roads and well sites may cause effect to the aquatic habitat due to alterations from high suspended sediments from erosion caused by vegetation removal. Sustained elevated turbidity levels from runoff can reduce transmission of sunlight, thus limiting photosynthesis. In turn, this can reduce the level of oxygen in the water. Organic matter introduced into a watercourse can lead to further deoxygenation as the organic matter is decomposed by micro-organisms and results in eutrophication. If oxygen levels fall below the natural DO variability in a system, flora phytoplankton, zooplankton and benthos diversity and abundance could decline.

6.4.8.4 Significance of Impacts

The impact to flora and fauna from access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation will be local in extent, short-term in duration, reversible and of low-magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be low.

The Significance Ranking of impacts to terrestrial flora and fauna from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance is rated as **Low**. (**Table 6-32**)

Table 6-32: Significance Ranking of impacts to terrestrial flora and fauna from access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation.

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.4.8.5 Impact and Risk Mitigation Measures

Impacts to terrestrial flora can be mitigated through the use of the following measures:

Ecological Environment Impact Assessment – Construction and Installation Phase			
7. Flora and Fauna	7.1 Site Clearing for Construction of roads and well / camp sites	7.1.1 Degradation or destruction of natural habitat	7.1.1.1 High valued habitat to be avoided where practicable in the design process.
			7.1.1.2 Remove vegetation in project areas only (roads, camp site, well site).
			7.1.1.3 Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
	7.2 Construction of roads and well site/ camp sites	7.2.1 Habitat degradation from construction	7.2.1.1 Minimize noisy construction work during daytime hours only.
			7.2.1.2 Limit vegetation removal to a minimum.
			7.2.1.3 Limit to cut the tree only in well site and access road.
			7.2.1.4 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation or wildlife.
			7.2.1.5 Hunting and trapping will be specifically prohibited.
	7.3 Site Runoff and Drainage	7.3.1 Habitat degradation of aquatic biota	7.3.1.1 Avoid the construction of the well pads in areas where such construction obstructs a water route.
			7.3.1.2 Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
			7.3.1.3 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to aquatic biota. In addition, fishing will be specifically prohibited.
			7.3.1.4 Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
			7.3.1.5 Provide drip pans and absorbents at fuel storage area to contain any spillage.
			7.3.1.6 Strictly implement and follow mitigation measures for impacts to

			soil and surface water hydrology and quality.

6.4.8.6 Residual Impacts and Risks

With these management measures, the residual significance of impacts to flora and fauna from access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste, and labor and accommodation is determined to be **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5 Environmental Impact Assessment during Drilling Phase

Key issues identified by the screening process must be assessed to determine their impacts during the drilling phase, including:

- Air quality
  - Dust
  - Air Pollution
  - Hydrogen Sulfide
  - Greenhouse Gas
- Noise
- Heat and Light
- Soil
- Surface Water Quality
- Groundwater quality
- Flora and Fauna

6.5.1 Assessment of Impacts to Air Quality

6.5.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Air Quality/ Climate	Drilling Phase	Rig Move Vehicle and Equipment Use	Deterioration of air quality from fuel combustion and release of hydrogen Sulfide during the drilling phase Greenhouse Gas

6.5.1.2 Assessment of Dust Impacts from Vehicle and Equipment Use

Vehicles driving on gravel/dirt roads during the drilling phases will disperse dust. Vehicles grind dust into fine particles lifted into the air by tire rotation and eddy air currents (Hesketh et al., 1983).

Dust dispersion can lead to a temporary deterioration in air quality by increasing TSP (Total Suspended Particulates) and PM_{10} (Particulate Matter <10 microns, units mg/m^3) concentrations.

During transportation of materials and equipment during drilling, sensitive receptors within a 2-km radius of the well sites may be affected by impacts to air quality. These receptors are mostly located in rural area and include:

- Village Households
- Pagodas, Monasteries
- Schools
- Fields

The sensitive receptors near the well site are shown in **Section 6.1.3.** The closest sensitive receptors from the proposed wells are is over 500 m from the well sites. The two closest receptors are Nga Bat

Kya village (0.7 km) from the proposed wellsite and Shan Kyaw Village and Ban Kyin (0.8 km each) from the respective proposed well sites.

Vehicles driving on laterite roads or off road will disperse dust: vehicles grind dust into finer particles, and tire rotation and eddy air currents lift particles into the air (Hesketh *et al.*, 1983). This dust will temporary affect air-quality in the area depending on the season.

6.5.1.3 Significance of Impacts

Without mitigation measures the impacts to air quality from nuisance dust are expected to be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts to air quality from nuisance dust is rated as **Medium**. (**Table 6-33**)

Table 6-33: Sigificance Ranking of impacts to Air Quality from Nuisance Dust

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

In general, the potential impact is estimated for a worst case scenario; in reality vehicles and equipment will only be used intermittently. Therefore, the emissions will be less than presented above.

Based on the ranking, nuisance dust from the construction phase is considered as medium. Dust emissions from the construction activities are expected to potentially deteriorate the existing status of air quality around the project area especially during the dry season and when winds blow from the construction site to nearby communities.

The impacts would be short-term and limited to localized areas. But, if there were no mitigation measures, dust emissions can cause nuisance close to the construction sites, so would potentially affect construction workers, villagers and the environment.

6.5.1.4 Assessment of Impacts from Vehicle and Equipment Use

Air pollutants come from various sources: fugitives and exhausts, fuel combustion, gas and oil processing, evaporation, flaring, waste incineration, refrigerators and freezers, vaporization from drilling muds, etc.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane. The major contributor of air pollutants will be the diesel generators on site during drilling. Estimated carbon dioxide emissions are discussed under Greenhouse Gases in **Section 6.5.1.8**.

Drilling Rig Diesel Generators

Diesel generators will be used as a source of power supply for drilling. The generators will operate 24 hr/day throughout a drilling period of 60 days for each well.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion of 8 m^3/day for the Land Drilling Rig.

This will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 6-34**.

The total emission values are a worst case scenario for two wells. The rig is powered by 4 diesel driven generator sets and each rated 600KVA to supply the rig site with power.

Table 6-34: Air pollution emissions from Drilling per Well

Air Pollutant	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day/well)	Total Emission (tonnes)
Drilling Rig Century Generator and Camp Site – (8 m^3/day/well), 60 days per well			
Nitrogen Oxides (NO_x)	1,896	0.552	**33.1**
Sulphur Oxides (SO_x)	126	0.037	**2.2**
Carbon Monoxide (CO)	410	0.119	**7.14**

*Includes 60 days of drilling/well
Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January 1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf.

6.5.1.5 Significance of Impacts

Without mitigation measures, the impact from air pollutants will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from air pollutants is ranked **Medium**. (**Table 6-35**)

Table 6-35: Sigificance Ranking of impacts from Air Pollutants

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.1.6 Assessment of Impacts from Hydrogen Sulphide

Gas produced from the wells is constantly analysed for its composition and for the presence of hydrogen sulphide (H_2S). Hydrogen sulfide is a colorless, flammable, highly toxic gas. US Occupational Safety and Health Administration's (OSHA) occupational standard in the workplace is 10 ppm (8hr. TWA (time weighted average) and 15ppm (15min. STEL (short term exposure limit)); NIOSH IDLH (immediately dangerous to life or health) = 100 ppm. The potential for H_2S is a possibility but unlikely.

H_2S detection and safety equipment is standard issue (see **Section 4.5.7.4**). PTTEP SA have developed emergency response plan (ERP) to support emergency cases. The drilling contractors too have their own H_2S Contingency Plan.

6.5.1.7 Significance of Impacts

Without mitigation measures, hydrogen sulphide impacts during drilling will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from hydrogen sulphide release is rated as **Medium**. (**Table 6-36**)

Table 6-36: Sigificance Ranking of impacts from Hydrogen Sulphide

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.1.8 Impacts from GHG Emissions

The potential sources of deterioration of air quality are fuel combustion from:

- Vehicle Emissions
- Diesel Generators (Drilling Rig and Camp site)

The sensitive receptors for greenhouse gas emissions are the same as those listed for dust emissions.

The GHG emissions are estimated following the Tier 1 approach of IPCC (2006). GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O). The estimated GHG emissions for the project is shown in **Table 6-37**.

Total greenhouse gas emissions during for the project (4 exploration wells) amounts to 10658.8 ton eq CO_2. When compared with available data on Myanmar's national CO_2 equivalent GHG emissions of 184,710,000 tonnes in 2012, including land use change (World Resources Institute, Climate Analysis Indicators Tool (CAIT)), the GHG emissions arising from the proposed activities are insignificant (approximately 0.0058%), and therefore will not significantly impact the environment.

Table 6-37: Estimated Total GHG Emissions per Well

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Drilling	Equipment and Supplies	10.3
	Drill cuttings transport	43.5
	Transport (fuel, water, personnel)	13.0
	Heavy equipment use	1299.5
	Generator to power drilling rig and camp site	1,298.4
Total per well		2,664.7

6.5.1.9 Significance of Impacts

Without mitigation measures, the impact from greenhouse gas emissions during drilling are considered to be a global issue and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from GHG emissions is **Low**. (**Table 6-38**)

Table 6-38: Sigificance Ranking of impacts from GHG Emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High

Significance	Positive	Negligible	Low	Medium	High
			■		

6.5.1.10 Impact and Risk Mitigation Measures

Potential impacts from dust dispersion can be mitigated by application of the following measures:

Environment Impact Assessment –Drilling Phase			
1. Air Quality	1.1. Vehicle and Equipment Use	1.1.1. Deterioration of air quality due to dust.	1.1.1.1. Implement construction and installation phase mitigation measures in 2.1.
	1.2. Vehicle and Equipment Use	1.2.1. Deterioration of air quality due to vehicle emissions.	1.2.1.1. Implement construction and installation phase mitigation measures in 2.2.
	1.3. Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	1.3.1.1. Install Gas Detectors to response during emergency situation.
			1.3.1.2. If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).
			1.3.1.3. All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.
	1.4. Vehicle and Equipment Use	1.4.1. *Climate Change due to GHG*	1.4.1.1. Implement construction and installation phase mitigation measures in 2.3.

6.5.1.11 Residual Impacts and Risks

With these management measures, the magnitude of impacts to air quality from nuisance dust, hydrogen sulphide, air pollutants and GHG emissions will be reduced resulting in a residual significance that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.5.2 Assessment of Impacts to Noise

6.5.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Noise	Drilling Phase	Rig Move Drilling Wells Vehicle and Equipment Use	Increased noise and vibration

6.5.2.2 Assessment of Noise Impacts from Drilling

The compounded noise level will be generated during drilling operations will last for 60 days.

During drilling operations, the highest compounded noise level at the site is expected from the drilling rig and two generators working simultaneously. Using **Equation 6-4**, the compounded noise level is:

$$Leq_{\,(Total)} = 10 \text{ Log } [(10^{81/10}) + (10^{85/10})] = 86.5 \text{ dB (A) at 50 feet from noise source}$$

Drilling activities will last 60 day for each well. Drilling noise levels at sensitive receptors using **Equation 6-3** are combined with ambient noise measurements taken within MOGE-3 had 24-hour equivalent noise levels ranged that from 37 dB (A) to 42 dB (A) using **Equation 6-4** into a specific noise level. The drilling noise and specific noise levels at sensitive receptors are shown in **Table 6-39**.

Table 6-39: Noise Calculations during Drilling

Wellsite	Receptor	Distance (km)	Noise at Receptor	Specific Noise	Nuisance Noise
Monatkon	Baw (South)	2000	44.1	46.2	4.2
Ngabetkya	Nga Bay Kya	700	53.3	53.6	11.6
Padaukpin	Pi Tauk Pin	1800	45.1	46.8	4.8
Sakangryi	Taung Baw	1600	46.1	47.5	5.5
Banbyin	Ban Pyin	800	52.1	52.5	10.5
Taziquak	Ta see Kauk (East)	1800	45.1	46.8	4.8
Natmi	Pauk U Kar	3100	40.3	44.3	2.3
Talaba	Yea Myet	1300	47.9	48.9	6.9

The nuisance noise level can exceed the nuisance noise standard of 10 dB (A) at Ngabetkya and Banbyin well sites. The estimated noise levels present an absolute worst-case condition: the surrounding trees and other vegetation and the topography will lead to a far more rapid attenuation. Drilling activities are expected to last approximately 60 days for each well; noise levels will return to previous levels upon cessation of drilling activities.

On the well site itself, all workers will be issued with standard safety equipment, including ear protectors, and their use will be strictly enforced where required by regulations in areas with high levels of noise and vibration. This is the standard industry practice on all rigs and part of the routine health and safety procedures.

The assessment of noise impacts from Vehicle and Equipment use is the same as during construction phase in **Section 6.4.3.**

6.5.2.3 Significance of Impacts

Without mitigation measures, impacts from noise from Drilling to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

The Significance Ranking of impacts from Noise to sensitive receptors is rated as **Low**. (**Table 6-40**)

Table 6-40: Sigificance Ranking of impacts from Noise to Sensitive Receptors

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High

Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.2.4 *Impact and Risk Mitigation Measures*

Impacts from noise can be mitigated through the use of the following mitigation measures:

Environment Impact Assessment –Drilling Phase			
2. Noise	2.1. Well Drilling and Vehicle and Equipment Use	2.1.1. Increase in noise levels during exploration drilling.	2.1.1.1. Install noise barrier at the well site boundary toward nearest community
			2.1.1.2. Ensure use of mufflers on diesel/gas driven machinery.
			2.1.1.3. Ensure all machinery and vehicles are properly checked and inspected.

6.5.2.5 *Residual Impacts and Risks*

With these management measures, the residual significance from the impact of noise to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.3 Assessment of Impacts to Heat and Light

6.5.3.1 *Scope of Assessment*

Resource/Receptor	Project Phase	Activity	Impact
Heat and Light	Drilling Phase	Drilling Wells	Lighting on the site at night

6.5.3.2 *Assessment of Light Impacts from Artificial Light Sources*

Project components of the exploration program are to be artificially lit to varying extents during all phases of the project, therefore generating light spill. Light emissions will occur from vehicles, drill rig, well site and campsite. Site preparation and abandonment will be carried out in daylight. Hence,

light impacts will not be relevant during these project phases. Drilling will be conducted on a 24-hour basis. Lighting on the site will be kept to a minimum and directed so that, consistent with safety and security, as little as possible falls outside the pad area and should be partly or fully hidden by scattered trees, thickets and topography.

Artificial light can disrupt biological processes that rely on natural light for visual cues. Terrestrial fauna that are known to be sensitive to light and may be disorientated, attracted to or repelled by light spill including mammals, reptiles and birds. The amount of light spill emanating from project activities will vary according to the number of light sources, wavelength and intensity of light sources, location of and/or placement of fittings and the method of light switching (rapid or gradual turning on of light sources).

This section discusses the impacts of light spill on ecological receptors identified within or adjacent to the project area.

Light Sources

Sources of artificial light for project will include:

- Functional lighting on vehicles and drill rig, camp site and well site

Functional Lighting

Functional lighting is required on vehicles, drill rigs, campsite and well site at levels that provide a safe working environment for personnel. Lighting typically consists of bright white lights, used in accordance with safety requirements. Working lights will be directed into the site so that impacts from working lights will be minimized off-site.

6.5.3.3 Significance of Impacts

Without mitigation measures, impacts from light emissions to sensitive receptors occurring from vehicles, drill rig, well site, campsite and flaring are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts to light emissions is rated as **Low**. (**Table 6-41**)

Table 6-41: Sigificance Ranking of impacts from light emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.3.4 Impact and Risk Mitigation Measures

Impacts from light can be mitigated through the use of the following measures:

Environment Impact Assessment –Drilling Phase			
3. Heat and Light	3.1. Functional lighting on vehicles and drill rig, camp site and well site during Drilling Wells.	3.1.1. Lighting on the site at night	3.1.1.1. Drilling Rig located in area distant to sensitive receptors.
			3.1.1.2. Keep night lighting to a minimum, consistent with safety and security.
			3.1.1.3. Direct lighting to the inside of the well sites.

6.5.3.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from heat and light is determined to be **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.4 Assessment of Impacts to Surface Water Quality

6.5.4.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Quality	Drilling Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals	Potential contamination from spills or wastewater drainage to nearby water bodies

6.5.4.2 Assessment of Impacts from Site Runoff and Drainage

Activities during drilling that may affect surface water quality include chemical storage and handling, fuel storage and handling and the drilling operation itself. The sensitive receptors are the same as those identified for the construction phase.

The volume of runoff from the well site will be calculated from the volume of the heaviest rainfall within 30 minutes with a month's equivalent rainfall in one hour. The volume of the cuttings pit (2300 m^3) and concrete lined cutting pit is much more than the volume of the extremely heavy runoff. Therefore, the cuttings pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the cuttings pit will be monitored regularly. If water level in the cuttings pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit. Around well site area, the buffer zone and earth bun will be provided and served as a secondary containment. The earth bun will contain the runoff from the well site. The bun will be excavated 1.5 m high.

Calculation of surface water drainage from a well site is subdivided based on the various surfaces. Drainage calculated from each distinct area is outlined in **Table 6-42**.

Table 6-42: Runoff Distribution from Well Site and Capacity of Receiving Areas

Areas	Project Site Areas	Catchment Area (A)	Runoff Coefficient (C)	Runoff (Q) for extreme ½ hr storm	Receiving Area
Well Site					
Rig Pad	Rig Pad: Drilling Rig, Mud Tanks and Pumps, Cement Units, Generators, Solid Control Equipment (reinforced concrete pad)	20x20 m = 400 m^2	0.95	24.5 m^3	Cuttings pit Capacity 2,300 m^3/pit
	Cuttings Pit	40 m x 30 m = 1,200 m^2	1	77.5 m^3	
Well site and Camp site	Well site Pipe Storage, Work Shops, Offices	48,000 m^2 (well pad) –400 m^2 (rig pad) – 1200 m^2 (waste pit) = 46,400 m^2	0.35	1908.1 m^3	Cuttings pit Capacity 2,300 m^3/pit
	Accommodation camp (compacted fill)	80 m x 120 m = 9,600 m^2	0.35	144.6	Off site through drainage system with weir and oil trap

The uncontaminated runoff water from the camp site area will discharge to a drainage system surrounding the area passing with an off site flow rate of 144.6 m^3 for the extreme ½ hr storm. Runoff after campsite construction is greater than runoff prior to construction; the compacted granular fill will inhibit infiltration compared to pre-construction conditions.

The contaminated runoff water from rig pad will drain only to designated cuttings pit (capacity 2,300 m^3). The runoff from the rig pad and well site combined with rain falling on the waste pit for a ½-hr duration storm totals 2010.1 m^3. The waste pit has an actual holding capacity of 2,300 m^3. The waste pit can therefore contain much more rainfall than the rainfall intensity of a ½-hr duration storm a month's equivalent rainfall in one hour. In the unlikely event that the waste pit should become full and overflow, tanker trucks are prepared to drain rainwater from the pit. This can be stored for later use as mix water, or if contaminated, will be disposed of at approved disposal site.

Runoff containing certain chemicals or drill fluid additives can cause water quality deterioration by increasing nutrient and/or organic matter loads (which can lead to eutrophication of water bodies from organic matter decomposition by micro-organisms), and by introducing toxic material into the water bodies. The potential for impacts from silt in runoff from the well site is minimal once the construction is complete; the suspended solid load following construction is practically identical to the pre-construction load.

On site fuel will be stored in steel tanks that sit on an area lined with a tarpaulin and surrounded by a bund wall. The well site area of including the mud tanks and pumps, cement units, generators and solid control equipment is designed with an intermediate drainage system to drain all rainwater run-off into the waste pit.

These measures will create a zero-discharge well site and should ensure there is no release of contaminated water from the well sites. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site, and will be disposed of by the local authority.

6.5.4.3 Significance of Impacts

Without mitigation measures, impacts to surface water quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area

currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on surface water quality and aquatic biota from land and habitat disturbance is **Medium**. (**Table 6-43**)

Table 6-43: Sigificance Ranking of impacts to Surface Water Quality and Aquatic Biota

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.4.4 Assessment of Impacts from Sewage and Sludge

Sewage and sludge (grey water generated from domestic processes such as dish washing, laundry and showers) will be generated at the campsite and well site. The disposal of sewage and sludge will be managed in accordance with PTTEP SA Waste Management Procedure.

The wastewater and sewage will be collected in a plastic-lined sewage pit with a capacity of 8 m^3 (8000 litres). It is estimated that some 7 m^3 (7000 litres) of combined sewage and waste water will be produced each day during maximum manned operations (100 people). A septic tank will be installed on all locations for preliminary wastewater treatment then overflow to infiltration field. The sewage sludge from the septic tanks will be left in the septic tank onsite.

Without mitigation measures, impact on from sewage and sludge on soil, surface and ground water resources will be local in extent and transient, short term in duration, reversible and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

The Significance Ranking of impacts from sewage and sludge on soil, surface and ground water is ranked as **Low**. (**Table 6-44**)

Table 6-44: Sigificance Ranking of impacts from sewage and sludge on soil, surface and ground water

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High

Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.4.5 Impact and Risk Mitigation Measures

Impacts to water quality and aquatic biota can be mitigated through the use of the following measures:

Environment Impact Assessment –Drilling Phase			
4. Surface Water Quality	4.1. Site Runoff and Drainage	4.1.1. Contamination of surface water from runoff and drainage	4.1.1.1. Implement construction and installation phase mitigation measures in 5.1.
			4.1.1.2. Provide drainage, buffer zone and earth bund surrounding well site area.
			4.1.1.3. The fuel storage will be surrounded by a bund wall in case of spill.
	4.2. Hazardous/non-hazardous waste management	4.2.1. Degradation of surface water quality from disposal of domestic sewage and grey water	4.2.1.1. Install concrete lined septic tank and soak away pit at the well site for holding & treating sewage..

6.5.4.6 Residual Impacts and Risks

With these management measures, the magnitude of impacts to *surface water quality and aquatic biota from land and habitat disturbance* will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.5 Assessment of Impacts to Soil Quality

6.5.5.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Soil	Drilling Phase:	Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and chemicals	Soil contamination from accidental releases

6.5.5.2 Assessment of Impacts from Site Runoff and Drainage

Wastewater drainage, Hazardous/non-hazardous waste management, Handling of materials and chemicals Spills of fuel and chemicals may cause contamination and/or the fertility of the soil to be reduced. Spills of fuel can occur during the transport of vehicles or fuel tanks on the project area. The project will clean chemical materials or oil spills immediately by using cleaning equipment on the drill that consisted of shovels, absorbents, and steel containers. The impact from spills is detailed in **Section 6.16.4**.

The well site and camp site have drainage which is derived from rainwater and wash down water that may contain minor quantities of oil, grease and detergents if present on the site. Runoff within the drilling area will be drained via drainage gutter into the cuttings pit, which will accumulate all of the runoff and contaminated water generated within the drilling area. Therefore, contaminated water from this area will go through an oil trap and end up in the concrete lined cuttings pit and won't escape to contaminate surrounding areas. The impact from run-off and drainage are detailed in **Section 6.5.4**.

The volume of the cuttings pit (2,300 m^3) and concrete lined cutting pit is much more than the volume of the extremely heavy runoff. Therefore, the cuttings pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the cuttings pit will be monitored regularly. If water level in the cuttings pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit. Around the well site area, the buffer zone and earth bun will be provided and served as a secondary containment. The earth bun will contain the runoff from the well site. The bun will be excavated 1.5 m high.

The cuttings and fluids contain potassium chloride, which are saline and residual hydrocarbons. The entry of saline and hydrocarbon contaminated fluids into the ground water may affect the growth of agricultural crops and be potentially toxic to terrestrial and aquatic flora and fauna. The cuttings and fluids may also contain heavy metals, which may contaminate soils and affect the growth of agricultural crops.

The volumes of cuttings produced during this project are unlikely to cause major local environmental impacts, particularly as cuttings will be bioremediated onsite or sent to the designated waste management facility.

Salinity levels are not predicted to be high, and the short duration of the drilling activity will not allow for the excessive evaporation levels required to concentrate and produce highly saline liquids.

6.5.5.3 Significance of Impacts

Without mitigation measures, impact from drill site drainage on soil, surface and ground water resources will be local in extent, short-term in duration, reversible and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

6.5.5.4 Impact and Risk Mitigation Measures

Impacts to soils can be mitigated through the use of the following measures:

Environment Impact Assessment – Drilling Phase			
5. Soil Quality	5.1. Drill site Site Runoff and Drainage	5.1.1. Contamination of soil from runoff	5.1.1.1. Implement drilling phase mitigation measures in 4.1.

6.5.5.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts from soil disturbance and erosion during the drilling phase, resulting in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.6 Assessment of Impacts to Ground Water Quality

Resource/Receptor	**Project Phase**	**Activity**	**Impact**
Groundwater Quality	Drilling Phase	Drilling wells Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table

Groundwater can be affected by liquid wastes generated during the drilling campaign in varying quantities and contain both hazardous and non-hazardous materials. Liquid wastes discussed in this section are:

- Lost Circulation Mud
- Infiltration from the Drill Cuttings and fluids waste pit and sub-irrigation field
- Naturally Occurring Radioactive Materials

The nearest water receptors are the community water ponds, intermittent streams and rivers. The sensitive receptors near the well site are shown in **Section 6.1.3** The closest sensitive receptor is Pun Canal (0.1 km) from the proposed well site 05 (Banbyin).

6.5.6.1 Assessment of Impacts from Lost Circulation of Drill Cuttings and Fluids

Once the well is spudded, the mud circulates in an essentially closed system. The practice of casing sections of the well with steel tubing, cemented in place as it is drilled, will prevent significant losses of mud to the formation and prevent groundwater contamination.

In the event of lost circulation, mud may be released into the surrounding formations via fractures. As lost circulation normally occurs in the reservoir section, which is much deeper than the surface aquifers, mud is not likely to impact aquifers.

If mud loss should occur, a series of steps will be taken to seal the well bore as follows:

- Pump in Lost Circulation Material (LCM) such as mica;
- If this does not work, try to drill through it with water and LCM;

- If this does not work, the well will be plugged with cement and re-drilled.

The drilling fluids that are used for the well will be returned to the surface from the annulus of the drill with rock cuttings, and may also contain small quantities of other fluids, such as hydrocarbons and produced water. Shakers will separate the fluids from the cuttings. For this exploration drilling program, The Drilling Program for this project will use Water Based Mud or Synthetic Based Mud (SBM) depending on results of subsurface and seismic interpretation. The majority of the components of the drilling mud systems are classified as low toxic with the exception of a few key chemicals. The toxicology for Caustic Soda (sodium hydroxide), Sodium Bicarbonate, Calcium Hydroxide, Polymeric Blend are shown in **Table** 6-109**.**

At the end of the first well location, the left over drilling mud will be transferred and used at the next well location. At the end of drilling campaign the left over mud will be sent back to mud contractor for reuse or use for other drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs. Approximately 1500 m^3 per well of cuttings would be disposed during the drilling process. Discharged cuttings will contain some residual water-based mud, and residual hydrocarbons and any other contaminants such as heavy metals. There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the designated waste management facility.

6.5.6.2 Significance of Impacts

Without mitigation measures, impact from drill cuttings and fluids on soil, water, and flora and fauna will be local in extent and transient, reversible, medium term duration and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Risk Ranking of impacts from drill cuttings and fluids on soil, water, and flora and fauna disposal is rated as **Medium**. (**Table 6-45**)

Table 6-45: Sigificance Ranking of impacts from drill cuttings and fluids on soil, water, and flora and fauna

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.5.6.3 Assessment of Impacts from Infiltration

Infiltration is the process by which water on the ground surface enters the soil. The septic tanks will use a sub-irrigation infiltration field to treat the grey water from the project site. This field will be installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters. Infiltration is also possible from the waste pit.

The volume of the cuttings pit (2,300 m^3) and concrete lined cutting pit is much more than the volume of the extremely heavy runoff. Therefore, the cuttings pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the cuttings pit will be monitored regularly. If water level in the cuttings pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit. Around the well site area, the buffer zone and earth bun will be provided and served as a secondary containment. The earth bun will contain the runoff from the well site. The bun will be excavated 1.5 m high.

6.5.6.4 Significance of Impacts

Without mitigation measures the impacts to groundwater quality from site runoff and drainage are expected to be local in extent, potentially medium-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium.

The Significance Ranking of impacts from site runoff and drainage of the cuttings and dirty water waste pit to groundwater quality is rated as **Medium**. (**Table 6-46**)

Table 6-46: Sigificance Ranking of impacts from site runoff and drainage of the cuttings and dirty water waste pit to groundwater quality

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.5.6.5 Impacts from Naturally Occurring Radioactive Materials

No produced formation water is expected for the exploration drilling campaign. Produced water can contain small quantities of naturally occurring radioactive materials (NORMS). Under certain conditions (high salinity, together with the presence of sulphates and/or carbonates, calcium, barium and strontium) NORMS can become bound to scale deposits in production wells, pipelines and process equipment. Maintenance of wells, pipelines and process pipework or equipment may require the disposal of scale if it has built up as a solid. However, since no produced formation water is

expected and the exploration wells will be drilled over a short time frame (60 days) the potential for scale deposition containing NORMS to build up has been assessed as **Negligible**.

6.5.6.6 Impact and Risk Mitigation Measures

Impacts to groundwater from loss of circulation, site runoff and drainage from cuttings and dirty water waste pit can be mitigated through the use of the following measures:

Environment Impact Assessment – Drilling Phase			
6. Groundwater Quality	6.1. Loss of circulation mud during Drilling wells	6.1.1. Groundwater degradation from drilling	6.1.1.1. Install steel casing and cement in place to prevent chemical leak or contaminate into rock formation.
			6.1.1.2. Strict steel casing to well wall by cementing to prevent chemical contaminate to groundwater level.
	6.2. Infiltration from the waste pit and sub-irrigation field	6.2.1. Deterioration of shallow Groundwater	6.2.1.1. Install HDPE liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.

6.5.6.7 Residual Impacts and Risks

With these management measures, the duration and magnitude of impacts will be reduced resulting in a residual significance to possible impacts to groundwater from site runoff and drainage from the cuttings and dirty water waste pit to be ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

With these management measures, the impact magnitude will be reduced resulting in a residual significance of impacts to groundwater quality from loss of circulation mud that is ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.7 Assessment of Impacts to Flora & Fauna

6.5.7.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Flora & Fauna	Drilling Phase	Rig Move Drilling wells Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Labour and Accommodation	Harvesting of plants and animals by human activity Disturbance Caused by Vehicle and Equipment Use Accidental Release

Sources of potential impact on aquatic biota in the drilling phase include contamination from wastewater and waste, spills and physical disturbance by workers and vehicle and equipment use. Impacts on soil, surface water quality, vegetation and aquatic biota from accidental spills are discussed **Section 6.16.4**.

6.5.7.2 Impacts from physical disturbance by workers and vehicle and equipment use

The activities in the project area may cause effect to wildlife such as; disturb the animal habitat, the transportation will cause and increase the noise levels and an increase in disturbance The effect can be classifies into 3 levels: high, medium, and low which are related to the capable adaptation of wild animal. The 3 possible directions to consider the effects on wildlife are:

1) **Disadvantage for wild animal**: there will be the negative effect from the activities of the project in direct and indirect. The habitat, food resources, breeding places may be disturbed due to the activities such as operation of heavy equipment, which will cause an increase in the noise levels and increase of disturbance, and the clearance may destroy the habitat and food resource of animals. This group of wildlife will move away from existing habitat. They may move too close to other colony/habitat that may cause compete for food and habitat
2) **Advantage for wild animal:** if the animal is able to adapt in the new environment (human resident, noisy, opened area) there will be the migration into the project area to find food, for breeding, nesting result in increasing of animal population.
3) **The adaptable animal** is the animal that is effected from the changing of habitat condition. However, they can adapt to the new environment and residential living area. However, most wildlife groups are small, fast moving and require low space such as birds.

The activities of the project site such as the transportation of equipment, which will cause an increase in the noise levels but it is not specified as new phenomenon due to most of studied area are almost used as agriculture and communities. Most of animals are highly adaptive and capable adapting to the new environment, but there some animals that may be effected from some activities. The project will also construct drainage around the well pad to prevent any chemical spillage outside the working areas; therefore, the importance is rates as low.

Vehicles moving from the central campsite to each well site could disturb flora / fauna. The potential impacts from the movement of vehicles associated with the exploration drilling campaign are:

- Disturbance leading to behavioral changes or displacement of fauna
- Increased likelihood of incidents

The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation. Some behavioral disturbance may occur for short periods if fauna are present or near access road and project site.

Human activity will be confined to the access road and well sites and will not constitute a new impact on the area, which is already regularly visited by people. Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife. In addition, hunting and trapping will be specifically prohibited and violations are grounds for termination of contract and dismissal.

The well site area is an existing agricultural paddy areas and open forest areas with limited natural terrestrial flora. As standard practice, PTTEP SA will ensure that its staff and contractors will not cut trees or forage in the area surrounding the well sites during any phase of the project. No protected area or reserved forest area are located near the project sites.

6.5.7.3 Significance of Impacts

The impact to flora and fauna from drilling activities, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste, flaring and labor and accommodation will be local in extent, short-term in duration, reversible and of low-magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be low.

The Significance Ranking of impacts to terrestrial flora and fauna from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance is rated as **Low**. (**Table 6-47**)

Table 6-47: Significance Ranking of impacts to terrestrial flora and fauna from access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation.

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
			■		

6.5.7.4 Impact and Risk Mitigation Measures

Impacts to terrestrial flora can be mitigated through the use of the following measures:

Ecological Environment Impact Assessment – Drilling Phase			
7. Terrestrial Flora and Fauna	7.1. Drilling Activities and Labour and Accommodations	7.1.1. Flora and Fauna, and habitat disturbed from workers' activities	7.1.1.1. Fishing or Hunting will be prohibited to workers.
			7.1.1.2. Clearly mark signs showing the boundary of the project area.
			7.1.1.3. Prohibit workers from cleaning machines/ equipment in a public water source.
			7.1.1.4. Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.

6.5.7.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts to flora and fauna from access road and site construction, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation is determined to be **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.6 Environmental Impact Assessment during Well Testing Phase

From the screening matrix the impacts in the well testing phase must be assessed in detail includes:

- Air quality
    - Dust
    - Air Pollution
    - Hydrogen Sulfide
    - Greenhouse Gas
- Noise
- Heat and Light
- Surface Water Quality
- Groundwater Quality
- Soil Quality
- Flora and Fauna

6.6.1 Assessment of Impacts to Air Quality

6.6.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Air Quality/ Climate	Well Testing Phase	Flaring of excess gas Vehicle and Equipment Use	Deterioration of air quality from fuel combustion and flaring emissions

6.6.1.2 Assessment of Dust Impacts from Well Testing

During the testing phase, dust can occur from transportation of employees, equipment and waste. The dust emission from the transportation of employee, equipment and machine during the testing phase can be calculated from the equation of dust emission from unpaved road (United state Environmental Protection Agency)US.EPA) AP-42 Compilation of Air Pollutant Emission Factor, 1995(and dust emission from paved road. Thus, the impacts from dust emission during the well testing phase is similar to the drilling phase impacts in **Section 6.5.1.2**.

6.6.1.3 Assessment of Air Emissions from Well Testing

Diesel generators will be used as a source of power supply for testing. The generators will operate 24 hr/day throughout a testing period of 30 days. The maximum flow during a DST test generally never exceeds 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 22 days per well.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 6-48**. Estimated carbon dioxide emissions are discussed under Greenhouse Gases below.

Table 6-48: Estimated Total Air Pollutant Emissions for Well Testing Phase

Air Pollutants – Fuel Use	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day/well)	Total Emission (tonnes)
350-KVA Camp Site Generator (1.5 m^3/day/well) – 30 days per well			
Nitrogen Oxides (NO_x)	1,896	0.103	3.1**
Sulphur Oxides (SO_x)	126	0.007	0.2**
Carbon Monoxide (CO)	410	0.022	0.7**
Air Pollutants – Flaring	**Emission Factor ($lb/10^6$ Btu)**	**Emission of Air Pollutant (lb/day)**	**Total Emission (tonnes)***
Flaring max 10 mmscfgd or 10 x 10^9 BTU/day/well – 22 d/well per well			
Carbon Monoxide (CO)	0.37	3700	37
Total Hydrocarbons**	0.14	1400	14
Nitrogen Oxides (NO_x)	0.068	680	6.8

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf; http://www.eppo.go.th/ref/UNIT-OIL.html.
Note: Density of diesel oil is 0.8397 kg/L for calculation, IEA (2004), Densities of Oil Product, Energy Statics Working Group Meeting; Net Calorific Values is 43.33 TJ/Gg for calculation, IEA (2009), CO_2 Emission From Fuel Combustion, Documentation For Beyond 2020 Files

6.6.1.4 Significance of Impacts

Without mitigation measures, the impact from air pollutants will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from air pollutants is ranked **Medium**. (**Table 6-49**)

Table 6-49: Sigificance Ranking of impacts from Air Pollutants

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.1.5 Assessment of Impacts from Hydrogen Sulphide

Hydrogen sulfide is a colorless, flammable, highly toxic gas. High concentration of H2S are immediately dangerous to life and health. Employees who work in the area may be affected by hydrogen sulfide (H2S) during testing.

Gas produced from the wells is constantly analysed for its composition and for the presence of hydrogen sulphide (H_2S). Hydrogen sulfide is a colorless, flammable, highly toxic gas. US Occupational Safety and Health Administration's (OSHA) occupational standard in the workplace is 10 ppm (8hr. TWA (time weighted average) and 15ppm (15min. STEL (short term exposure limit)); NIOSH IDLH (immediately dangerous to life or health) = 100 ppm. The potential for H_2S is a possibility but unlikely.

H_2S detection and safety equipment is standard issue (see **Section 4.5.7.4**). PTTEP SA has developed emergency response plan (ERP) to support any emergency cases. Furthermore, the drilling contractors will have their own H_2S Contingency Plan.

6.6.1.6 Significance of Impacts

Without mitigation measures, hydrogen sulphide impacts during well testing will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from hydrogen sulphide release is rated as **Medium**. (**Table 6-50**)

Table 6-50: Sigificance Ranking of impacts from Hydrogen Sulphide

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.1.7 Impacts from GHG Emissions

Fuel combustion of machinery during testing, transportation activities and fugitive emissions during testing and flaring. The sensitive receptors for greenhouse gas emissions are the same as those listed for dust emissions.

The GHG emissions are estimated following the Tier 1 approach of IPCC (2006). GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O). The estimated GHG emissions for the project are shown in **Table 6-51**.

Total greenhouse gas emissions during for the project (4 exploration wells) amounts to 60546.8 ton eq CO_2. When compared with available data on Myanmar's national CO_2 equivalent GHG emissions of 184,710,000 tonnes in 2012, including land use change (World Resources Institute, Climate Analysis Indicators Tool (CAIT)), the GHG emissions arising from the proposed activities are insignificant (approximately 0.03%), and therefore will not significantly impact the environment.

Table 6-51: Estimated Total GHG Emissions per Well

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Testing Activity	Flaring	15,136.70
Total per well		15,136.70

6.6.1.8 Significance of Impacts

Without mitigation measures, the impact from greenhouse gas emissions during well testing considered to be a global issue and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from GHG emissions is **Low**. (**Table 6-52**)

Table 6-52: Sigificance Ranking of impacts from GHG Emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.1.9 Impact and Risk Mitigation Measures

Potential impacts from dust dispersion can be mitigated by application of the following measures:

Environment Impact Assessment –Well Testing Phase			
1 Air Quality	1.1 Vehicle and Equipment Use	1.1.1 Deterioration of air quality due to dust.	1.1.1.1 Implement construction and installation phase mitigation measures in 2.1.
		1.1.2 Deterioration of air quality due to combustion of diesel fuel and flaring.	1.1.2.1 Implement construction and installation phase mitigation measures in 2.2.
			1.1.2.2 Process control to minimize flaring.
			1.1.2.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			1.1.2.4 Verify the operation's flaring system to highest efficiency.
	1.2 Well testing releasing hydrogen sulphide	1.2.1 Deterioration of air quality due to hydrogen sulphide	1.2.1.1 Install Gas Detectors to response during emergency situation.
			1.2.1.2 If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).
			1.2.1.3 All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.
			1.2.1.4 Limit well testing period where possible.
	1.3 Flare Emissions	1.3.1 Climate Change due GHG	1.3.1.1 To maximize energy efficiency and design facilities to minimize energy use
			1.3.1.2 Operating flare to control odor and visible smoke emissions.
			1.3.1.3 Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.
			1.3.1.4 Implementation of burner maintenance and replacement, programs to ensure continuous maximum flare efficiency.
			1.3.1.5 Metering flare gas.
			1.3.1.6 Keep installation and functioning of flare gas system safe according to the good engineering practice.
			1.3.1.7 Ensure flare system has efficient combustion.
			1.3.1.8 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.

6.6.1.10 Residual Impacts and Risks

With these management measures, the magnitude of impacts to air quality from nuisance dust, hydrogen sulphide, air pollutants and GHG emissions will be reduced resulting in a residual significance that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.6.2 Assessment of Impacts to Noise

6.6.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Noise	Well Testing Phase	Flaring Vehicle and Equipment Use	Increased noise from flaring stack

The noise impacts from Vehicle and Equipment Use and equipment transportation are the same as in the construction phase in **Section 6.4.3**.

6.6.2.2 Assessment of Noise Impacts from Well Testing (Flaring)

During well testing (22 days/well), Noise will be generated from equipment and flaring. The flaring rate of 10 mmscfgd at the well site, noise during testing is not expected to be a significant source beyond about 500 m. The flare stack will be horizontal burner directed to an earth bermed flare pit to ensure the safety of workers at the well site. The earth bermed flare pit will shield the flaring and limit noise emissions during flaring.

The well testing phase has a lower power consumption than the phase. Maximum noise levels generated by the various pieces of equipment during well testing are listed in **Table 6-53**.

Table 6-53: Noise Level of Machine During Well Testing Phase

Source	Noise level at source (dB (A))	Number of Sources at one time
Diesel Generator	81	1
Gas flaring system	87[6]-83	1

Source: [1]US Federal Highway Administration, US Department of Transportation, 2008;

Reference distance 15.24 meter (50 feet); (http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm)

[2]Abdulkareem, A.S. and J. O. Odigure, 2006 Reference distance 20 meter

6.6.2.3 Significance of Impacts

Without mitigation measures, impacts from noise from well testing to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

The Significance Ranking of impacts from Noise to sensitive receptors is rated as **Low**. (**Table 6-54**)

[6] Noise level of gas combustion is 87-83 dB(A) at distant 20 m, the selected level is 87dB(A) to calculate the noise level at distance 15.24 m by using **Equation 5-7**; the noise level at distance 15.24m. will be 89.95 dB(A) and substitute in **Equation 5-8**

Table 6-54: Sigificance Ranking of impacts from Noise to Sensitive Receptors

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
			■		

6.6.2.4 Impact and Risk Mitigation Measures

Impacts from noise can be mitigated through the use of the following mitigation measures:

Environment Impact Assessment –Well Testing Phase			
2 Noise	2.1 Flaring during Well Testing	2.1.1 Increase in noise levels during well testing.	2.1.1.1 Implement construction and installation phase mitigation measures in 3.1.
			2.1.1.2 Verify the operation's flaring system.
			2.1.1.3 Minimize the duration of flaring when possible.

6.6.2.5 Residual Impacts and Risks

With these management measures, the residual significance from the impact of noise to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.6.3 Assessment of Impacts to Heat and Light

6.6.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Heat and Light	Testing Phase	Flaring of excess gas	Increased light and heat emitted from gas flaring

6.6.3.2 Assessment of Light Impacts from Flaring

Gas flaring during well testing is a source of light. If drilling results indicate the presence of sufficient petroleum hydrocarbons, well testing will be performed. The flare stack will be horizontal burner directed to an earth bermed flare pit to ensure the safety of workers at the well site. The flare pit will have dimensions 20 m long by 10 m wide with a depth of 3 m. The nearest community will be located over 500 m away (for all the proposed well sites); thus, impact from light and sound from the flare stack is designed to be minimal. A safety zone will be established around the flare with security fencing. The earth bermed flare pit will shield and limit light emissions during flaring.

Any impacts from light on wildlife will be limited to the immediate vicinity of the well sites. Animals that are disturbed will avoid the area during the period of occupation. Insects will be attracted to the lights, which is likely to provide an easy food source for birds and other wildlife species.

Functional lighting is required on vehicles, drill rigs, campsite and well site at levels that provide a safe working environment for personnel. Lighting typically consists of bright white lights, used in accordance with safety requirements. Working lights will be directed into the site so that impacts from working lights will be minimized off-site.

6.6.3.3 Significance of Impacts

Without mitigation measures, impacts from light emissions to sensitive receptors occurring from vehicles, drill rig, well site, campsite and flaring are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts to light emissions is rated as **Low**. (**Table 6-55**)

Table 6-55: Sigificance Ranking of impacts from light emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.3.4 Assessment of Impacts from Heat

Heat can disrupt terrestrial fauna within the project area. This section discusses the impacts of heat on terrestrial fauna within or adjacent to the project area.

The volume of gas to be flared from the wells in an LTP test is expected to be a maximum of 10 mm scfgd per well. The recommended safe distance for heat radiation was calculated from the API equation (**Equation 6-7**):

$$D = \sqrt{\frac{F * Q}{4 * \pi * K}}$$ **Equation 6-7**

Where

D is minimum distance in feet from midpoint of flame to the object;

F is fraction of radiated heat (0.2 for methane API RP 521)

Q is total heat content (BTU/hr) – 10 mmscfgd ÷ 24 hr/d * 1000 BTU/scf

K is allowable radiation (BTU/hr-sqft)

The calculated safe distances are provided in **Table 6-56**.

Table 6-56: Safe Distance from Flare

Exposure	F	Q	K	D	
				ft	m
Continuous exposure with no protection	0.2	416,666,667	500	115	35.1
Continuous exposure with minor discomfort	0.2	416,666,667	1000	81	24.8
Emergency access – several minutes	0.2	416,666,667	1500	66	20.3

The flare stack will be located a reasonable distance from site facilities and the area will be cleared of vegetation. Furthermore, a constant fire watch will be posted during flaring and testing operations to specifically watch this area and ensure that in the event of any fire the operation is immediately shut down and the ground fire extinguished before it can spread. This follows the standard operational procedure when testing a well. Wildlife within this radius will be displaced due to a loss of habitat (including insects and birds feeding on the insects), but wildlife will avoid any adverse heat effects. Heat is therefore not expected to affect wildlife off site.

6.6.3.5 Significance of Impacts

Without mitigation measures, impacts from heat to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts to heat are rated as **Low**. (**Table 6-57**)

Table 6-57: Sigificance Ranking of the impacts of heat on terrestrial flora and fauna

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.3.6 Impact and Risk Mitigation Measures

Impacts from heat and light can be mitigated through the use of the following measures:

Environment Impact Assessment –Well Testing Phase			
3 Heat and Light	3.1 Flaring during Well testing	3.1.1 Increase in light at night from flaring	3.1.1.1 Position flare away from sensitive receptors.
			3.1.1.2 Direction the light into wellpad as much as possible.
			3.1.1.3 Minimize the duration of flaring process when possible
		3.1.2 Increase heat from flaring	3.1.2.1 Clear vegetation around the flare stack and build earth bermed flare pit.
			3.1.2.2 Minimize flare duration when possible.
			3.1.2.3 Maintain safety distance between flare stack and well site facilities and adjacent crops
			3.1.2.4 Follow flare management procedures to ensure optimum management of fare system

6.6.3.7 Residual Impacts and Risks

With these management measures, the residual significance of impacts from heat and light is determined to be **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.6.4 Assessment of Impacts to Surface Water Quality

6.6.4.1 Source of Impact

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Quality	Testing Phase	Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Potential contamination from spills or wastewater drainage to nearby water bodies

6.6.4.2 Assessment of Impacts from Site Drainage, Hazardous/Non-hazardous Waste Management and Chemical Management

Activities during testing that may affect surface water quality include fuel spillage, produced water from well testing. Contamination of surface water from drained domestic waste and grey water which are the same as during the construction and installation phase described in **Sections 6.4.5** and **0.**

During well testing, the separated emulsion-condensate will be stored in separate tanks and send to disposal at a permitted waste disposal facility. Chemical used for well exploration will be placed on the water proof concrete cement base, with roof and over flow curve to contain any spills. Any spills will be immediately cleaned up using the spill kits provided on site.

6.6.4.3 Significance of Impacts

Without mitigation measures, impacts to surface water quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on surface water quality from site drainage, hazardous/non/hazardous waste management and chemical management is **Medium**. (**Table 6-58**)

Table 6-58: Sigificance Ranking of impacts to Surface Water Quality and Aquatic Biota

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.6.4.4 Impact and Risk Mitigation Measures

Impacts to water quality and aquatic biota can be mitigated through the use of the following measures:

Environment Impact Assessment –Well Testing Phase			
4 Surface Water Qualtiy	4.1 Non Hazardous waste management	4.1.1 Contamination of surface water from drained domestic waste and grey water	4.1.1.1 Prohibit workers from cleaning machines/ equipment in a public water source.
			4.1.1.2 Prohibit workers and contractors discharging or

				discarding project waste, chemicals, oil into public water sources.
			4.1.1.3	Install septic tank and soak away pit on each well site for holding sewage.

6.6.4.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts to *surface water* from site drainage, hazardous/non/hazardous waste management and chemical management will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.6.5 Assessment of Impacts to Soil Quality

6.6.5.1 Source of Impact

Resource/Receptor	Project Phase	Activity	Impact
Soil Quality	Testing Phase	Site Runoff and Drainage Handling of Materials and chemicals Hazardous/non-hazardous waste management	Potential contamination from spills or wastewater drainage

6.6.5.2 Assessment of Impacts from Site Drainage, Hazardous/Non-hazardous Waste Management and Chemical Management

Activities during testing that may affect soil quality include fuel spillage, produced water and condensate from well testing. Contamination of soil from drained domestic waste and grey water which are the same as during the construction and installation phase described in **Sections 6.4.5.**

During well testing, the separated emulsion-condensate will be stored in separate tanks and send to disposal at a permitted waste disposal facility. Chemical used for well exploration will be placed on the water proof concrete cement base, with roof and over flow curve to contain any spills. Any spills will be immediately cleaned up using the spill kits provided on site.

6.6.5.3 Significance of Impacts

Without mitigation measures, impacts to soil quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to soil quality from site drainage, hazardous/non/hazardous waste management and chemical management is **Medium**. (**Table 6-59**)

Table 6-59: Sigificance Ranking of impacts to Surface Water Quality and Aquatic Biota

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.6.5.4 *Impact and Risk Mitigation Measures*

Impacts to water quality and aquatic biota can be mitigated through the use of the following measures:

Environment Impact Assessment –Well Testing Phase			
5 Soil Quality	5.1 Non Hazardous waste management	5.1.1 Contamination of soil from drained domestic waste and grey water	5.1.1.1 Prohibit workers from cleaning machines/ equipment in non designated areas.
			5.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, oil in non designated areas.
			5.1.1.3 Install septic tank and soak away pit on each well site for holding sewage.

6.6.5.5 *Residual Impacts and Risks*

With these management measures, the magnitude of impacts to *surface water quality* from site drainage, hazardous/non/hazardous waste management and chemical management will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.6.6 Assessment of Impacts to Ground Water Quality

Resource/Receptor	Project Phase	Activity	Impact
Groundwater Quality	Testing Phase	Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table

6.6.6.1 Assessment of Impacts from Site Drainage, Hazardous/Non-hazardous Waste Management and Chemical Management

Activities during well testing that may affect groundwater quality include fuel spillage, hazardous/non-hazardous wastes and chemical spills. Contamination of groundwater from drained domestic waste and grey water may also leach into the water table.

During abandonment fuel will be stored in a bunded area and wastes will be separated and stored in a secure location in appropriate containers. Wastes will ultimately be sent for disposal at a permitted waste disposal facility. Chemicals will be placed on the water proof concrete cement base, with roof and over flow curve to contain any spills. Any spills will be immediately cleaned up using the spill kits provided on site.

The wastewater and sewage will be collected in a plastic-lined sewage pit with a capacity of 8 m^3 (8000 litres). It is estimated that some 7 m^3 (7000 litres) of combined sewage and waste water will be produced each day during maximum manned operations (100 people). A septic tank will be installed on all locations for preliminary wastewater treatment then overflow to infiltration field. The sewage sludge from the septic tanks will be left in the septic tank onsite.

6.6.6.2 Significance of Impacts

Without mitigation measures, impacts to groundwater quality are therefore expected to be local in extent, short-term in duration and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on groundwater from site drainage, hazardous/non/hazardous waste management and chemical management is **Medium**. (**Table 6-60**)

Table 6-60: Sigificance Ranking of impacts to Groundwater Quality

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.6.6.3 Impact and Risk Mitigation Measures

Impacts to groundwater quality can be mitigated through the use of the following measures:

Resource/Receptor	Project Phase	Activity	Impact
8 Groundwater Qualtiy	8.1 Hazardous/Non Hazardous waste management and chemical handling	8.1.1 Contamination of groundwater from waste, chemicals and wastewater	8.1.1.1 Prohibit workers from cleaning machines/ equipment in unauthorized locations.
			8.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, or oil in unauthorized locations.
			8.1.1.3 Install septic tank on each well site for holding sewage and grey water.
			8.1.1.4 Store wastes and chemicals in a secure area that has a hard surface and closed drains.

6.6.6.4 Residual Impacts and Risks

With these management measures, the magnitude of impacts to groundwater from site drainage, hazardous/non/hazardous waste management and chemical management will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.6.7 Assessment of Impacts to Flora & Fauna

6.6.7.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Flora & Fauna	Testing Phase	Flaring of Gas Vehicle and Equipment Use Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management Hazardous/non-hazardous waste management Labour and Accommodation	Harvesting of plants and animals by human activity

6.6.7.2 Assessment of Impacts from Vehicle & Equipment Use, Chemical and Waste Management and Site-Run-Off, Labour and Accommodation

Sources of impacts on fauna during the well testing phase include fuel and chemical spillage, waste management and habitat degradation from workers' activities, noise from vehicle and equipment use and flaring.

Water that may be contaminated with a chemical / fuel spills will be collected into a dirty water pit by using gutters around the concrete drilling pad area. In practice, contaminated water should not be generated. The pit at drilling pad is required for cuttings. After drilling is finished and cuttings will be taken out, the pit will be cleaned and used to contain the contaminated water, if required.

The contaminated water will be transported for treatment and disposal by service companies who has the permission from the government. The fuel, chemicals and mud used are stored properly, which makes the chance of spillage leading to contamination of ground and surface water unlikely. The toxicity of stored chemical is low and biodegradable, limiting both the severity and the duration of any impact.

The potential impacts from the movement of vehicles associated with the exploration drilling campaign are:

- Disturbance leading to behavioral changes or displacement of fauna
- Increased likelihood of incidents

The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation. Some behavioral disturbance may occur for short periods if fauna are present or near access road and project site.

Human activity will be confined to the access road and well sites and will not constitute a new impact on the area, which is already regularly visited by people. Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife. In addition, hunting and trapping will be specifically prohibited and violations are grounds for termination of contract and dismissal.

The well site area is an existing agricultural paddy areas and open forest areas with limited natural terrestrial flora. As standard practice, PTTEP SA will ensure that its staff and contractors will not cut trees or forage in the area surrounding the well sites during any phase of the project. No protected area or reserved forest area are located near the project sites.

6.6.7.3 Assessment of Impacts from Flaring

Flaring during well testing will cause light. The light may have an impact on crop productivity around the well sites. Vegetation within this radius may be displaced but this safety zone will prevent fire spreading to nearby fields. For one well site the value as habitat is significantly affected by its current use as agriculture areas are used to grow beans/pulses, corn and sesame, rice, corn and vegetables and continued human activity. The other well sites are in an open mixed forest area.

Lighting on the site at night will be kept to a minimum and directed so that as little as possible falls outside the confines of the pad, consistent with safety and security.

Any impacts from light on wildlife will be limited to the immediate vicinity of the well sites. Animals that are disturbed will avoid the area during the period of occupation. Insects will be attracted to the lights, which is likely to provide an easy food source for birds and other wildlife species.

The flare stack will be located a reasonable distance from site facilities and the area will be cleared of vegetation. Furthermore, a constant fire watch will be posted during flaring and testing operations to specifically watch this area and ensure that in the event of any fire the operation is immediately shut down and the ground fire extinguished before it can spread. This follows the standard operational

procedure when testing a well. Wildlife within this radius will be displaced due to a loss of habitat (including insects and birds feeding on the insects), but wildlife will avoid any adverse heat effects. Heat is therefore not expected to affect wildlife off site.

6.6.7.4 Significance of Impacts

The impact to flora and fauna from during well testing due to site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste, flaring and labor and accommodation will be local in extent, short-term in duration, reversible and of low-magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be low.

The Significance Ranking of impacts to terrestrial flora and fauna from well testing is rated as **Low**. (**Table 6-61**)

Table 6-61: Significance Ranking of impacts to terrestrial flora and fauna during well testing from movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste, flaring and labor and accommodation.

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			X		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			X		
Magnitude	Positive	Negligible	Low	Medium	High
			X		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				X	
Significance	Positive	Negligible	Low	Medium	High
			X		

6.6.7.5 Impact and Risk Mitigation Measures

Impacts to terrestrial flora can be mitigated through the use of the following measures:

Ecological Environment Impact Assessment – Well Testing Phase			
5 Terrestrial Flora and Fauna	5.1 Labour and Accommodations	5.1.1 Habitat degradation from workers' activities	5.1.1.1 Mark well site clearly and prohibit vehicles from moving off site onto surrounding land.
			5.1.1.2 Forest incursions will be specifically prohibited.
			5.1.1.3 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation.

	5.2 Flaring during Well Testing	5.2.1 Habitat degradation from light and heat	5.2.1.1 Implement well testing phase mitigation measures 3.1.

6.6.7.6 *Residual Impacts and Risks*

With these management measures, the residual significance of impacts to flora and fauna from well testing is determined to be **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.7 Environmental Impact Assessment during Abandonment Phase

Environmental Aspects that need to be assessed during Well abandonment phase are:

- Topography
- Air Quality
- Noise
- Surface Water Quality
- Surface Water Hydrology
- Groundwater quality
- Soil
- Flora and Fauna

6.7.1 Assessment of Impacts to Topography

6.7.1.1 *Scope of Assessment*

Resource/Receptor	Project Phase	Activity	Impact
Topography	Abandonment Phase	Access road and Site abandonment and restoration	Disturbance to local topography

6.7.1.2 *Assessment of Impacts from Site Abandonment*

Potential impacts to topography from well abandonment phase include the removal of the camp and well site, well site de-mobilization, transportation of machine and equipment, restoration of the site to original condition. However normally the community requests to keep the access road for local use.

The well abandonment will follow normal industry practices and procedures, conforming to all internal PTTEP SA regulations and MOGE requirements. The well site will be cleared of all equipment and cleaned up. The rig cellar will be broken down and removed; the well pipe will be cut 3 m below grade and capped with a steel plate before being backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off

site for disposal as normal building rubble. The surface of the well pad, consisting of compacted granular fill will be broken up and the contours of the site restored to their original levels. The stripped topsoil will be placed over the area to restore to its original condition.

6.7.1.3 Significance of Impacts

Without mitigation measures, the impact on topography from abandonment and site restoration activity will be medium in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the impact significance to Topography is determined to be a medium.

The Significance Ranking of impacts to topography from abandonment and site restoration activity is rated as **Medium**. (**Table 6-62**)

Table 6-62: Sigificance Ranking of impacts to topography

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.1.4 Impact and Risk Mitigation Measures

Impacts from abandonment and site restoration activities on topography can be mitigated through the use of the following measure:

Environment Impact Assessment –Well Abandonment Phase			
1 Topography	1.1 Site and Road abandonment and restoration	1.1.1 Disturbance to local topography	1.1.1.1 Limit site-clearing activities to well sites and access roads only.
			1.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.

6.7.1.5 Residual Impacts and Risks

With these management measures, the extent and magnitude of impacts from a change to topography from site abandonment will be reduced resulting in a residual significance ranked that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.7.2 Assessment of Impacts to Air Quality

6.7.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Air Quality	Abandonment Phase	Vehicle and Equipment Use, Site Restoration	Deterioration of air quality from dust, vehicle emissions and Greenhouse Gas

6.7.2.2 Assessment of Dust Impacts from during Abandonment

Site restoration activities may cause dust and vehicles and machine transportation may cause of air pollution.

Potential impacts to air quality during the well abandonment phase will be caused by removing all equipment and cleaning up the site (soil excavation, soil levelling, and soil transportation). These activities may cause the dispersion of dust which may decrease temporary the air quality such as Total Suspended Particle (TSP) and Paticulate Matter (PM-10).

The impact significance to air quality from dust due to abandonment and site restoration activities will be the same as the construction and installation phase in **Section 6.4.2.2**.

6.7.2.3 Deterioration of air quality due to combustion of diesel fuel and flaring

Fuel combustion from site clearance, transportation and site restoration. During the well abandonment phase, combustion products will be released from vehicles transporting personnel and equipment and machinery. The clearance and site restoration will use dump trucks, loader, tractor/bulldozers, and levelling truck. Combustion products from these vehicles will be similar to those already experienced in the area.

6.7.2.4 Significance of Impacts

Without mitigation measures, air emission impacts during well abandonment will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from dust and fuel combustion is rated as **Medium**. (**Table 6-63**)

Table 6-63: Sigificance Ranking of impacts from Dust & Fuel Combustion

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.2.5 Impacts from GHG Emissions

The potential sources of deterioration of air quality are fuel combustion from:

- Vehicle Emissions
- Diesel Generators

The sensitive receptors for greenhouse gas emissions are the same as those listed for dust emissions.

The GHG emissions are estimated following the Tier 1 approach of IPCC (2006). GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O). The estimated GHG emissions for the project is shown in **Table 6-64**.

Total greenhouse gas emissions during for the project (4 exploration wells) amounts to 1514.8 ton eq CO_2. When compared with available data on Myanmar's national CO_2 equivalent GHG emissions of 184,710,000 tonnes in 2012, including land use change (World Resources Institute, Climate Analysis Indicators Tool (CAIT)), the GHG emissions arising from the proposed activities are insignificant (approximately 0.00087%), and therefore will not significantly impact the environment.

Table 6-64: Estimated Total GHG Emissions per Well

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Abandonment and Restoration	Heavy Equipment and transportation.	378.7
Total per well		378.7

6.7.2.6 Significance of Impacts

Without mitigation measures, the impact from greenhouse gas emissions during abandonment are considered to be a global issue and of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from GHG emissions is **Low**. (**Table 6-65**)

Table 6-65: Sigificance Ranking of impacts from GHG Emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
			■		

6.7.2.7 Impact and Risk Mitigation Measures

Potential impacts from dust dispersion can be mitigated by application of the following measures:

Environment Impact Assessment –Well Abandonment Phase			
2 Air Quality	2.1 Vehicle and Equipment Use	2.1.1 Deterioration of air quality due to dust.	2.1.1.1 Implement construction and installation phase mitigation measures in 2.1.
		2.1.2 Deterioration of air quality due to combustion of diesel fuel.	2.1.2.1 Implement construction and installation phase mitigation measures in 2.2.
		2.1.3 *Climate Change due to GHG*	2.1.3.1 Implement n construction and installation phase mitigation measures in 2.3.

6.7.2.8 Residual Impacts and Risks

With these management measures, the magnitude of impacts to air quality from nuisance dust, air pollutants and GHG emissions will be reduced resulting in a residual significance that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.7.3 Assessment of Impacts to Noise

6.7.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Noise	Abandonment Phase	Vehicle and Equipment Use Site Restoration	Increased noise and vibration from machines and equipment

6.7.3.2 Assessment of Noise Impacts from Vehicle and Equipment Use

For permanent well abandonment and site restoration, machinery will be used for clearance activities. The machinery will be used to clean up and restore the site to its original condition. Also transportation of equipment and machines will cause noise during well abandonment. The maximum noise level generated during this phase are presented in **Table 6-66**.

Table 6-66: Noise Level from Equipment, Engine and Tools for Well Abandonment and Site Restoration

Source	Noise at source (dB (A))	Number of source
Dump Truck	84	1
Excavator	83	1
Bulldozer	75	1
Grader	75	1
Jack-Hammer	75 - 80	1

Source: British Columbia Ministry of Transportation and Infrastructure, 2012, reference distance = 15 m (49.21 ft): (http://www.th.gov.bc.ca/BCHighways/contracts/Reference_Material_Tenders/03901-0001/AW_CEMP_10%20Feb_2012.pdf)

The estimated noise levels for an absolute worst-case condition includes simultaneous operation of three pieces of equipment: dump truck, excavator and jack-hammer. Not all equipment is likely to operate at the same time.

6.7.3.3 Significance of Impacts

Without mitigation measures, impacts from noise from site abandonment to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be Low.

The Significance Ranking of impacts from Noise to sensitive receptors is rated as **Low**. (**Table 6-67**)

Table 6-67: Sigificance Ranking of impacts from Noise to Sensitive Receptors

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.3.4 Impact and Risk Mitigation Measures

Impacts from noise can be mitigated through the use of the following mitigation measures:

Environment Impact Assessment –Well Abandonment Phase			
3 Noise	3.1 Vehicle and Equipment Use	3.1.1 Increase in noise levels from machines/engines during site demolition & restoration and transportation.	3.1.1.1 Implement construction and installation phase mitigation measures in 3.1.

6.7.3.5 Residual Impacts and Risks

With these management measures, the residual significance from the impact of noise to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.7.4 Assessment of Impacts to Surface Water Hydrology

6.7.4.1 Source of Impact

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Hydrology	Abandonment Phase	Site Restoration	Return to pre-construction condition

6.7.4.2 Assessment of Impacts from Site Restoration, Drainage, Hazardous/Non-hazardous Waste and Chemical Management

The well site will be cleared of all equipment and cleaned up. The cement walls of the rig cellar will be broken down below the surface and the hole backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The soil surface will be levelled to the previous level (before the project) which may cause change to surface water hydrology.

The activities of well abandonment and site restoration which may affect surface water hydrology are: site clearance, levelling of soil surface to previous level (before the project), and re-vegetation.

6.7.4.3 Significance of Impacts

Without mitigation measures, impacts to surface water hydrology are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts on surface water hydrology and soil quality is **Medium**. (**Table 6-68**)

Table 6-68: Sigificance Ranking of impacts to Surface Water Hydrology

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.4.4 Impact and Risk Mitigation Measures

Impacts to surface water hydrology can be mitigated through the use of the following measures:

Environment Impact Assessment – Well abandonment Phase			
4 Surface water Hydrology	4.1 Soil excavation for site restoration	4.1.1 Area compaction or erosion during site demolition & restoration.	4.1.1.1 During restoration, avoid causing obstacles to water drainage
			4.1.1.2 Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies.
			4.1.1.3 Vegetate site with native species

6.7.4.5 Residual Impacts and Risks

With these management measures, the residual significance from the impact of surface water hydrology to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.7.5 Assessment of Impacts to Surface Water Quality

6.7.5.1 Source of Impact

Resource/Receptor	Project Phase	Activity	Impact
Surface Water Quality	Abandonment Phase	Site Runoff and Drainage Handling of materials and chemicals Hazardous/non-hazardous waste management	Potential contamination from spills or wastewater drainage to nearby water bodies

6.7.5.2 Assessment of Impacts from Site Restoration, Drainage, Hazardous/Non-hazardous Waste and Chemical Management

The well site will be cleared of all equipment and cleaned up. The cement walls of the rig cellar will be broken down below the surface and the hole backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The soil surface will be levelled to the previous level (before the project) which may cause change to surface water quality.

The activities of well abandonment and site restoration which may affect surface water quality are; clearance of all equipment, structures and foundation, removal of contaminated runoff storage, removal of laterite well pad area and soil surface levelling to previous level and condition (before the project).

The activities of well abandonment and site restoration which may affect surface water quality are: site clearance, levelling of soil surface to previous level (before the project).

6.7.5.3 Significance of Impacts

Without mitigation measures, impacts to surface water quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts on surface water quality is **Medium**. (**Table 6-69**)

Table 6-69: Sigificance Ranking of impacts to Surface Water Quality

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.5.4 Impact and Risk Mitigation Measures

Impacts to surface water quality can be mitigated through the use of the following measures:

Environment Impact Assessment –Well abandonment Phase				
5 Surface Water Quality	5.1 Hazardous/non-hazardous waste management	5.1.1 Potential contamination from spills or wastewater drainage to nearby water bodies during site restoration	5.1.1.1	Implement construction and installation phase mitigation measures in 5.1.
			5.1.1.2	Restore the site and hand back to MOGE as per agreed conditions.

6.7.5.5 Residual Impacts and Risks

With these management measures, the residual significance from the impact of surface water quality to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			X		

6.7.6 Assessment of Impacts to Soil Quality

6.7.6.1 Source of Impact

Resource/Receptor	Project Phase	Activity	Impact
Soil Quality	Abandonment Phase	Site Runoff and Drainage Handling of Materials and chemicals Hazardous/non-hazardous waste management, Site Restoration	Return to pre-construction condition Potential contamination from spills or wastewater drainage

6.7.6.2 Assessment of Impacts from Site Restoration, Drainage, Hazardous/Non-hazardous Waste and Chemical Management

The well site will be cleared of all equipment and cleaned up. The cement walls of the rig cellar will be broken down below the surface and the hole backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The soil surface will be levelled to the previous level (before the project) which may cause change to surface water hydrology, soil, and groundwater.

The activities of well abandonment and site restoration which may affect soil are; clearance of all equipment, structures and foundation, removal of contaminated runoff storage, removal of laterite well pad area and soil surface levelling to previous level and condition (before the project).

The land contamination encountered during the site decommissioning due to known or unknown historical releases of hazardous materials or oil, or due to the waste pit infrastructure used to store or handle these materials requires appropriate measures to remediate after site closure.

6.7.6.3 Significance of Impacts

Without mitigation measures, impacts to surface soil quality are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs both an area

currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts on soil quality is **Medium**. (**Table 6-70**)

Table 6-70: Sigificance Ranking of impacts to Soil Quality

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.6.4 Impact and Risk Mitigation Measures

Impacts to soil quality can be mitigated through the use of the following measures:

Environment Impact Assessment – Well abandonment Phase			
6 Soil Quality	6.1 Soil excavation for site restoration	6.1.1 Degradation of soil quality through compaction or erosion during site demolition & restoration.	6.1.1.1 Limit site demolition & restoration only to well sites and access roads.
			6.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.
			6.1.1.3 Test and Managing potentially contaminated areas with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post decommissioning.
			6.1.1.4 Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with international hazardous waste management guidelines.

6.7.6.5 Residual Impacts and Risks

With these management measures, the residual significance from the impact of soil quality to sensitive receptors is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			X		

6.7.7 Assessment of Impacts to Ground Water Quality

Resource/Receptor	Project Phase	Activity	Impact
Groundwater Quality	Abandonment Phase	Handling of materials and chemicals Hazardous/non-hazardous waste management	Degradation of groundwater quality from spills or leaks leaching into water table

6.7.7.1 Assessment of Impacts from Site Drainage, Hazardous/Non-hazardous Waste Management and Chemical Management

Activities during abandonment that may affect groundwater quality include fuel spillage, hazardous/non-hazardous wastes and chemical spills. Contamination of groundwater from drained domestic waste and grey water may also leach into the water table.

During abandonment fuel will be stored in a bunded area and wastes will be separated and stored in a secure location in appropriate containers. Wastes will ultimately be sent for disposal at a permitted waste disposal facility. Chemicals will be placed on the water proof concrete cement base, with roof and over flow curve to contain any spills. Any spills will be immediately cleaned up using the spill kits provided on site.

The wastewater and sewage will be collected in a plastic-lined sewage pit with a capacity of 8 m^3 (8000 litres). It is estimated that some 7 m^3 (7000 litres) of combined sewage and waste water will be produced each day during maximum manned operations (100 people). A septic tank will be installed on all locations for preliminary wastewater treatment then overflow to infiltration field. The sewage sludge from the septic tanks will be left in the septic tank onsite.

6.7.7.2 Significance of Impacts

Without mitigation measures, impacts to groundwater quality are therefore expected to be local in extent, short-term in duration and of medium magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance is determined to be medium.

The Significance Ranking of impacts to on groundwater from site drainage, hazardous/non/hazardous waste management and chemical management is **Medium**. (**Table 6-71**)

Table 6-71: Sigificance Ranking of impacts to Groundwater Quality

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km

Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.7.7.3 Impact and Risk Mitigation Measures

Impacts to groundwater quality can be mitigated through the use of the following measures:

Resource/Receptor	Project Phase	Activity	Impact
9 Groundwater Qualtiy	9.1 Hazardous/Non Hazardous waste management and chemical handling	9.1.1 Contamination of groundwater from waste, chemicals and wastewater	9.1.1.1 Prohibit workers from cleaning machines/ equipment in unauthorized locations.
			9.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, or oil in unauthorized locations.
			9.1.1.3 Install septic tank on each well site for holding sewage and grey water.
			9.1.1.4 Store wastes and chemicals in a secure area that has a hard surface and closed drains.

6.7.7.4 Residual Impacts and Risks

With these management measures, the magnitude of impacts to groundwater from site drainage, hazardous/non/hazardous waste management and chemical management will be reduced which will result in a residual significance ranking that is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.7.8 Assessment of Impacts to Flora & Fauna

6.7.8.1 *Scope of Assessment*

Resource/Receptor	Project Phase	Activity	Impact
Flora & Fauna	Abandonment Phase	Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management Handling of materials and chemicals Hazardous/non-hazardous waste management Site Restoration Labour and Accommodation	Degradation or destruction of natural habitat Harvesting of plants and animals by human activity

6.7.8.2 *Assessment of Impacts from Abandonment and Site Restoration*

Sources of potential impact on flora in the well abandonment and site restoration phase include clearance of site, the removal of concrete rig pad, other foundations and the water pit.

The well abandonment will follow normal industry practices and procedures, conforming to all internal PTTEP SA regulations and MOGE requirements. The well site will be cleared of all equipment and cleaned up. The cement walls of the rig cellar will be broken down below the surface and the hole backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The soil surface will be levelled to the previous level (before the project), which cause physical changes that could cause deterioration in terrestrial aquatic flora and fauna.

Soil compaction can reduce the permeability of water, which leads to increased runoff. A high volume of runoff may limit the growth of plants. The project will mark the area to be demolished to prevent soil compaction. The removal of vegetation in the well site area may cause sedimentation in water resource which will affect the aquatic biota. Runoff water from the project area may affect the surface water quality which may cause effects to aquatic biota in the area. The sedimentation could cause elevated turbidity levels from runoff which can reduce transmission of sunlight, thus limiting photosynthesis. In turn, this can reduce the level of oxygen in the water. Organic matter introduced into a watercourse can lead to further deoxygenation as the organic matter is decomposed by micro-organisms and result in eutrophication. If oxygen levels fall below the natural DO variability in a system, aquatic biota diversity and abundance could decline as described in **Section 6.4.5.3**.

6.7.8.3 *Significance of Impacts*

The impact to flora and fauna from abandonment and site restoration, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation will be local in extent, short-term in duration, reversible and of low-magnitude. The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value; therefore the sensitivity of the receptor or resource is rated medium. Given these impact criteria considerations the significance ranking is determined to be low.

The Significance Ranking of impacts to terrestrial flora and fauna from clearance of site, installation of physical disturbance due to site abandonment is rated as **Low**. (**Table 6-72**)

Table 6-72: Significance Ranking of impacts to terrestrial flora and fauna from site restoration and abandonment, movement of vehicles, equipment and the rig, site runoff and drainage, handling materials and chemicals, hazardous/non-hazardous waste and labor and accommodation.

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			X		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			X		
Magnitude	Positive	Negligible	Low	Medium	High
			X		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				X	
Significance	Positive	Negligible	Low	Medium	High
			X		

6.7.8.4 Impact and Risk Mitigation Measures

Impacts to terrestrial flora can be mitigated through the use of the following measures:

Ecological Environment Impact Assessment – Well Abandonment Phase			
8 Terrestrial Flora and Fauna	8.1 Labour and Accommodations	8.1.1 Degradation or destruction of natural habitat and harvesting wild plants / animals	8.1.1.1 Limit abandonment to daytime hours only.
			8.1.1.2 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to flora and fauna. In addition, fishing and hunting will be specifically prohibited.
	8.2 Site-Run off and drainage	8.2.1 Potential degradation or destruction of aquatic biota	8.2.1.1 Implement construction and installation phase mitigation measures in 7.3.

6.7.8.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts to flora and fauna from abandonment and site restoration is determined to be **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			X		

6.8 Social Impact Assessment during Construction Phase

From the screening process the following must be assessed to determine their impacts during the preparation phase:

- Land Use
- Transportation
- Public Utility
- Drainage and Flooding
- Waste Management
- Socio-Economy
- Cultural and Archaeological Resources
- Tourism
- Visual Aesthetics

6.8.1 Assessment of Impacts to Land Use

6.8.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Land Use	Construction Phase	Access road and Site Construction (Change from agricultural to industrial area)	Change in land use (Loss of agricultural activity)

6.8.1.2 Assessment of Impacts from Land Acquisition

The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value.

The main project activity that affects land use is the well site, campsite and access road construction as well as the topsoil storage area. All land needed for the project has been will be acquired or rented by PTTEP SA. The well sites will be constructed and a work camp area will be built adjacent to the Thayet Township. The well site area will be 200 x 240 m for a total the land area of 48,000 m^2 that will be disturbed for each well. The well sites are located in existing agricultural land or open forestland; all new earth access roads will need upgraded to construct as required. The roads will be constructed with a 5 m wide top and 1.5 m side slope with a height of approximately 20 to 30 cm before compaction with granular fill. The earth road distances required for each location are; Tazigauk 1.3 km. Monatkon 3.2 km, Ngabetkya 14 km, Banbyin 4.5 km, Padukpin 1.4 km, Sakangyi 0.5 km. The maximum length of the area impacted would be Ngabetkya well site with a road length of 14 km.

The well site and adjacent accommodation campsite areas will be cleared of topsoil and then levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted granular pad will be 500 mm thick. In the event that the results of the well testing conclude that the wells are non-commercial, the well site, campsite and access roads will be restored to its original state.

The purchase of the land provided a significant financial benefit to landowners. While this land will be temporarily lost from agriculture production. Project operations too may degrade the nearby land and reduce agriculture productivity in those areas (i.e. dust, flares, drainage previously discussed). If hydrocarbon resources are not found the land will be restored to its original state. The impacts from

changes in land use to human use values and quality of life values will be local in extent, short term in duration, of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away.

6.8.1.3 Significance of Impacts

Given the short-term impact of this aspect and its return to its original state, it is determined to be a positive benefit as a result of the financial benefit to land owners and the community.

The significance of impacts from changes in land use to human use values and quality of life values is ranked as **Positive**. (**Table 6-73**)

Table 6-73: Sigificance Ranking of impacts from changes in land use to human use values and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		
Significance	Positive	Negligible	Low	Medium	High
	■				

6.8.1.4 Impact and Risk Mitigation Measures

Impacts from construction activities on land use can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase				
9. Land Use	9.1 Purchase of land access road/well pad and camp site	9.1.1 Change of traditional use.	9.1.1.1	Transparent and fair compensation to land owners and users according to land acquisition committee decision.
			9.1.1.2	Ensure all permissions are obtained from landowners and local authorities.
			9.1.1.3	Notify surrounding landowners before on location and time of project activities.
			9.1.1.4	Hand back the land to concerned parties with agreed condition after project completion.

6.8.1.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from changes in land use to human use values and quality of life values will result in a **Positive** financial benefit.

Residual Significance	Positive	Negligible	Low	Medium	High

6.8.2 Assessment of Impacts to Transportation

6.8.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Transportation	Construction Phase	Access Road Construction and Site Construction Vehicle and Equipment Use Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic

6.8.2.2 Assessment of Impacts from Equipment and Vehicle Use

Transportation of equipment, people and services will increase traffic volume in the local area of the planned project and may disrupt of community traffic. Transportation during construction and installation phase consists of transport of workers, construction equipment and supplies.

The impact of transportation of the project affects the people that use the same route used for the project and around the project area. The transportation of personnel and equipment and materials from well site to well sites will be from Yangon to well site. There will be no restrictions on movement of the local population along the Highway during drilling.

6.8.2.3 Significance of Impacts

The impacts from increased traffic and traffic disruption to human use and quality of life values will be medium in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of increased traffic and traffic disruption on human use and quality of life values is ranked as **Medium**. (**Table 6-74**)

Table 6-74: Sigificance Ranking of impacts from traffic to human use values and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.8.2.4 Impact and Risk Mitigation Measures

Impacts from construction activities on traffic can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
10. Transport	10.1 Construction Activities	10.1.1 Damage to roads	10.1.1.1 Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures
			10.1.1.2 Repair the road if found the damage is caused by project transportation

6.8.2.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impacts from increased traffic and traffic disruption on human use and quality of life values being reduced and ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.8.3 Assessment of Impacts to Water Supply

6.8.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Water Supply	Construction Phase	Public Utility	Increased water consumption

6.8.3.2 Assessment of Impacts from Water Supply on Public Utility

During the construction phase, water use will consist of water for dust suppression and cleaning and potable water for workers. The civil works campsite will be built near the well site construction zone. There is no suitable existing accommodation, such as hotels or guesthouses, within a reasonable distance of the proposed well sites, so a temporary campsite will be established near to the well sites.

The planned campsite will be located 3 km outside of Thayet town by the main road. The area of the campsite is about 100 m x 100 m. (Coordinate WGS84 = X: 412004.39, Y: 21388942.42). The basecamp will be designed and built to international standard and comply with IFC Workers' accommodation Guidelines.

The domestic water supply for clean water for the camp site will be provided by the Thayet Township. The water from the township is sufficient in the dry summer months without affecting nearby villages.

It is estimated that a total of 300 bbls/day of industrial grade fresh (non-potable) water will be required during the drilling operation (to be used as makeup water for the drilling mud, cement mixing and losses). Water will be supplied to each well site from deep tube wells at the well site. If tube type wells are not successful or water supply rate not suitable, PTTEP SA will contact local water resource from Tote Kaing Village or Ye Myat Village and transported by tanker to Drilling well site. Local authorities will be consulted prior water hauling begins.

During the civil work phase, there will be a temporary base camp built to place all the workers with basic requirement as per IFC minimum remote site accommodation requirements such as beds, food, clean water and hygienic washroom facilities.

All drinking water will be sourced from local retail suppliers. The maximum demand from the operation, estimated to be 200 litres per day, will have a beneficial impact on the local sales of bottled drinking water.

6.8.3.3 Significance of Impacts

The impacts from water use to human use and quality of life values will be medium in extent, medium-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more 500 m away. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of water use on human use and quality of life values is ranked as **Medium**. (**Table 6-75**)

Table 6-75: Sigificance Ranking of impacts from water use to human use and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
				X	
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				X	
Magnitude	Positive	Negligible	Low	Medium	High
				X	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			X		
Significance	Positive	Negligible	Low	Medium	High
				X	

6.8.3.4 Impact and Risk Mitigation Measures

Impacts from construction activities on water use will be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
11. Water Use	11.1 Use of water public utility for construction and domestic use	11.1.1 Compete for water use of communities	11.1.1.1 Inform authority for drilling a ground water well.
			11.1.1.2 PTTEP SA to drill their own ground water wells on site.
			11.1.1.3 Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, should not affect the availability of water to locals.

6.8.3.5 Residual Impacts and Risks

With these management measures, the impact magnitude and duration will be reduced resulting in a residual significance of impacts from water us to human use values and quality of life values is ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			X		

6.8.4 Assessment of Impacts to Drainage and Flooding

6.8.4.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Drainage and Flooding	Construction Phase	Access road and Site Construction Site Runoff and Drainage	Potential increase in surface flow

6.8.4.2 Assessment of Impacts from Surface runoff from roads, site and camp site

Surface runoff from roads and campsite will result in increased drainage potentially affecting roads and infrastructure. Vegetation removal, construction of well sites and access roads can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increases runoff and change in local drainage patterns. Heavy rains can intensify changes in surface water hydrology and cause changes in drainage.

Agriculture and water sources around project well sites could be affected from water drainage during construction of the well sites. However, a civil engineering contractor will be hired to survey and upgrade the road. The contracted civil engineer will determine and recommend if culverts or additional ditches are necessary to manage surface water runoff. Local authorities and local landowners will also be consulted to address their requirements for any culverts or ditching to be installed at any point along the road. If culverts are required or requested, the size of culvert to install will depend on the civil engineer's recommendation and/or local authority's recommendation. Generally, culverts in this area are 60 cm in diameter, made of reinforced concrete and purchased prefabricated.

6.8.4.3 Significance of Impacts

The impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life will be local in extent, transient, reversible, short term in duration and of low magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life is ranked as **Low**. (**Table 6-76**)

Table 6-76: Significance Ranking of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.8.4.4 Impact and Risk Mitigation Measures

Impacts from drainage can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
12. Drainage and Flooding	12.1 Surface runoff from roads, site and camp site	12.1.1 Increase runoff and change local drainage patterns	12.1.1.1 Obtain approval from MOGE and appropriate government offices before constructing, upgrading or reroute access roads.
			12.1.1.2 Follow civil engineer's recommendation on well site and access road construction design.
			12.1.1.3 Avoid construction of well sites in areas that may cause obstacles to water drainage.
			12.1.1.4 Water drainage lines (culverts/causeway) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.

6.8.4.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life is ranked as **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.8.5 Assessment of Impact to Waste Management

6.8.5.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Waste Management	Construction Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure

6.8.5.2 Assessment of Waste Management and Disposal

General non-hazardous waste will be generated from the drill site, campsite and vehicles during the construction stage. General non-hazardous wastes may include scrap metal, packaging, wood, cardboard, paper and empty containers. Improper handling and disposal of non-hazardous materials may cause adverse effects by materials spills or (as in the case of domestic wastes) being carried away by wind, vectors, etc. Burning some types of innocuous-looking waste types (especially plastics) may create toxic tar or even extremely toxic dioxin. Depending on their pathway, the end result would be air, soil, groundwater, freshwater life contamination. General non-hazardous solid wastes will be segregated at source into recyclable and non-recyclable wastes and stored in marked containers. Recyclable materials will be given to local recycling facilities for a net economic benefit and the remaining materials will be sent to approved landfill facilities.

Food and kitchen wastes will be produced from the campsite and well site during all phases of the project. Organic refuse, if not stored properly, attracts vectors (rats, mosquitoes, flies, cockroaches, etc.) causing health threats and unsightliness. Food scraps will be segregated and transferred to local government waste disposal facilities.

It is estimated that the well site will generate between 1 and 4 tonnes of “domestic” waste and “industrial” waste per month. All solid general waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site.

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 0.5 tonnes per month. The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to Yangon for disposal at approved location by YCDC or DOWA waste management facility.

All materials brought onto the well site and accommodation campsite will be logged and the relevant supplier or contractor will identify all sources of potential toxic waste. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

6.8.5.3 Significance of Impacts

The impacts from waste management and disposal and its effect on human use and quality of life will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs

an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-77**)

Table 6-77: Significance Ranking of impacts from waste management and disposal and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		
Significance	Positive	Negligible	Low	Medium	High
				■	

6.8.5.4 *Impact and Risk Mitigation Measures*

Impacts from activities required for waste management can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
13. Waste Management	13.1 Non Hazardous waste management	13.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	13.1.1.1 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.2 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.3 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.4 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.5 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.

			13.1.1.6 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.7 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.8 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			13.1.1.9 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.

6.8.5.5 Residual Impacts and Risks

With these management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of impacts from waste management and disposal and its affect on human use and quality of life being reduced and ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.8.6 Assessment of Impacts to Socio Economy

6.8.6.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Socio-Economic	Construction Phase	Access road and Site Construction Handling materials and Chemicals Use of Public Utility Hazardous/non-hazardous waste management Labour and accommodation	Increased employment/income and procurement opportunities for people, business and services in surrounding area Labour in-migration causing conflict with local communities

6.8.6.2 Assessment of Impacts from Employment and Income

Impact Assessment

Project employment and business opportunities will increase jobs and related income for local communities.

During construction, 30 – 50 workers will be employed and supplies (such as laterite, selected fill material, fuel, water) and services (accommodation, waste management) will be required. The composition of the crew will depend on actual contracting companies, most of which will be Myanmar subsidiaries of international companies. An onsite camp will be developed for workers.

IEM surveyed 412 households in this region. Results indicated 40% of respondents earned between 500,001-1,000,000 Kyats; 36% earned between 1000,001-2,000,000 kyats, 11% earned between 2,000,001 – 3,000,000 kyats, 6% earned below 500,000 kyats, 5% earned between 3,000,001-5,000,000 kyats and earned above 5,000,000 kyats:

Of those interviewed, 79% considered oil and gas drilling to be important to the community. When asked what positive impacts from the project did they anticipate, the Villagers anticipated increased employment (35%), improved transport/ infrastructure (26%), and increase annual income (15%).

PTTEP SA has a policy to encourage the hiring of local staff and contractors. Advance meetings with local authorities on approaches to hiring will help PTTEP SA design hiring to maximise the positive effects and limit the loss of labour availability to local businesses at critical times (i.e. harvest).

6.8.6.3 Significance of Impacts

The impacts from employment and income from the project and its effect on human use and quality of life will be local in extent, short term in duration, reversible and of low magnitude but positive. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as Positive.

The Significance Ranking of impacts from employment and income from the project and its effect on human use and quality of life is ranked as **Positive**. (**Table 6-78**)

Table 6-78: Sigificance Ranking of impacts to employment and income from the project and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.8.6.4 Assessment of Impacts from Labour In-Migration

In-migration of labour and social interaction may result in conflict between workers from other regions and local communities.

During construction, 30 – 50 workers will be employed and supplies (such as granular fill, fuel, water) and services (accommodation, waste management) will be required. The composition of the crew will depend on actual contracting companies, most of which will be Myanmar subsidiaries of international companies. An onsite camp will be developed for workers.

The baseline household survey showed that:

- 76% felt that larger projects (including oil and gas and infrastructure projects) had not affected labour availability for traditional businesses, while only 24% indicated that it did affect the availability of labour.
- 50% were a little worried about labour in-migration, while 25% were very worried, and 25% were not worried.
- 17% were concerned about possible environmental pollution, while 18% were concerned about health, and 18% were concerned about loss of the land.

The receptors of impact from the project are:

- businesses that trade and provide services near the project area and people who live in the surrounding area. The project would provide opportunities for additional work and business.
- businesses and trade who lose access to employees and contractors during the construction phase.
- vulnerable social and ethnic groups who are exposed to migrant project employees and contractors. The surveys indicated that Groups of possible concern are children (51%), women affected from the project (24%) and No concern (22%)

Pre-project awareness programs with migrant workers on local community, social and ethnic group sensitivities will help create increased understanding and, where advisable, limit interactions during project construction.

6.8.6.5 *Significance of Impacts*

The impacts from labour in-migration and its affect on human use and quality of life will be medium in extent, short term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from labour in-migration and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-79**)

Table 6-79: Sigificance Ranking of impacts from labour in-migration and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
				■	
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.8.6.6 Impact and Risk Mitigation Measures

Impacts from project activities on the socio-economy are positive and can be further enhanced by the following measures:

Social Impact Assessment – Construction and Installation Phase			
14. Socio-Economy	14.1 Services Supply for Construction Activities	14.1.1 Employment/income and procurement opportunities for people, business and services in surrounding area	14.1.1.1 Employ qualified local workers.
			14.1.1.2 Purchase local supplies and services, whenever possible.
			14.1.1.3 Terms of contract for recruitment of manpower in these project needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.
	14.2 In-migration of labour and social interaction	14.2.1 Potential conflict between workers from other regions and local communities	14.2.1.1 Restrict workers to within project boundaries and do not allow local interaction within the communities.

6.8.6.7 Residual Impacts and Risks

With these management measures, the residual significance of impacts from impacts to employment and income from the project and its effect on human use and quality of life will be a **Positive**.

Residual Significance	Positive	Negligible	Low	Medium	High
	✓				

With these management measures, the residual significance of impacts from labour in-migration and its affect on human use and quality of life will be ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			✓		

6.8.7 Assessment of Impacts to Cultural and Archaeological Resources

6.8.7.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Historical/Archaeological Sites	Construction Phase	Access road and Site Construction	Archaeological/ fossil finds within project area.

6.8.7.2 Assessment of Impacts

Potential impacts to the local historical, archaeological and cultural resources during the construction phase include possible damage or demolition of historical buildings or archaeological sites during construction of the access roads, campsite and well sites. During the archaeological and historic site assessment for the project area, the Township Administrator from Thayet GAD confirmed that there is no Archaeological or Historic Department in Thayet and no archaeological or historic sites are present in the Thayet Township. The well site is located on agricultural and secondary forestland and no

historic or archaeological sites are located near the planned project. Although there is no Heritage area and Archaeological zone approved by government in block MOGE 3, some ancient pagodas that are in good condition and decayed stage could be found in many places within project area.[7]

During the field program for the present project local residents were canvassed in regard to their cultural activities and cultural sites. The most important cultural focus in the communities of those interviewed was local festivals (55%), temples/archaeology (35%) and custom (18%). Villagers interviewed indicated that 70% of them know of the important cultural, historic and religious sites around their community and Villagers felt that local cultural, historic and religious sites are not adequately protected (52%).

The well site land is currently either paddy agricultural field or mixed open forest. No cultural or historic site was identified in the site assessment. Therefore, construction activities will not disrupt any culturally important activities or cause any damage to the archaeological resources. However, there is a very small chance that unknown and prehistoric communities existed in the area and additional artefacts may be recovered during construction of the well sites, campsite and access roads. If any artefact is found, then work will be stopped and PTTEP SA will inform the Thayet GAD for further action before proceeding with operations.

6.8.7.3 Significance of Impacts

The impacts on local historical, archaeological and cultural resources during the construction and its effect on human use and quality of life will be local in extent, medium term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as low.

The Significance Ranking of impacts on local historical, archaeological and cultural resources during the construction and its effect on human use and quality of life is ranked as **Low**. (**Table 6-80**)

Table 6-80: Sigificance Ranking of impacts to local historical, archaeological and cultural resources during the construction and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		
Significance	Positive	Negligible	Low	Medium	High

7 REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

6.8.7.4 Impact and Risk Mitigation Measures

Impacts from construction activities on historical, archaeological and cultural resources can be mitigated through the use of the following measures:

Cultural Impact Assessment – Construction and Installation Phase			
15. Historical, Archaeological and Cultural Resources	15.1 Construction of access road/well pad and camp site	15.1.1 Archaeological/ fossil finds within project area.	15.1.1.1 Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.
			15.1.1.2 Report to the Thayet GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed
			15.1.1.3 If artefacts are found during the construction phase, PTTEP SA will inform the responsible local office immediately.
			15.1.1.4 Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact.

6.8.7.5 Residual Impacts and Risks

With these management measures, the duration of impacts will be reduced resulting in a residual significance of impacts on local historical, archaeological and cultural resources during the construction and its effect on human use and quality of life will be ranked as **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.8.8 Assessment of Impacts to Tourism

6.8.8.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Attractions/Recreational Areas	Construction Phase	Access road and Site Construction	Change in local environment

6.8.8.2 Assessment of Impacts

Project operation effects on tourism and recreation may reduce the tourism and recreational experience. As this area is a remote area outside of the township, little tourism and recreation currently exists. The project well sites will not directly affect tourism and recreation through land use and aesthetic changes. The main potential impacts would be increased traffic activity on major corridors that has been ranked as a Low Residual Risk.

6.8.8.3 Significance of Impacts

The impacts from project effects impact on tourism and recreation experience and its effect on human use and quality of life will be medium in extent, short term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from project effects impact on tourism and recreation experience and its effect on human use and quality of life is ranked as **Low**. (**Table 6-81**)

Table 6-81: Sigificance Ranking of impacts to from project effects impact on tourism and recreation experience and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.8.8.4 Impact and Risk Mitigation Measures

Impacts from project activities on tourism and recreation can be mitigated through the use of the transportation mitigation measures:

Visual Impact Assessment – Construction and Installation Phase			
16. Tourism and Recreational experience	16.1 Well Site, Road and Camp Construction	16.1.1 Disturbance and reduction of tourism and recreational experience	16.1.1.1 Post and enforce speed limit.
			16.1.1.2 Consult with local authority before major movement.
			16.1.1.3 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
			16.1.1.4 Restrict/ avoid movement of heavy equipment during rush hours.
			16.1.1.5 Provide traffic signs or flags at junction of access roads and main roads.
			16.1.1.6 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
			16.1.1.7 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.
			16.1.1.8 Strictly enforce training programs to reduce transport incident cases by its contractors.
			16.1.1.9 Restore any damage to roads if caused by contractor or company.
			16.1.1.10 Restrict local traffic on PTTEP SA private access road and wellsite area.
			16.1.1.11 When project complete, promptly (within 6 months), hand back the land to MOGE.

6.8.8.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from project effects impact on tourism and recreation experience and its effect on human use and quality of life values is ranked as **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.9 Social Impact Assessment during Drilling Phase

Key issues identified by the screening process must be assessed to determine their impacts during the drilling phase, including:

- Transportation
- Water Supply
- Power Supply
- Waste Management
- Socio-Economy

6.9.1 Assessment of Impacts to Transportation

6.9.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Transportation	Drilling Phase	Vehicle and Equipment Use Rig Move Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic

6.9.1.2 Assessment of Impacts from Rig Move, Equipment and Vehicle Use

Transportation of equipment, people and services will increase traffic volume in the local area of the planned project and may disrupt of community traffic. Transportation during drilling consists of transport of rig move, workers and supplies, transport of industrial water supply and drilling support equipment (Including casing, chemical and etc.)

PTTEP SA plans to use a land rig for the drilling program. The exact transport route and duration of rig move is not available as the rig contract not yet awarded. The most likely route will be via the Pathein-Monywa road or by Irrawaddi River. The rig mobilization will include around 100 truckloads to complete rig and support equipment. The maximum mobilization distance for the rig is estimated at about 400 km. The rig mobilization duration will be 2-3 weeks.

Drilling Materials will be transported from Yangon to the well sites. The estimated number of round trips for rig and support equipment is 130 truckloads during drilling activities. The rig personnel will transported to the well locations from Yangon.

The impact of transportation of the project affects the people that use the same route used for the project and around the project area. The transportation of personnel and equipment and materials from well site to well sites will be from Yangon to well site. There will be no restrictions on movement of the local population along the Highway during drilling.

6.9.1.3 Significance of Impacts

The impacts from increased traffic and traffic disruption to human use and quality of life values will be medium in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of increased traffic and traffic disruption on human use and quality of life values is ranked as **Medium**. (**Table 6-82**)

Table 6-82: Sigificance Ranking of impacts from traffic to human use values and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.9.1.4 Impact and Risk Mitigation Measures

Impacts from construction activities on traffic can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
8. Transport	8.1 Rig Move and Equipment and Vehicle Use.	8.1.1 Disruption of traffic	8.1.1.1 Ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect performance. 8.1.1.2 Strictly Follow Speed Limits 8.1.1.3 Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures. 8.1.1.4 Safety equipment and emergency equipment must be installed on vehicles such as tool box safety belts and portable fire extinguisher etc. as per company standards. 8.1.1.5 Provide left hand drive car as priority. 8.1.1.6 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.

			8.1.1.7 Consult with local authority before major movement.
			8.1.1.8 Restrict/ avoid movement of heavy equipment during rush hours.
			8.1.1.9 Provide traffic signs or flags at junction of access roads and main roads.
			8.1.1.10 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
			8.1.1.11 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.
			8.1.1.12 Strictly enforce training programs to reduce transport incident cases by its contractors.
			8.1.1.13 Restore any damage to roads that is caused by contractors or Company.
			8.1.1.14 Restrict local traffic in well site area
			8.1.1.15 Road Hazard Assessment will be conducted before transporting any large equipment.
			8.1.1.16 Vehicles will take direct routes where possible and avoid significant habitat areas.
			8.1.1.17 Construction vehicles will follow speed limits.
		8.1.2 Damage to roads	8.1.2.1 Check and restore for any damage from project activities to local roads.

6.9.1.5 Residual Impacts and Risks

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impacts from increased traffic and traffic disruption on human use and quality of life values being reduced and ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			(highlighted)		

6.9.2 Assessment of Impacts to Water Supply

6.9.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Water Supply	Drilling Phase	Public Utility	Increased water consumption Increase or decrease of available power for local community

6.9.2.2 Assessment of Impacts

The planned campsite will be located 3 km outside of Thayet town by the main road. The area of the campsite is about 100 m x 100 m. The basecamp will be designed and built to international standard and comply with IFC Workers' accommodation Guidelines.

During the drilling phase, there will be a base camp which might be the same camp used during the civil work with additional containers required. There will also small container to be placed at the rig site to accommodate the essential crew such as company man, rig tool pusher and minimum crew. The camp accommodation will be a container types with the power being generated from a portable diesel engine generator. The campsite will be industry-standard, consisting of container-based sleeping and living quarters, messing and recreation facilities, with a capacity to accommodate up to 140 personnel. Of these personnel, PTTEP SA plans to hire local workers. It will have its own cooking, freezer food storage, laundry and sanitation facilities as well as its own power generation by diesel powered generators.

Access to and availability of water is an important issue to all communities in the Regional Study Area. Community water wells are a critical piece of local infrastructure, and access to water to support domestic and farming requirement is critical.

It is estimated that a total of 300 bbls/day of industrial grade fresh (non-potable) water will be required during the drilling operation (to be used as makeup water for the drilling mud, cement mixing and losses). Water will be supplied to each well site from deep tube wells at the well site. If tube type wells are not successful or water supply rate not suitable, water will be sourced and transported by tanker from near by rivers. Local authorities will be consulted prior water hauling begins.

The industrial water will be stored on the well site in an in ground storage pit 30 m x 15 m x 3 m deep for a maximum capacity of 1,200 m^3.

All drinking water will be sourced from local retail suppliers. The maximum demand from the operation, estimated to be 200 litres per day, will have a beneficial impact on the local sales of bottled drinking water.

6.9.2.3 Significance of Impacts

The impacts from water use to human use and quality of life values will be medium in extent, medium-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more 500 m away. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of water use on human use and quality of life values is ranked as **Medium**. (**Table 6-83**)

Table 6-83: Sigificance Ranking of impacts from water use to human use and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.9.2.4 Assessment of Impact on Power Supply

All power for the campsite will be supplied by Project-supplied diesel powered generators. No public power utilities will be required at the campsite.

No power-use impacts will occur from power use by the project. All electrical power for the well site, drilling rig and associated equipment will be provided by 1500 – 1800 hp diesel fuelled generator sets.

6.9.2.5 Significance of Impacts

The impacts (extent, duration and magnitude) from power use to human use and quality of life values will be negligible. Nearby communities are not affected. As a result of these impact criteria considerations, significance is ranked as negligible.

The Significance of power use on human use and quality of life values is ranked as Negligible (**Table 6-84**)

Table 6-84: Sigificance Ranking of impacts from power use on human use and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.9.2.6 Impact and Risk Mitigation Measures

Impacts from construction activities on public utility will be mitigated through the use of the following measures:

Social Impact Assessment – Drilling Phase			
9. Water Use	9.1. Use of public utility for water resources	9.1.1. Water usage of project affects the community's water supply.	9.1.1.1. Implement construction and installation phase mitigation measures in 10.1.
			9.1.1.2. Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.

Social Impact Assessment – Drilling Phase			
10. Power Use	10.1. Power for drilling operations and work camp	10.1.1. Increase or decrease of available power for local community	10.1.1.1. Install diesel-powered generators to supply all project power related needs.

6.9.2.7 Residual Impacts and Risks

With these management measures, the impact magnitude and duration will be reduced resulting in a residual significance of impacts from water us to human use values and quality of life values is ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

As PTTEP SA will install their own power generators to supply electricity, the residual significance of impacts from power use to human use values and quality of life values is ranked as **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.9.3 Assessment of Impacts to Waste Management

6.9.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Waste Management	Drilling Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure

6.9.3.2 Assessment of Impacts from Wastewater

Project operation may affect water quality and has the potential to impact agriculture. Most households are engaged in agriculture. The main agriculture crop in this area is Beans/Pulses (45%), with rice as the next most common crop (40%), with some sesame (9%) and corn (16%).

Accidental release of drill cuttings and drilling mud, spills, overflow of the cuttings and waste pit could affect soil quality and vegetation (agriculture), surface water quality and aquatic biota (aquaculture). Wastewater released from the sites could result in impacts on agriculture crops and river fishing. Impacts on soil, surface water quality, vegetation and aquatic biota from accidental spills are discussed **Section 6.16.4**.

6.9.3.3 Assessment of Non-Hazardous Waste Management

Solid wastes produced will consist of both hazardous and nonhazardous materials. For all solid wastes, a policy of reduce, reuse and recycle will be implemented, where possible, across all phases of the project.

Management of solid waste will be undertaken by PTTEP SA in accordance with PTTEP SA standards. For each solid waste type generated the most appropriate method of management will be determined and documented in a Waste Management Plan. Solid non-hazardous wastes to be produced during exploration drilling campaign are summarised in **Table 6-85**.

Table 6-85: Types of Solid Waste and Potential Impacts

Waste Type	Potential Impacts
Food Waste	• Odour • Attraction of pests and disease vectors
Paper and plastic packaging, rags, plastic, glass	• Fire hazard • Wind-blown litter • Fouling of surface water
Metal and plastic drums, sacks and bags	• Fire hazard • Wind-blown litter • Fouling of surface water • Contamination of soil and water
Wooden packaging	• Fire hazard • Debris hazard
Scrap Metal	• Contamination of soil and water • Public Safety • Debris hazard

General non-hazardous waste will be generated from the drill site, campsite and vehicles during all phases of the project. General non-hazardous wastes may include scrap metal, packaging, wood, cardboard, paper and empty containers. Improper handling and disposal of non-hazardous materials may cause adverse effects by materials spills or (as in the case of domestic wastes) being carried away by wind, vectors, etc. Burning some types of innocuous-looking waste types (especially plastics) may create toxic tar or even extremely toxic dioxin. Depending on their pathway, the end result would be air, soil, groundwater, freshwater life contamination. General non-hazardous solid wastes will be segregated at source into recyclable and non-recyclable wastes and stored in marked containers. Recyclable materials will be given to local recycling facilities for a net economic benefit and the remaining materials will be sent to approved landfill facilities.

Food and kitchen wastes will be produced from the campsite and well site during all phases of the project. Organic refuse, if not stored properly, attracts vectors (rats, mosquitoes, flies, cockroaches,

etc.) causing health threats and unsightliness. Food scraps will be segregated and transferred to local government waste disposal facilities or give to community for animal feeding if required.

This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 4 tonnes of "domestic" waste and "industrial" waste per month. All solid general non-hazardous waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site.

6.9.3.4 Significance of Impacts

The impacts from waste management and disposal and its effect on human use and quality of life will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-86**)

Table 6-86: Significance Ranking of impacts from waste management and disposal and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		
Significance	Positive	Negligible	Low	Medium	High
				■	

6.9.3.5 Impacts from Hazardous Solid Waste

The well site will generate a low volume of hazardous waste throughout all project phases including:

- Excess or spent chemicals.
- Paints and paint cans.
- Biological waste from medical facilities.
- Oil contaminated materials (e.g. sorbents, filters and rags).
- Waste oils.
- Drums and containers used for oil or chemical transportation and storage;
- Batteries.
- Fluorescent light tubes.

General hazardous solid waste will be generated during all phases of the project. General hazardous solid wastes will be segregated at source into recyclable and non-recyclable wastes and stored in

covered skips prior to transfer to an approved recycling contractor wherever practicable, or waste disposal site.

Hazardous wastes will be handled and stored in accordance with the material safety data sheets (SDS) and tracked from source to its final destination. The estimated quantity of hazardous waste generated is approximately 0.5 tonnes per month of activities.

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 0.5 tonnes per month. The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to Yangon for disposal at approved waste management facility.

All materials brought onto the well site and accommodation campsite will be logged and the relevant supplier or contractor will identify all sources of potential toxic waste. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

6.9.3.6 Significance of Impacts

Without mitigation measures, impact from hazardous waste on human use and quality of life will be local in extent and transient, reversible, long term in duration and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-87**)

Table 6-87: Sigificance Ranking of impacts from Hazardous Waste to Human Use and Quality of Life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.9.3.7 Assessment of Impacts from Drill Cuttings and Fluids

The drilling fluids that are used for the well will be returned to the surface from the annulus of the drill with rock cuttings, and may also contain small quantities of other fluids, such as hydrocarbons and produced water. Shakers will separate the fluids from the cuttings. For this exploration drilling program, the drilling will use Water Based Mud (WBM) or Synthetic Based Mud (SBM) depending on results of subsurface and seismic interpretation. The majority of the components of the drilling

mud systems are classified as non-hazardous with the exception of a few key chemicals. The toxicology for Caustic Soda (sodium hydroxide), Sodium Bicarbonate, Calcium Hydroxide, Polymeric Blend are shown in **Table** 6-109**.**

At the end of the first well location, the left over drilling mud will be transferred and used at the next well location. At the end of drilling campaign the left over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP other drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs. Approximately 1500 m^3 per well of cuttings would be disposed during the drilling process. Discharged cuttings will contain some residual water-based mud, and residual hydrocarbons and any other contaminants. There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the approved waste management facility.

The cuttings and fluids contain potassium chloride, which are saline and residual hydrocarbons. The entry of saline and hydrocarbon contaminated fluids into the ground water may affect the growth of agricultural crops and be potentially toxic to terrestrial and aquatic flora and fauna. The cuttings and fluids may also contain heavy metals, which may contaminate soils and affect the growth of agricultural crops.

The volumes of cuttings produced during this project are unlikely to cause major local environmental impacts, particularly as cuttings will be bioremediated onsite or sent to the approved waste management facility.

Salinity levels are not predicted to be high, and the short duration of the drilling activity will not allow for the excessive evaporation levels required to concentrate and produce highly saline liquids.

6.9.3.8 Significance of Impacts

Without mitigation measures, impact from hazardous waste on human use and quality of life will be local in extent and transient, reversible, long term in duration and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-88**)

Table 6-88: Sigificance Ranking of impacts from drill cuttings and fluids on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.9.3.9 *Impact and Risk Mitigation Measures*

Impacts from activities required for waste management can be mitigated through the use of the following measures:

Social Impact Assessment – Drilling Phase			
11. Waste Management	11.1. Non Hazardous waste management	11.1.1. Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and groundwater and vector for disease	11.1.1.1. Implement construction and installation phase mitigation measures in 12.1.
	11.2. Hazardous waste management	11.2.1. Hazard waste contaminate to environment.	11.2.1.1. Ensure treatment and disposal of hazardous waste by licensed contractor.
			11.2.1.2. Segregate and store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring. Make sure all containers are clearly labeled.
			11.2.1.3. Always check and record the type(s) and amount of hazardous waste generated.
			11.2.1.4. Dispose of waste in labeled containers for possible recycling or reuse.
			11.2.1.5. Prohibit open burning of any waste at project site.
			11.2.1.6. Enforce "Good Housekeeping" practices.
			11.2.1.7. All hazardous waste will be collected in skips ready for treatment and disposal. Hazardous wastes will be transported and disposed at approved waste management facility.
			11.2.1.8. Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.
	11.3. Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1. Localized change in water quality and soil quality from chemical composition of drill fluids	11.3.1.1. Drill cuttings and adhered fluids will not be discharged to surrounding area.
			11.3.1.2. Volume of cuttings and

			fluids discharged will be minimised through use of solids control equipment.
			11.3.1.3. Store all chemicals in secured storage area.
			11.3.1.4. Hazardous wastes materials will be handled and stored in accordance with the corresponding SDS.
			11.3.1.5. Implement awareness training on the hazards of the chemicals.
			11.3.1.6. Enforce use of PPE.
			11.3.1.7. Handle chemicals only in well-ventilated and controlled areas
			11.3.1.8. Fuel storage tanks to be surrounded by bund wall.
			11.3.1.9. Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the concrete pit.
			11.3.1.10. Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).
			11.3.1.11. Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan.
			11.3.1.12. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.
			11.3.1.13. Monitor level of cuttings and dirty water in waste pit.
			11.3.1.14. Implement land transportation procedure.

6.9.3.10 Residual Impacts and Risks

With these management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of impacts from hazardous and non-hazardous waste management and disposal and its effect on human use and quality of life being reduced and remaining a ranking of **Low**. However the residual impact of mud and cuttings remains at **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High

Residual Significance	Positive	Negligible	Low	Medium	High

6.9.4 Assessment of Impacts to Socio Economy

6.9.4.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Socio-Economic	Drilling Phase	Rig Move Drilling wells Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation	Increased employment/income and procurement opportunities for people, business and services in surrounding area

6.9.4.2 Assessment of Impacts from Employment and Income

Project employment and business opportunities will increase jobs and related income for local communities.

During drilling, around 100 workers will be employed and supplies (such as fuel and water) and services (accommodation, waste management) will be required. Most of the workers are expected to be experienced drillers and rig crews, not locally available.

IEM surveyed 412 households in this region. Results indicated 40% of respondents earned between 500,001-1,000,000 Kyats; 36% earned between 1000,001-2,000,000 kyats, 11% earned between 2,000,001 – 3,000,000 kyats, 6% earned below 500,000 kyats, 5% earned between 3,000,001-5,000,000 kyats and earned above 5,000,000 kyats:

Of those interviewed, 79% considered oil and gas drilling to be important to the community. When asked what positive impacts from the project did they anticipate, the Villagers anticipated increased employment (35%), improved transport/ infrastructure (26%), and increase annual income (15%).

PTTEP SA has a policy to encourage the hiring of local staff and contractors. Advance meetings with local authorities on approaches to hiring will help PTTEP SA design hiring to maximise the positive effects and limit the loss of labour availability to local businesses at critical times (i.e. harvest).

6.9.4.3 Significance of Impacts

The impacts from employment and income from the project and its effect on human use and quality of life will be local in extent, short term in duration, reversible and of low magnitude but positive. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away. As a result of these impact criteria considerations, significance is ranked as Positive.

The Significance Ranking of impacts from employment and income from the project and its effect on human use and quality of life is ranked as **Positive**. (**Table 6-89**)

Table 6-89: Sigificance Ranking of impacts to employment and income from the project and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
	■		■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
	■		■		
Magnitude	Positive	Negligible	Low	Medium	High
	■		■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
	■				

6.9.4.4 Impact and Risk Mitigation Measures

Impacts from project activities on the socio-economy are positive and can be further enhanced by the following measures:

Social Impact Assessment – Drilling Phase			
12. Socio-Economy	12.1. Employment opportunities and Use of local goods and services	12.1.1. Employment and income	12.1.1.1. Employ qualified local workers if possible.
			12.1.1.2. Purchase local supplies and services, whenever possible.

6.9.4.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from impacts to employment and income from the project and its affect on human use and quality of life will be a **Positive**.

Residual Significance	Positive	Negligible	Low	Medium	High
	■				

6.10 Social Impact Assessment during Well Testing Phase

From the screening process the following must be assessed to determine their impacts during the preparation phase:

- Transportation
- Waste Management
- Socio-Economy

6.10.1 Assessment of Impacts to Transportation

6.10.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Transportation	Testing Phase	Vehicle and Equipment Use Hazardous/Non Hazardous waste management Labour and Accommodation	Increased traffic

6.10.1.2 Assessment of Impacts from Transportation

Transportation of equipment, people and services will increase traffic volume in the local area of the planned project and may disrupt of community traffic. Transportation during testing phase consists of transport of workers and supplies, transport of industrial water supply and equipment and will be similar to the impacts during construction in **Section 6.8.2**.

6.10.2 Assessment of Impact to Waste Management

6.10.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Waste Management	Testing Phase	Hazardous/non-hazardous waste management	Increased stress on local infrastructure

6.10.2.2 Assessment of non-hazardous waste management

Non-hazardous waste from the well testing phase consists mostly of general non-hazardous waste from the well site and campsite. The General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labeled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 4 tones of "domestic" waste and "industrial" waste per month. All solid general waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site. The impact significance is similar to the impacts in the Construction Phase in **Section 6.8.5**.

6.10.2.3 Assessment of hazardous waste management

General hazardous solid waste will be generated during all phases of the project. The well testing phase could generate a portion of condensate from the well testing procedure. This condensate will be separated and stored on site before being disposed as hazardous waste at the approved waste management facilities.

6.10.2.4 Significance of Impacts

The impacts from waste management and disposal and its effect on human use and quality of life will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated Low for potential social impacts as the communities are more than 500m away. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its effect on human use and quality of life is ranked as **Medium**. (**Table 6-90**)

Table 6-90: Significance Ranking of impacts from waste management and disposal and its affect on human use and quality of life

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		
Significance	Positive	Negligible	Low	Medium	High
				■	

6.10.2.5 Impact and Risk Mitigation Measures

Impacts from activities required for waste management can be mitigated through the use of the following measures:

Social Impact Assessment – Well Testing Phase			
7 Waste Management	7.1 Hazardous/Non Hazardous waste management	7.1.1 Domestic waste can be a fire hazard, constitute. windblown litter, attract vermin, contaminate surface and groundwater and be a vector for disease	7.1.1.1 Implement construction and installation phase mitigation measures in 12.1.
		7.1.2 Hazard waste i.e. condensate	7.1.2.1 Implement from drilling phase in 13.4.
			7.1.2.2 Transport produced water to dispose by licensed water treatment facility.

6.10.2.6 Residual Impacts and Risks

With these management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of impacts from waste management and disposal and its effect on human use and quality of life being reduced and remaining a ranking of **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High
			■		

6.10.3 Assessment of Impacts to Socio Economy

6.10.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Socio-Economic	Well Testing Phase	Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation	Increased employment/income and procurement opportunities for people, business and services in surrounding area

6.10.3.2 Assessment of Impacts from Employment and Income

Impact Assessment

During well testing phase, around 30 workers will be employed and supplies (such as fuel and water) and services (accommodation, waste management) will be required. Most of the workers are expected to be experienced well testing crew and not locally available. The impacts will be similar the construction and installation phase described in **Section 6.8.6**.

6.11 Social Impact Assessment during Abandonment Phase

From the screening process the following must be assessed to determine their impacts during the preparation phase:

- Land Use
- Transportation
- Waste Management
- Socio-Economy

6.11.1 Assessment of Impacts to Land Use

6.11.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Land Use	Well Abandonment	Site restoration	Restoration of land use

6.11.1.2 Assessment of Impacts from Land Acquisition

The impact disturbs both an area currently used for agriculture with limited conservation value; and also an area of open secondary forest with a medium conservation value.

The main project activity that affects land use is the well site, campsite and access road construction as well as the topsoil storage area. All land needed for the project has been will be acquired or rented by PTTEP SA. The well sites will be constructed and a work camp area will be built adjacent to the Thayet Township. The well site area will be 200 x 240 m for a total the land area of 48,000 m^2 that will be disturbed for each well. The well sites are located in existing agricultural land or open forestland; all new earth access roads will need upgraded to construct as required. The roads will be constructed with a 5 m wide top and 1.5 m side slope with a height of approximately 20 to 30 cm before compaction with granular fill. The earth road distances required for each location are; Tazigauk 1.3 km. Monatkon 3.2 km, Ngabetkya 14 km, Banbyin 4.5 km, Padukpin 1.4 km, Sakangyi 0.5 km. The maximum length of the area impacted would be Ngabetkya well site with a road length of 14 km.

The well site and adjacent accommodation campsite areas will be cleared of topsoil and then levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted granular pad will be 500 mm thick. In the event that the results of the well testing conclude that the wells are non-commercial, the well site, campsite and access roads will be restored to its original state.

The purchase or rental of the land provided a significant financial benefit to landowners. While this land will be temporarily lost from agriculture production. Project operations too may degrade the nearby land and reduce agriculture productivity in those areas (i.e. dust, flares, drainage previously discussed). If hydrocarbon resources are not found the land will be restored to its original state. The impacts from changes in land use to human use values and quality of life values will be local in extent, short term in duration, of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low for potential social impacts as the communities are more than 500 m away.

6.11.1.3 Significance of Impacts

Given the short-term impact of this aspect and its return to its original state, it is determined to be a positive benefit as a result of the financial benefit to land owners and the community.

The significance of impacts from changes in land use to human use values and quality of life values is ranked as **Positive**. (**Table 6-91**)

Table 6-91: Sigificance Ranking of impacts from changes in land use to human use values and quality of life values

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
			■		

Significance	Positive	Negligible	Low	Medium	High

6.11.1.4 Impact and Risk Mitigation Measures

Impacts from construction activities on land use can be mitigated through the use of the following measures:

Social Impact Assessment – Construction and Installation Phase			
9. Land Use	9.1 Return of Well site Land	9.1.1 Change of traditional use.	9.1.1.1 Restore the site and hand back to MOGE as per agreed conditions.

6.11.1.5 Residual Impacts and Risks

With these management measures, the residual significance of impacts from changes in land use to human use values and quality of life values will result in a **Positive** financial benefit.

Residual Significance	Positive	Negligible	Low	Medium	High

6.11.2 Assessment of Impacts to Transportation

6.11.2.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Transportation	Abandonment Phase	Vehicle and Equipment Use Hazardous/Non Hazardous waste management Site Restoration Labour and Accommodation	Increased traffic

6.11.2.2 Assessment of Impacts from Vehicle and Equipment Use

Transportation of equipment, people and services will increase traffic volume in the local area of the planned project and may disrupt of community traffic. Transportation during drilling consists of transport of workers and supplies, transport of industrial water supply and drilling support equipment (Including casing, chemical and etc.) and will be similar to the impacts during construction in **Section 6.8.2**.

6.11.3 Assessment of Impact to Waste Management

6.11.3.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Waste Management	Abandonment Phase	Site Runoff and Drainage Hazardous/non-hazardous waste management	Increased stress on local infrastructure

6.11.3.2 Assessment of Non-Hazardous Solid Waste

General non-hazardous waste will be generated from the drill site, campsite and vehicles during the abandonment phase.

This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 4 tonnes of "domestic" waste and "industrial" waste per month. All solid general non-hazardous waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site. The impact significance is similar to the construction and installation phase in **Section 6.8.5.2.**

6.11.4 Assessment of Impacts to Socio Economy

6.11.4.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Socio-Economic	Abandonment Phase	Handling of Materials and chemicals Hazardous/non-hazardous waste management Use of Public Utility Labour and accommodation Site Restoration	Increased employment/income and procurement opportunities for people, business and services in surrounding area

6.11.4.2 Assessment of Impacts from Employment and Income

Project employment and business opportunities will increase jobs and related income for local communities. The impact significance will be similar to construction phase in **Section 6.8.6**.

6.12 Health Impact Assessment during Construction

From the screening process the following must be assessed to determine their impacts during the preparation phase:

- Dust
- Noise
- Traffic Accidents
- Non-hazardous waste

6.12.1 Assessment of Impacts on Public and Occupational Health

6.12.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Public and Occupational Health	Construction Phase	Access road and Site Construction Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc. Traffic Accidents

6.12.1.2 Assessment of Health Impacts from Dust

During the construction phase, new access roads and the well site will be constructed, while some sections of roads will be upgraded. Granular fill transport and construction activities may increase dust concentrations in air. The types of equipment used during construction include ten wheel dump trucks, graders, rollers and water trucks. The construction time will be 150 days for the well site and access road per site.

The potential health effects of dust are closely related to particle size. Particle sizes are normally measured in microns, and the size range of airborne particles is typically from less than 0.1 microns up to about 500 microns, or half a millimetre. Human health effects of airborne dust are mainly associated with particles less than about 10 microns in size (PM_{10}), which are small enough to be inhaled. Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20 microns.

Many forms of dust are considered to be biologically inert, and hence the primary effects on people relate to our sense of aesthetics. There can also be minor health effects, such as eye irritation, when the dust is airborne. Indirect stress-related health effects could also arise, especially if dust problems are allowed to persist for an unreasonable length of time.

Some nuisance dust may have the potential to cause other types of health effects because of the presence of specific biologically active materials. For instance, some mineral dusts contain quantities of quartz, which can cause the lung disease known as silicosis when persistent at high concentrations. Other dusts may contain significant amounts of toxic metals such as mercury or lead.

There is also the potential for contamination of roof-collected water supplies. Dusty conditions can also affect people's ability to enjoy their outdoor environment. For most people, a major effect of a

dust nuisance problem is annoyance at the increased requirement for cleaning.

Airborne dust can have effects on visibility, although dust is usually less regionally significant. Visibility effects from dust are usually only a concern in the immediate vicinity of a specific source. Visibility effects are largely a matter of aesthetics. However, it should also be recognised that visibility is one of the main ways by which people commonly judge air quality. Loss of visibility is also a safety concern under extreme conditions, especially for road traffic.

Dust may result in respiratory irritation of construction workers and respiratory irritation and worsen asthma of people living nearby. *Dust levels during construction were evaluated in* **Section 6.4.2.2**. The results from the baseline survey indicate that the 24-hour average levels of both $PM_{2.5}$ and PM_{10} did not meet the WHO guideline (50 µg/m^3) at all sampling points. This area is dry and dusty, with fugitive dust emissions being high due to the wind action, agriculture activities, open burning, forest fires and usage of wood stoves contributing to high particulate daily levels in rural background area. The existing baseline levels of dust (respirable $PM_{2.5}$ and PM_{10}) in all regions can cause nuisance and respiratory tract infection. Dust calculations in **Section 6.4.2.2** indicate that construction of access roads to and well sites could increase dust levels further beyond the ambient air standard. The ambient air standard is set to protect public health.

6.12.1.3 Significance of Impacts

The health impacts from dust will be local in extent, short term in duration, reversible and of low magnitude as communities are over 500 m away from the project location. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of health impacts from dust is ranked as **Low**. (**Table 6-92**)

Table 6-92: Sigificance Ranking of health impacts from dust

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
			■		
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
			■		

6.12.1.4 Assessment of Health Impacts from Noise

During the construction phase, noise will primarily be generated from project vehicles for transportation of granular fill, workers, construction equipment and generators.

Construction is expected to result in nuisance noise at some communities but is not expected to exceed the ambient noise standard (See **Section 6.4.3**).

Transport of road fill and the drilling rig will be on local roads. Heavy trucks are expected to emit noise levels of 88 dB (A) at 50 ft. from the source. Houses are located approximately 50 m away from the road. Using **Equation 6-3**, the noise calculated for these houses is approximately 77.7dB (A). The impact however takes place only during the time the truck passes the house. Ambient noise standards do not apply for this type of noise.

Noise levels from construction equipment do not exceed the 90 dB (A) noise standard in the workplace for an 8-hr exposure time. However, a combination of several construction machines could result in a compounded noise level 91 dB (A), exceeding the workplace standard.

The noise levels estimated at communities assumed a worst-case scenario of hemispherical spreading with no attenuation from the surrounding area. However, the presence of trees, vegetation, and the topography will attenuate the noise levels.

6.12.1.5 Significance of Impacts

The health impacts from noise will be local in extent, short term in duration, reversible and of low magnitude as communities are over 500 m away from the project location. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of health impacts from noise is ranked as **Low**. (**Table 6-93**)

Table 6-93: Sigificance Ranking of the Health Impacts from Noise

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.12.1.6 Assessment of Impacts from Traffic Accidents

Transportation of equipment during construction will increase traffic volume in the local area of the planned project resulting in a increase in traffic accidents. The transportation during construction and installation phase consists of transport of workers, construction equipment, fill materials and general supplies.

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures. Before operations PTTEP SA will develop a road safety management plan for the facility during all phases of operations. Measures will be in place to train all drivers in safe and defensive driving methods and the safe transportation of passengers. Speed limits for all vehicles will be implemented and enforced. Vehicles will be maintained in an appropriate road worthy condition and include all necessary safety equipment.

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

The road traffic accidents (RTA) data for Magway compared to Myanmar rates for the years of 2014-2016 are included below.

Year	Region	Road Traffic Accident[8]	
		(1)	(2)
2014	Magway	2.1	8.2
	Union	2.8	8.1
2015	Magway	2.3	7.7
	Union	3.0	8.4
2016	Magway	2.3	8.1
	Union	3.2	9.2

. (1) Morbidity rate per 1000 Population
. (2) Mortality rate per 100,000 Population

The RTA rates are lower in Magway than the union average. The road traffic accident risk in Magway still moderate when compared with that of similar countries. The rate of fatalities per 100,000 people for 2016 in Magways is 8.2. This is not currently considered a high rate per 100,000 people on an international comparative basis. In 2010, the Philippines had a fatality rate of 8.3, Indonesia 17.7, Cambodia 17.6, and Thailand experienced a very high rate of 38.8.[9]

6.12.1.7 Significance of Impacts

The health impacts from traffic accidents will be local in extent, short term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open

[8] Ministry of Health and Sports Department of Public Health, Public Health Statistics (2014 - 2016), Nay Pyi Taw, September 2017

[9] Asian Development Bank, Myanmar transport sector policy note: Road safety. Mandaluyong City, Philippines: Asian Development Bank, 2016.

forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of traffic accidents on health is ranked as **Medium**. (**Table 6-74**)

Table 6-94: Sigificance Ranking of Health Impacts from Traffic Accidents

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.12.1.8 Impact and Risk Mitigation Measures

Impacts from construction activities on traffic accidents can be mitigated through the use of the following measures:

Health Impact Assessment – Construction and Installation Phase			
17. Public & Occupational Health	17.1 Construction Activities & Transportation	17.1.1 Traffic Accidents	17.1.1.1 Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
			17.1.1.2 Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle
			17.1.1.3 Ensuring moving equipment is outfitted with audible back-up alarms
			17.1.1.4 Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads

			when lifting them to higher job-site elevations.
			17.1.1.5 Limit the speed of project vehicles, according to the road condition.
			17.1.1.6 Maintain construction equipment and vehicles.
			17.1.1.7 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
			17.1.1.8 Consult with community leaders on plan and transportation route before movement of large equipment.
			17.1.1.9 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
			17.1.1.10 Strictly enforce training programs to reduce transport and drilling incidents by its contractors.
			17.1.1.11 Implement emergency response training, fire training and response drills.

6.12.1.9 Residual Impacts and Risks

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impacts from traffic accidents on occupational and public health values being reduced and ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High
				■	

6.12.1.10 Assessment of Health Impacts from Non-Hazardous Waste

Non-hazardous wastes during construction and installation phase include food waste, paper, plastic and wooden packaging, rags, glass, metal and plastic drums, sacks, and scrap metal. General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 4 tonnes of "domestic" waste and "industrial" waste per month.

All solid general waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site.

Solid wastes may impact physical health, mental health, and quality of life: for example, food remains cause foul smell, unpleasant ambience, act as a fire hazard and provide habitat for disease carriers including bacteria, flies and rats. This increases the chance of bringing diseases to local people.

Myanmar is a tropical country prone to vector borne disease outbreaks, such as gastrointestinal diseases and dengue and malaria. In 2016, over 36,749 cases were reported as malaria by Basic Health

Staff reporting.[10] Dengue and dengue haemorrhagic fever cases have seasonal epidemics; it is a leading cause of morbidity in Myanmar with 24,700 cases report in 2013.[11] Due to inadequate facilities, the number illnesses due to lack of water supply and sanitation in Myanmar for 2013 are as follows: 49,799 reported cases of diarrhea, 77,964 cases of Gastritis and Duodenitis. Statistics indicate that the situation of communicable vector-borne disease in the project districts is a public health concern.

6.12.1.11 Significance of Impacts

The health impacts from non-hazardous waste will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from non-hazardous waste is ranked as **Medium**. (**Table 6-95**)

Table 6-95: Sigificance Ranking of Health Impacts from Non-Hazardous Waste

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.12.1.12 Impact and Risk Mitigation Measures

PTTEP SA will implement the following mitigation measures to reduce health impacts:

Health Impact Assessment – Construction and Installation Phase			
9. Public and	9.1 Well Site, Road	9.1.1 Respiratory	9.1.1.1 Implement construction and

[10] Public Health Statistics (2014 ‑ 2016), Ministry of Health and Sport, 2017

[11] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

Occupational Health	and Camp Construction	irritation and Exacerbation of asthma impact from dust	installation phase mitigation measures in 2.1.
	9.2 Vehicle and Equipment Use during construction	9.2.1 Hearing impairment for workers and annoyance for public.	9.2.1.1 Implement construction and installation phase mitigation measures in 3.1.
			9.2.1.2 Provide PPE to workers on site.
			9.2.1.3 Should complaints over noise be received, consideration will be given to the provision of noise barriers.
	9.3 Non-Hazardous Waste Management	9.3.1 Food safety, Increase in vector-borne diseases: malaria, typhus and dengue and others.	9.3.1.1 Implement construction and installation phase mitigation measures in 12.1.

6.12.1.13 Residual Impacts and Risks

With the implementation of management measures, the magnitude of impacts from dust will be reduced resulting in a residual significance of the health impacts being ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the residual significance ranking of the health impacts from Noise is **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the magnitude of impacts from non-hazardous waste will be reduced resulting in a residual significance of health impacts being ranked **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.13 Health Impact Assessment during Drilling Phase

Key issues identified by the screening process must be assessed to determine their impacts during the drilling phase, including:

- Noise
- Traffic Accident

- Non-Hazardous Waste
- Hazardous Waste
- Chemical Management
- Labour and Accommodations

6.13.1 Assessment of Impacts to Public and Occupational Health

6.13.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Public and Occupational Health	Drilling Phase	Rig Move Drilling Wells Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc. Traffic Accident

6.13.1.2 Assessment of Health Impacts from Noise

Drilling is expected to result in nuisance noise at some communities which exceeds the ambient noise standard (See **Section 6.4.3**).

Noise levels from drilling equipment and generators do not exceed the 90 dB (A) noise standard in the workplace for an 8-hr exposure time. In addition, the compounded noise level of the drilling rig and two generators. (87.5 dB (A), does not exceed the workplace standard).

6.13.1.3 Significance of Impacts

The health impacts from noise will be local in extent, short term in duration, reversible and of low magnitude as communities are over 500 m away from the project location. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of health impacts from noise is ranked as **Low**. (**Table 6-96**)

Table 6-96: Sigificance Ranking of the Health Impacts from Noise

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.13.1.4 Assessment of Impacts from Traffic Accident

Traffic accidents are a significant cause of injuries and fatalities among members of the public worldwide. Therefore, during the drilling phase all project personnel must implement traffic safety during the rig mobilization and the personnel travelling from the well site to central campsite, and operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and the general public.

PTTEP SA plans to use a land rig for the drilling program. The exact transport route and duration of rig move is not available as the rig contract not yet awarded. The most likely route will be via the Pathein-Monywa road or by Irrawaddi River. The rig mobilization will include around 100 truckloads to complete rig and support equipment. The maximum mobilization distance for the rig is estimated at about 400 km. The rig mobilization duration will be 2-3 weeks.

Drilling Materials will be transported from Yangon to the well sites. The estimated number of round trips for rig and support equipment is 130 truckloads during drilling activities. The rig personnel will transported to the well locations from Yangon.

6.13.1.5 Significance of Impacts

The health impacts from traffic accidents will be local in extent, short term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of traffic accidents on health is ranked as **Medium** (**Table 6-74**)

Table 6-97: Sigificance Ranking of Health Impacts from Traffic Accidents

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.13.1.6 Impact and Risk Mitigation Measures

Impacts from drilling on traffic accidents can be mitigated through the use of the following measures:

Health Impact Assessment – Drilling Phase			
18. Public & Occupational Health	18.1 Drilling Support Activities & Transportation	18.1.1 Traffic Accidents	18.1.1.1 Adoption of best transport safety practices across all drilling operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public including: • Emphasizing safety aspects among drivers • Improving driving skills and requiring licensing of drivers • Adopting limits for trip duration and arranging driver rosters to avoid overtiredness • Avoiding dangerous routes and times of day to reduce the risk of accidents • Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
			18.1.1.2 Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
			18.1.1.3 Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on
			18.1.1.4 Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
			18.1.1.5 Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker

			transport to minimizing external traffic
			18.1.1.6 Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

6.13.1.7 Residual Impacts and Risks

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impacts from traffic accidents on public health values being reduced and ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High
				■	

6.13.1.8 Assessment of Health Impacts from Non-Hazardous Waste

Non-hazardous wastes during drilling include food waste, paper, plastic and wooden packaging, rags, glass, metal and plastic drums, sacks, and scrap metal. General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 4 tonnes of “domestic” waste and “industrial” waste per month.

All solid general waste will be sent for recycling or disposal to at the Thayet CDC disposal dump site.

Solid wastes may impact physical health, mental health, and quality of life: for example, food remains cause foul smell, unpleasant ambience, act as a fire hazard and provide habitat for disease carriers including bacteria, flies and rats. This increases the chance of bringing diseases to local people.

Myanmar is a tropical country prone to vector borne disease outbreaks, such as gastrointestinal diseases and dengue and malaria. In 2016, over 36,749 cases were reported as malaria by Basic Health Staff reporting.[12] Dengue and dengue haemorrhagic fever cases have seasonal epidemics; it is a leading cause of morbidity in Myanmar with 24,700 cases report in 2013.[13] Due to inadequate facilities, the number illnesses due to lack of water supply and sanitation in Myanmar for 2013 are as follows: 49,799 reported cases of diarrhea, 77,964 cases of Gastritis and Duodenitis. Statistics indicate that the situation of communicable vector-borne disease in the project districts is a public health concern.

6.13.1.9 Significance of Impacts

The health impacts from non-hazardous waste will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed;

[12] Public Health Statistics (2014 – 2016), Ministry of Health and Sport, 2017

[13] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from non-hazardous waste is ranked as **Medium**. (**Table 6-98**)

Table 6-98: Sigificance Ranking of Health Impacts from Non-Hazardous Waste

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
				■	
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.13.1.10 Assessment of Health Impacts from Mud, Chemicals and Drilling Waste

Generally, the likelihood of workers in the drilling area to expose the chemicals is low. The workers may expose the chemicals by inhalation, irritation (skin and eye) and eating. However, spill accidents included during transportation may be caused to contaminate soil, surface water or groundwater.

Properties and toxicity of drilling chemicals to environment and health are shown in **Table 6-109**. Most of composition in drilling mud is not classified as hazardous. Some compositions are exceptional such as Caustic Soda (sodium hydroxide), Sodium Bicarbonate, Calcium chloride and Calcium Carbonate can have some health effects and require awareness of the Permissible Exposure Limits (PEL). Standard levels of the chemicals in the workplace are shown in **Table 6-99**.

The chemicals used for exploration drilling will be secured in designated storage area with impervious (cement or plastic sheet) floor and bund wall. If there is a chemical spill, they will be recovered/ cleaned with spill clean up kits provided for the designated rapid response teams to clean up quickly and efficiently.

The Drilling Program for this project will use Water Based Mud or Synthetic Based Mud (SBM) depending on results of subsurface and seismic interpretation. The majority of the components of the drilling mud systems are classified as low-toxic with the exception of a few key chemicals.

Table 6-99: Permissible Exposure Limits (PEL) over 8-hour TWA

Chemicals	Permissible Exposure Limit (8-hr TWA)
Barium Sulphate (Barite)	Not applicable
Bentonite	Not applicable
Starch	Not applicable

Caustic Soda (sodium hydroxide),	2 mg/m³ (WEL-TWA, respirable dust)
Sodium Bicarbonate	5 mg/m³ (WEL-TWA, respirable dust)
Primary Emulsifier	Not applicable
Secondary Emulsifier	Not applicable
Organophilic Clay	Not applicable
Gilsonite	Not applicable
Calcium Hydroxide	Not applicable
Polymeric Blend	Not applicable
Calcium chloride	4 mg/m³ (WEL-TWA, respirable dust)
Calcium Carbonate	4 mg/m³ (WEL-TWA, Limestone-respirable dust)

Source: 1. SDS, Chemical Data Bank, Pollution Control Department of Thailand

2. Occupational Safety and Health Administration (OSHA), USA

Mud chemicals and drilling waste may impact community health should spillage contaminate soil, surface water or groundwater. Health may be impacted by accumulation of contaminants in the body if contaminated water is consumed and may cause irritation if used for bathing and washing. Local communities in the vicinity of the project site, particularly people who use and consume local water resources are potentially at risk. In addition, the public is concerned about chemicals and drilling waste.

Potential exposure to chemicals under normal conditions is limited to workers within the well site boundary. Workers can be exposed to the chemicals through the following exposure routes: inhalation, dermal or eye contact, and ingestion. However, accidental spills (including during transport) and leaks may release chemicals and drilling waste into the environment and impact nearby community health or contaminate their water and land resources.

Impacts from mud chemicals and drilling can have minor health effects, which are reversible e.g. skin irritation, food poisoning for occupational health; and for community health, extent of health effect limited to rare individual cases within worker and/or local community.

6.13.1.11 Significance of Impacts

The health impacts from mud chemicals and drilling waste will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from mud chemicals and drilling waste is ranked as **Medium**. (**Table 6-100**)

Table 6-100: Sigificance Ranking of health impacts from mud chemicals and drilling waste

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.13.1.12 Assessment of Health Impacts from Hazardous Chemicals and Waste

Drilling activities will generate a low volume of hazardous waste including lubricating and hydraulic oil, rags and other materials contaminated with chemicals, and drums and containers used for chemical transportation and storage. The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 0.5 tonnes per month. The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to the approved waste management facility.

Generally, the likelihood of workers in the drilling area to expose the hazard wastes is low. However, spill accidents included during transportation may be impact to health of employees and people.

Community health may be impacted through spills and subsequent contamination of soil, surface and groundwater resources. Consumption of such water may result in bioaccumulation of contaminants and various health impairments. Bathing and washing in it may cause skin irritation. Indirect public health impacts could occur through soil contamination by oils, chemicals and the bioaccumulation of heavy metals impacting crop yields and food quality. Worker health is affected in similar ways. Because workers are closer to and handle hazardous waste, the likelihood of exposure is higher of workers than for the public.

Any spills on the drill pad would be directed into the waste pit. An oil trap will prevent oil from flowing into the waste pit. The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills.

6.13.1.13 Significance of Impacts

Impacts from hazardous chemicals and waste may affect both occupational health and community health, and are considered to be local in extent, of medium term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from hazardous chemicals and waste is ranked as **Medium**. (**Table 6-101**)

Table 6-101: Sigificance Ranking of impacts from hazardous chemicals and waste

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km

Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.13.1.14 Assessment of Impacts from Health Impacts from Communicable Diseases

Drilling activities will require up to 100 temporary workers. Because these are specialized positions, most of these workers will temporarily move into the area. Experiences from other parts of the world have shown that oil and gas development activities introduced or increased incidence of communicable diseases, such as HIV/AIDS and malaria, in communities where these projects are located. Although the PTTEP SA project is not a large-scale development, the influx of outside workers could contribute to proliferation of communicable diseases in local communities.

The structures at the project well sites can conceivably contribute to vector-borne diseases such as malaria, dengue by providing breeding grounds for mosquitoes if they are not properly maintained. These structures include a perimeter drainage trench and an intermediate drainage trench and the concrete lined cutting pit. Unhygienic practices in the work place may also promote spread of gastrointestinal diseases amongst project employees.

The potential health impacts from an influx of workers could contribute to proliferation of communicable diseases in local communities and the work force.

National statistics on HIV/AIDS are provided in **Table 6-102**. Detailed information on HIV/AIDS is limited.

Table 6-102: National HIV/AIDS Statistics[14]

Number of people living with HIV	230 000 [200 000 - 260 000]
Adults aged 15 to 49 prevalence rate	0.8 [0.6 - 0.9]
Adults aged 15 and up living with HIV	220 000 [190 000 - 250 000]
Women aged 15 and up living with HIV	81 000 [71 000 - 91 000]

In 2016, over 36,749 cases were reported as malaria by Basic Health Staff reporting.[15] Dengue and dengue haemorrhagic fever cases have seasonal epidemics; it is a leading cause of morbidity in Myanmar with 24,700 cases report in 2013.[16] Due to inadequate facilities, the number illnesses due to lack of water supply and sanitation in Myanmar for 2013 are as follows: 49,799 reported cases of diarrhea, 77,964 cases of Gastritis and Duodenitis. Statistics indicate that the situation of communicable vector-borne disease in the project districts is a public health concern. Most surveyed respondents claimed to have slept under a mosquito net the previous night.

[14] UNAIDS Myanmar Statistics, 2016. Accessed on Feb 15th from http://www.unaids.org/en/regionscountries/countries/myanmar

[15] Public Health Statistics (2014 - 2016), Ministry of Health and Sport, 2017

[16] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

6.13.1.15 Significance of Impacts

Impacts from communicable disease may affect both occupational health and community health, and are considered to be local in extent, medium term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health Impacts from communicable disease is ranked as **Medium**. (**Table 6-103**)

Table 6-103: Sigificance Ranking of Impacts from Communicable Disease

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.13.1.16 Impact and Risk Mitigation Measures

PTTEP SA will implement the following mitigation measures to reduce health impacts:

Health Impact Assessment – Drilling Phase			
13. Occupational and Public Health	13.1. Rig, Generators and Equipment	13.1.1. Health impact from noise	13.1.1.1. Implement drilling phase mitigation measures in 2.1.
			13.1.1.2. Provide PPE to workers on site
	13.2. Non Hazardous waste management	13.2.1. Health impact from Non-Hazardous Waste	13.2.1.1. Implement construction and installation phase mitigation measures in 12.1.
	13.3. Handling and Disposal of Hazardous Waste	13.3.1. Health impact from hazardous Waste	13.3.1.1. Implement drilling phase mitigation measures in 11.2.
	13.4. Hazardous waste management and chemical	13.4.1. Health impact from Mud, Chemicals and	13.4.1.1. Implement drilling phase mitigation measures in 11.3.

	handling	Drilling Waste	
	13.5. Labour and Accommodations	13.5.1. Health impact from Communicable Diseases	13.5.1.1. Implement construction and installation phase mitigation measures in 12.1.
			13.5.1.2. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.
			13.5.1.3. Drainage and removal of waste from waste pit upon completion of drilling.
			13.5.1.4. Health screening of workers before employment.
			13.5.1.5. On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.
			13.5.1.6. Considering on hiring of qualified local workers to reduce reliance on outside labour and increase local employment.
			13.5.1.7. Do not allow workers to enter communities near the drill site.
			13.5.1.8. Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.

6.13.1.17 Residual Impacts and Risks

With the implementation of management measures, the residual significance ranking of the health impacts from Noise is **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from non-hazardous waste being ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the magnitude of impacts will be reduced resulting in a residual significance of the health impacts from hazardous waste being ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from mud chemicals and drilling waste being ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health Impacts from communicable disease that is ranked as **Low**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.14 Health Impact Assessment during Well Testing Phase

From the screening process the following must be assessed to determine their impacts during the preparation phase:

- Dust
- Light and Heat from Flaring
- Air Emissions from Flaring
- Traffic Accidents
- Non-hazardous waste
- Hazardous Waste

6.14.1 Assessment of Impacts on Public and Occupational Health

6.14.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Public and Occupational Health	Testing Phase	Flaring of Gas Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc.

6.14.1.2 Assessment of Health Impacts from Dust

During the well testing phase Vehicle and Equipment Use could result in dust along the local roads in the area from transportation of workers and supplies. The impact will be similar to the drilling phase in **Section 6.12.1.2**.

6.14.1.3 Assessment of Impacts from Health Impacts from Light and Heat

Testing will be conducted for those exploration wells showing promising hydrocarbon presence. During the well testing process (22 days/well), flaring will create high temperatures near the flare. Flaring during well testing will constitute a potentially significant light source where gas will be burnt off via a flare stack. The flare stack will be a horizontal flare directed into a protected flare pit to ensure the safety of workers at the well site and to reduce heat / light radiation. The nearest community is expected to be located more than 500m away (for all the proposed well sites); thus, impact from light and heat from the flare stack will be minimal. A safety zone will be established around the flare with security fencing.

Residents close to the well testing sites will be affected from flaring, mainly through disturbance of psychological wellbeing and annoyance if the flare is visible. However the flare will not be an issue if hydrocarbons are not found, and if found the flaring phase will last only 22 days per well.

Workers could however be affected by heat from the flare. An assessment of heat impacts was done in **Section 6.6.3.4** and the safe distance for continuous exposure without protection is 35 m.

6.14.1.4 Significance of Impacts

Health impacts from light and heat are considered to be local in extent, of short-term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from light and heat is ranked as **Medium**. (**Table 6-104**)

Table 6-104: Sigificance Ranking of Health Impacts from Light and Heat

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
			■		
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
			■		
Magnitude	Positive	Negligible	Low	Medium	High
				■	
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
				■	
Significance	Positive	Negligible	Low	Medium	High
				■	

6.14.1.5 Assessment of Health Impacts from Flare Emissions

Pollutants emitted from the flare include Carbon dioxide, Hydrocarbons and Nitrogen oxides. These pollutants may affect the respiratory system, circulatory system and central nervous system, depending on the concentration of pollutants and period of contact. Evaluation of the rate of emission of air pollutants caused by flaring in the well testing phase found greenhouse gas emissions from the activities of well testing phase is 15,136.70 tons of carbon dioxide equivalent per year of primary greenhouse gases (GHGs) (e.g. carbon dioxide CO2 and methane CH4) and varying amounts of other pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx) and sulphur (SOx), volatile organic compounds (VOCs), and particulate matter (PM) will be released to the atmosphere during the well testing program. This volume is considered low and not expected to have adverse health effect for the people who live around project site. The well testing process is short term (22 days/well).

6.14.1.6 Significance of Impacts

Health impacts from flare emissions are considered to be medium in extent, of short-term duration, reversible, and of medium magnitude. The impact disturbs an area currently used for agriculture and mixed open forest; income levels are low and health treatment infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium for potential health impacts. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from flare emissions is ranked as **Medium**. (**Table 6-105**)

Table 6-105: Sigificance Ranking of Health Impacts from Flare Emissions

	Level and Type of Impact				
	+1	0	-1	-2	-3
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.14.1.7 Assessment of Impacts from Traffic Accidents

Traffic Accidents during well testing will consist of transport of workers and supplies, transport of industrial water supply and testing support equipment and will be similar to the impacts during Drilling Phase in **Section 6.13.1.4**.

6.14.1.8 Assessment of Health Impacts from Non-Hazardous Waste

Non-hazardous wastes during well testing phase are similar to the impacts from construction and installation phase in **Section 6.13.1.8**.

6.14.1.9 Assessment of Health Impacts from Hazardous Waste

Hazardous wastes during well testing phase are similar to the impacts from drilling phase in **Section 6.13.1.12.**

PTTEP SA will implement the following mitigation measures to reduce health impacts:

Health Impact Assessment – Well Testing Phase			
9 Occupational and Public Health	9.1 Flaring	9.1.1 Heat exposure and Nuisance light from Light and heat	9.1.1.1 Implement well testing phase mitigation measures 3.1.
			9.1.1.2 Implement PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.
			9.1.1.3 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
			9.1.1.4 Heat impacts from the flare stack will be minimised by having a protected flare pit.

			9.1.1.5 Maintain a safe distance from nearest sensitive receptor.
	9.2 Flaring	9.2.1 Increase in respiratory illnesses/diseases, asthma, Disturbance psychological wellbeing from flaring emissions	9.2.1.1 Ensure flare system has efficient combustion.
			9.2.1.2 Clear vegetation around the flare stack and build earth bermed flare pit.
			9.2.1.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			9.2.1.4 H2S detection and safety equipment is standard issue. PTTEP SA's develop emergency response plan (ERP) and H2S Contingency Plan.
			9.2.1.5 Monitor H2S during well testing.
			9.2.1.6 Staff trained in H2S procedures.
	9.3 Well Testing Support Activities & Transportation	9.3.1 Traffic Accidents	9.3.1.1 Implement drilling phase mitigation measures in 18.1.
	9.4 Non-hazardous waste management	9.4.1 Waste can be a contaminate surface and groundwater, and be a vector for disease.	9.4.1.1 Implement construction and installation phase mitigation measures in 12.1.
	9.5 Hazardous waste management	9.5.1 Health impacts from Hazardous Waste	9.5.1.1 Implement drilling phase mitigation measures in 11.2.

6.14.1.10 Residual Impacts and Risks

With the implementation of management measures, the magnitude of impacts will be reduced resulting in a residual significance of the health impacts from heat due to flare emissions being ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High
			(highlighted)		

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from air emissions due to flaring ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.15 Health Impact Assessment during Abandonment Phase

From the screening process the following must be assessed to determine their impacts during the abandonment and site restoration phase:

- Traffic Accidents
- Non-hazardous waste

6.15.1 Assessment of Impacts on Public and Occupational Health

6.15.1.1 Scope of Assessment

Resource/Receptor	Project Phase	Activity	Impact
Public and Occupational Health	Abandonment Phase	Vehicle and Equipment Use Site Runoff and Drainage Hazardous/non-hazardous waste management, Handling of Materials and Chemicals Site Restoration Labour and accommodation	Exposure to air pollutants, dust, or noise, exposure to water contaminated by accidental spills, accidents, concern and stress about accidents, spills, wastes, noise, contagious diseases from workers etc. Traffic Accidents

6.15.1.2 Assessment of Impacts from Traffic Accidents

Traffic Accidents during well abandonment and site restoration will consist of transport of workers and supplies, construction equipment and removal of well infrastructure will be similar to the impacts during Construction Phase in **Section 6.12.1.6**.

6.15.1.3 Assessment of Health Impacts from Non-Hazardous Waste

Non-hazardous wastes during abandonment and site restoration phase are similar to the impacts from construction and installation phase in **Section 6.12.1.10**.

6.15.1.4 Impact and Risk Mitigation Measures

PTTEP SA will implement the following mitigation measures to reduce health impacts:

Health Impact Assessment – Well Abandonment Phase			
9 Public and Occupational Health	9.1 Well Abandonment Support Activities & Transportation	9.1.1 Traffic Accidents	9.1.1.1 Implement construction and installation phase mitigation measures in 17.1.
	9.2 Non-hazardous waste management	9.2.1 Exposure to contamination from non-hazardous wastes,	9.2.1.1 Implement construction and installation phase mitigation measures in 12.1.

6.16 Exploration Drilling Unplanned Events Impact Assessment

6.16.1 Criteria and Method for Unplanned Events Impact Assessment

The impacts associated with unplanned events during implementation of the PTTEP SA's Exploration Drilling Project are evaluated by determining the likelihood (or probability) of an event occurring, and the significance of the event on the environment, social, and health. Assessment of the level of significance impact requires consideration of the impact level (i.e. magnitude of the environmental effect, its geographical scale and duration) in relation to the sensitivity of the key receptors and resources considered. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking.

Unplanned Events Considered

For the PTTEP SA Exploration Drilling Project, the unplanned events considered were:

(1) Blowout (with subsequent fire and/or explosion);
(2) Fire or Explosion (not Associated with Blowout);
(3) Chemical or Hazardous Waste/Materials Spill
(4) Transportation Accidents;
(5) Thunderstorms; and
(6) Earthquakes.

These unplanned events will be assessed by determining possible causes, likely receptors affected, probability and Risk Rankings of the events. Residual risks will be evaluated after management measures are defined.

If the risk is determined to be "High", it is considered to be intolerable and must be reduced. If the risk is determined to be medium, risk reduction measures need to be implemented to reduce the frequency of occurrence or to mitigate any Risk Rankings to achieve a risk which is "As Low As Reasonably Possible" (ALARP). If the risk is determined to be "Low", the activity must be managed for continuous improvement.

The following table lists potential unplanned events affecting this exploration drilling program and identifies the aspects by project phase.

Table 6-106: Unplanned Event Aspects by Project Phase

Health Aspects	Site Construction	Exploration Drilling & Testing	Restoration and Abandonment
Blowout (with subsequent fire and/or explosion)		✓	
Fire or Explosion (not associated with Blowout)	✓	✓	✓
Chemical or Hazardous Waste/Material Spill	✓	✓	✓
Transportation Accidents	✓	✓	✓
Earthquakes	✓	✓	✓

The assessment of each aspect includes the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- A determination of the residual risk after management measures is included.
- An aspect summary assessment table.

6.16.2 Assessment of Impacts from Blowout (with subsequent Fire and/or Explosion)

Blowouts during exploration drilling and testing have an inherent risk of fire due to the flammability of hydrocarbon gas when mixed with air. The main risk is to the health and safety of the concessionaire's employees and contractors (People) working at the well site at the time of any incident and damage to equipment and structures (Assets).

A kick is an uncontrolled flow of formation fluids into the borehole and a blowout is the uncontrolled release at the surface. Not all kicks involve hydrocarbons; commonly they involve fresh or salty water. A kick can be controlled in the first instance by increasing the specific gravity of the drilling mud, which increases the effective pressure exerted by the mud on the formation, or by shutting in the well at the surface and increasing the mud weight. The ultimate response to a kick is to close the blow-out preventer (BOP) valve (pipe rams) to completely shut-in the well.

A blowout only occurs if all of the measures taken to control a kick fail and the pressure cannot be contained by the BOPs or the well casing ruptures. The most common cause of a blowout is that the well encounters unexpectedly high formation pressures or there is a rapid loss of the drilling mud into fractures or caverns in the formation. In areas where previous wells have already been drilled, the maximum formation pressures and depths of any over-pressured zones or lost circulation zones have been determined. The well plan is designed based on this information and ensures that the BOPs are sized to contain the pressure and the casing is positioned to establish control. Thus, there are numerous control systems, plans and procedures that have to fail in order for a blowout to occur. Nevertheless, they do occur and are a constant hazard that every well faces. Consequently, all drilling operations are planned taking into account the blowout risk and all personnel are trained and experienced in the procedures needed to control a kick and prevent a blowout.

Maximum pressure for the project prospect wells is expected to be not exceeding 9,500psi. PTTEP SA will use a 5,000 psi rated 21-1/4" BOP and a 10,000 to 15,000 psi BOP with double ram preventers in the 13-5/8" section.

The BOP is tested and certified as per API standards to 10,000 psi before installation. Once the BOP stack is installed it is pressure tested to API specification (API RP 53) to 10,000 psi. Once in service the BOP stack must be tested ever 3 weeks as per API specification. PTTEP SA's standard operation procedures require the BOP to be tested every 2 weeks which is more stringent than API specification. Also, every time a connection is made (i.e. wellhead connection) the BOP must be pressure tested again to as per API specification. BOP unit will have separate generator which will use power supply to generate pressure in the accumulator to operate BOP that is always available.

If a blowout contains hydrocarbons, these have the potential to mix with the air, providing oxygen, and a spark can cause the mixture to ignite. As the fluids flowing from the well will be under significant pressure, the result will be a 'jet' of flame that will shoot out in the direction of any holes in the well head (usually this is directed vertically).

The impact of a blowout will depend on the amount of hydrocarbons flowing from the well and their pressure. Thermal radiation of 8.5 kW/m^2 can result in pain after about 8 seconds exposure and second-degree burns after about 20 seconds of exposure. A blowout could have the potential to create a significant hazard to anyone without protective clothing. Even if a fire does not ignite, the released gas can lead to suffocation or poisoning. Thus, the first response to any blowout is to evacuate personnel to a safe distance before planning commences for containment and well control. With the exception of the personnel on site, the nearest people to any of the sites must be greater than 350 feet (about 100 meters). Therefore there is no immediate hazard to the local population in the unlikely event a blowout should occur, allowing time for evacuation in a severe situation.

Although standard precautions are taken on all wells drilled to prevent, control or contain a blowout, blowouts do occur, but rarely.

An escape of large quantities of gas could result in notable reduction in local air quality causing a temporary stress to those exposed. Natural gas can cause headaches, nausea and dizziness in a high concentration when inhaled.

Small leaks of gas will not be toxic and any irritation would be minor to workers. In addition, a blowout is very likely to cause damage to equipment and injuries to drill rig workers.

Liquid hydrocarbon impacts in the event of Blowout, would lead to contamination of soil and groundwater, and also surface water.

6.16.2.1 Significance of Impacts

The frequency of a blowout is very low at 4.4×10^{-4} blowouts per well drilled worldwide (E&P, 2010), or 4.9 $x10^{-4}$ (SENES Consultants, 2016) and much lower for wells drilled into normal formations i.e. not known to have high-pressure gas. The likelihood of its occurrence is considered “Occasional/Rare” which relates to B Unlikely in our Risk Matrix.

The significance of a blowout considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of **Medium**. (**Table 6-107**)

Table 6-107: Risk Assessment Matrix for Blowouts

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact		**Medium**			High Risk

6.16.2.2 Impact and Risk Mitigation Measures

PTTEP SA's Myanmar Asset Crisis Management Plan and Blowout Contingency Plan set out the specific management procedures to be implemented to mitigate the impact if a blowout/explosion occurs. This plan defines the procedures that are to be used in the event of a well control emergency occurring in their exploration drilling program.

A full set of preventative measures will be in place to reduce the risk significance of a blowout occurring, including:

- Examination of existing wells to identify shallow gas hazards.
- Drilling and Well Control Standard Operating Procedures and extensive SSHE Management System procedures and operational controls in place.
- Internal hazardous operations reviews and "Table Top Drilling" exercises to test procedures and individual personnel performances against the drilling plan.
- Select proper drill fluid formulation, provide well kill fluids/systems, loss control and weighting agents.
- Very careful monitoring of down hole conditions and mud returns.
- Use of appropriate, high quality materials in well construction (casing and cement grades).
- Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures.
- Follow PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan in place.
- PTTEP SA's SSHE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.

6.16.2.3 Residual Impacts and Risks

With the implementation of management measures, the residual risk from a Blowout is ranked as **Medium**.

Residual Risk	Positive	Negligible	Low	Medium	High
				■	

6.16.3 Assessment of Impacts from Fire or Explosion (not Associated with Blowout)

Potential sources of fire other than from a release of hydrocarbons from the well include the burning of garbage, discarded cigarettes, the presence of diesel fuel on site and the flare during testing. Burning of garbage will be prohibited and smoking will be restricted to safe areas. Diesel is not easily ignited as flash point of diesel is in the range of 40 to 100 ^{0}C which is above the normal room temperature, so the likelihood of a fire occurring is unlikely. Furthermore, the lower explosive limit (LEL) of diesel fuel is 0.6 percent that equals of the concentration of approximately 6,000 ppm. It is unlikely that a fuel spill would cause this concentration to ignite and explode when it occurs in an open area, such as PTTEP SA's well site.

6.16.3.1 Significance of Impacts

Incident statistics for the onshore oil and gas sector are general and not specific for onshore oil wells, similar to PTTEP SA's proposed project. For instance, statistics for all oil and gas workers in the

United States indicated that there were 120 fatalities in 2015 and 89 fatalities in 2016 for the entire Mining, quarrying, and oil and gas extraction industry. The rate of fatal injury is 10.1 per 100,000 full-time equivalent workers (FTEs)[17]. The probability of a fire or explosion is Unlikely (B).

A fire or explosion may result in multiple on-site fatalities. Therefore, the significance of a *fire or explosion not associated with a blowout* considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of **Medium**. (**Table 6-108**)

Table 6-108: Risk Assessment Matrix for Fire or Explosion

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact		**Medium**			High Risk

Should a fire occur, there are numerous fire extinguishers on site, and staffs are trained in their use, so any fire from these sources would quickly be brought under control. In an event of a major fire, PTTEP SA would alert and cooperate with the local fire brigades.

6.16.3.2 Impact and Risk Mitigation Measures

Fires will be managed under existing emergency plans. The risk significance of fire will be reduced by using the following mitigation measures:

- PTTEP SA's SSHE Integrated Management System Procedures and operational controls to prevent a fire/explosion.
- PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs.
- Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
- Pre-arranged call out support from local fire brigades.

[17]US Labour Statistics. Accessed on Feb 15th from https://www.bls.gov/news.release/cfoi.t04.htm

6.16.3.3 Residual Impacts and Risks

With the implementation of management measures, the residual risk from a Fire or Explosion not associated with a blowout is ranked as **Medium**.

Residual Risk	Positive	Negligible	Low	Medium	High

6.16.4 Hydrocarbon, Chemical or Hazardous Waste/Materials Spill

Hydrocarbon, chemicals and hazardous waste materials present potential risk of spills to the environment and spillage could affect air quality, soil quality, surface water, groundwater, biota and people. The quantity of the hazardous chemicals that will be used at well site is minimal; therefore, the impact on the environment in the case of a spill would be limited in area and likely to be transitory.

The potential impacts from spills of fuel or lubricant oils area:

- Decline in groundwater quality
- Temporary localized decline in surface water quality and aquatic biota
- Temporary localized decline in soil quality
- Temporary minor toxicity to flora and fauna

6.16.4.1 Impact from Hydrocarbon Spills Impacting Groundwater

The fuel tanks (approximate 80 m^3 capacity) will be set on the concrete rig pad within the rig pad. The fuel tanks will be completely surrounded with a bund to contain any spillage. The fuel storage area will have spill kits and absorbent material to contain any potential fuel spills during re-fuelling.

The areas of the well pad where oil, lubricants and drilling mud may spill are isolated by a drainage system designed to drain all run-off on the rig pad into the waste pit. The drilling well pad area is made of concrete, which prevents leakage of contaminated water to the surrounding area. Machines within the drilling pad area that could potentially release contaminated water include skip tank, cuttings pit, cement mixer, and drilling rig. Runoff within the drilling area will be drained via drainage gutter into the cuttings pit, which will accumulate all of the runoff and contaminated water generated within the drilling area. Therefore, contaminated water from this area will go through an oil trap and end up in the concrete lined cuttings pit and won't escape to contaminate surrounding areas.

The volume of runoff from the well site will be calculated from the volume of the heaviest rainfall within 30 minutes with a month's equivalent rainfall in one hour. The volume of the cuttings pit (2,300 m^3) and concrete lined cutting pit is much more than the volume of the extremely heavy runoff. Therefore, the cuttings pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the cuttings pit will be monitored regularly. If water level in the cuttings pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit.

Around the well site area, the buffer zone and earth bun will be provided and served as a secondary containment. The earth bun will contain the runoff from the well site. The bun will be excavated 1.5 m high.

These measures should ensure that there is no accidental release of hydrocarbons into the groundwater. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site.

0The groundwater table in the project area is very deep (except near seasonal drainage areas and watercourses. However, shallow unconfined aquifers are tapped as water source in certain villages, so the severity of impact depends on the location of well site to community wells.

6.16.4.2 Impact from Hydrocarbon Spills Impacting Surface Water Quality and Aquatic Biota

The areas of the well pad where oil, lubricants and drilling mud may spill are isolated by a drainage system designed to drain all run-off on the rig pad into the waste pit. The drilling well pad area is made of concrete, which prevents leakage of contaminated water to the surrounding area. Machines within the drilling pad area that could potentially release contaminated water include skip tank, cuttings pit, cement mixer, and drilling rig. Runoff within the drilling area will be drained via drainage gutter into the cuttings pit, which will accumulate all of the runoff and contaminated water generated within the drilling area. Therefore, contaminated water from this area will go through an oil trap and end up in the concrete lined cuttings pit and won't escape to contaminate surrounding areas. Around the well site area, the earth bun will be provided and served as a secondary containment. The earth bun will contain the runoff from the well site. The bun will be excavated 1.5 m high.

The fuel tanks (approximate 80 m^3 capacity) will be set on the concrete rig pad within the rig pad. The fuel tanks will be completely surrounded with a bund to contain any spillage. The fuel storage area will have spill kits and absorbent material to contain any potential fuel spills during re-fuelling. On site separated emulsion-condensate will be stored in separate tanks placed within the intermediate drainage system. These measures should ensure there is no release of contaminated water to the area outside the site. PTTEP SA has an oil spill contingency plan if there is any accidental release.

These measures should ensure there is no release of contaminated water to the area outside the site. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site. This will be disposed of as hazardous waste.

6.16.4.3 Impact from Hydrocarbon Spills Impacting Soils, Flora and Fauna

Fuel spills can increase soil toxicity and/or decrease soil fertility and impact flora and fauna. The site will have spill kits available to be used if any accidental fuel spill happens during operations. PTTEP SA has an oil spill contingency plan if there is any accidental release.

Fuel spills may occur during fuelling of vehicles or tanks at the drilling site, or because of leaks from the fuel storage tank at the drilling site. All spills will be cleaned up immediately with the spill kits on site that include shovels, absorbents (sand) and steel containers. At the end of the project, all oily wastes classified as hazardous will be transported and disposed at approved waste management facility.

Fuelling during drilling operations will be conducted within the prepared site. The oil traps on each side of the location will ensure that any spills are contained within the site and do not contaminate any soil surrounding the location.

6.16.4.4 Mud and Chemical Spills

Mud and chemical spills from storage and handling could happen during all phases of the exploration campaign.

Impact Assessment

The potential impacts from mud and chemicals are:

- Decline in groundwater quality

- Temporary localized decline in surface water quality and aquatic biota
- Temporary localized decline in soil quality
- Temporary minor toxicity to flora and fauna

6.16.4.5 Impact from Mud and Chemical Spill Impacting Groundwater

Only a limited amount of hazardous material is to be held at the project site and only during drilling. The mud chemicals are all delivered and stored on site as dry powder. The majority of components of the drilling mud are classified as non-hazardous with the exception of a few key chemicals. The Concentrations of these chemicals used in the drilling mud are however of low-toxicity.

Mud chemicals shall be stored in a covered and concreted warehouse before transportation to the drilling site. Mud chemicals will be stored with tarpaulin covers or roof to protect mud chemicals from rain. Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers. The area will have a berm to protect from accidental spills. However, the drilling chemicals are mostly dry powder materials, so the risk of spill is low. All Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers as per the manufactures recommendations. Other storage areas such as parts, equipment and repair shops will be contained in converted portable 40-foot containers or the steel baskets.

These measures should ensure that there is no accidental release into the groundwater. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site.

6.16.4.6 Impact from Mud and Chemical Spill Impacting Surface Water and Aquatic Biota

For this exploration drilling program, the drilling will use Water Based Mud or Synthetic Based Mod (SBM) depending on results of subsurface and seismic interpretation. The majority of the components of the drilling mud systems are classified as non-hazardous with the exception of a few key chemicals. The toxicology for Caustic Soda (sodium hydroxide), Sodium Bicarbonate, Calcium Hydroxide, Polymeric Blend are shown in **Table** 6-109. At the end of the first well location, the left over drilling mud will be transferred and used at the next well location. At the end of drilling campaign the left over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP other drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs. There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the approved waste management facility.

The areas of the well pad where oil, lubricants and drilling mud may spill are isolated by a drainage system designed to drain all rainwater run-off on site into the cuttings pit. Mud chemicals will be stored with tarpaulin covers or roof to protect mud chemicals from rain. Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers. The area will have a berm to protect from accidental spills. However, the drilling chemicals are mostly dry powder materials, so the risk of spill is low. All Hazardous chemicals will be segregated from the main chemicals and kept in appropriate containers as per the manufactures recommendations.

Accidental spills may deteriorate surface water quality and aquatic biota. Some chemicals from drilling operation may be toxic to aquatic biota and cause eutrophication or dissolved oxygen depletion of water bodies. Containment measures are installed at the well sites to ensure that there is no release of spilt material off-site. These measures include: drainage systems around the rig and areas of the well pad where oil, lubricants and drilling mud may spill, waste pit sufficient in size to contain any spills and storm rainfall event.

Table 6-109: Environmental Characteristics of Components in the Drilling Fluids

Chemical Compound	Biota Affected	Toxicity
Barium Sulphate (Barite)	N/A	No data
Bentonite	N/A	No data
Starch	N/A	No data
Caustic Soda (sodium hydroxide)	Fish	Fish $LC_{50\ (96h)}$: 43mg/l[2]
Sodium Bicarbonate	Fish	Fish $LC_{50\ (96h)}$: 8600 mg/l[2]
Primary Emulsifier	N/A	No data
Secondary Emulsifier	N/A	No data
Organophilic Clay	N/A	No data
Gilsonite	N/A	No data
Calcium Hydroxide	Fish	Fish $LC_{50\ (96h)}$: 160 mg/l[2]
PolymericBlend	Fish	Fish $LC_{50\ (96h)}$: fathead minnow 20 mg/l[2]
Calcium chloride	N/A	No data
Calcium Carbonate	N/A	No data

Source: [1]Ecotox: http://cfpub.epa.gov/ecotox/help.cfm?sub=about,
[2]SDS,
[3]http://www.pesticideinfo.org/List_ChemicalsAlpha.jsp

6.16.4.7 *Impact from Mud and Chemical Spill Impacting Soil*

With the necessary drainage isolation, capture systems, protected storage in place, together with good housekeeping, the risk of contaminants release into the soil around the site is minimal. The mud chemicals held on site are mostly non-toxic and biodegradable, limiting both the severity and the duration of any impact.

6.16.4.8 *Impact from Mud and Chemical Spill Impacting Terrestrial Flora and Fauna*

The containment systems chemicals and drilling mud are comprehensive and the likelihood of any of these substances reaching terrestrial flora and fauna off-site is unlikely. The mud chemicals held on site are mostly non-toxic and biodegradable, limiting both the severity and the duration of any impact from an on-site spill. Hazardous chemicals are segregated from the main chemicals and kept in appropriate containers during drilling. Spills during transportation however have the potential to affect soils and surface water quality and thus terrestrial flora and fauna.

6.16.4.9 *Significance of Impacts Mud, Chemical and Hydrocarbon Spills*

Without mitigation measures, the probability of a Hydrocarbon, chemicals and hazardous waste materials spill to the environment affecting air quality, soil quality, surface water, groundwater, biota and people impact occurring is determined to be Possible (C).

The value of the study area as habitat for one well is significantly affected by its current use as agriculture areas are used to grow Beans/Pulses (45%), with rice as the next most common crop (40%), with some sesame (9%) and corn (16%).

The second well however is located in an open mixed forest area considered to have a higher conservation values. The impact could be important on a local level; therefore the significance of a hydrocarbon, chemical or hazardous waste/materials spill considering its magnitude of the

environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be medium. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of **Medium**. (**Table 6-110**)

Table 6-110: Risk Assessment Matrix for Hydrocarbon, Chemical or Hazardous Waste/Materials

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			**Medium Risk**		
5	High Impact					High Risk

6.16.4.10 *Impact and Risk Mitigation Measures*

The impact of a hydrocarbon, chemical or hazardous waste/materials spill will be reduced by using the following mitigation measures:

- Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures.
- Spill containment and recovery equipment will be available near storage areas.
- Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP and Spill Contingency Plan.
- SDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the SSHE Officer.
- Construct drainage system around well sites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the concrete pit.
- Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).
- Provide drip pans and absorbents to contain any spillage.
- Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP.
- Prohibit workers from cleaning machines/equipment in/near a public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.

- Maintain oil traps along perimeter drainage around concrete pad to prevent any spills from flowing off site.
- Isolate any area(s) that might be contaminated from non-contaminated areas.
- Store Chemicals and hazardous materials on concrete pad.
- Procedures for response to chemical spills will be included in PTTEP SA's ERP.
- Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.
- Implement transportation plan.

PTTEP SA's Emergency Response Plan will set out the management procedures to be put in place to mitigate the impact if a spill occurs.

6.16.4.11 Residual Impacts and Risks

With the implementation of management measures, the residual risk from a hydrocarbon, chemical or hazardous waste/materials spill is ranked as **Medium**.

Residual Risk	Positive	Negligible	Low	Medium	High
				■	

6.16.5 Assessment of Impacts from Transportation Accidents

Transportation accidents associated with PTTEP SA's project may occur during transportation of equipment, personnel, granular fill, mud and cuttings, and waste.

PTTEP SA plans to use a land rig for the drilling program. The exact transport route and duration of rig move is not available as the rig contract not yet awarded. The most likely route will be via the Pathein-Monywa road or by Irrawaddi River. The rig mobilization will include around 100 truckloads to complete rig and support equipment. The maximum mobilization distance for the rig is estimated at about 400 km. The rig mobilization duration will be 2-3 weeks.

Drilling Materials will be transported from Yangon to the well sites. The estimated number of round trips for rig and support equipment is 130 truckloads during drilling activities. The rig personnel will transported to the well locations from Yangon.

6.16.5.1 Significance of Impacts

No data on accidents is available for the area. However, this part of the county has a relatively small number of vehicles (including motorcycles) per capita. The probability of these impact occurring are ranked as Possible C.

The significance of transportation accidents considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of **Medium**. (**Table 6-111**)

Table 6-111: Risk Assessment Matrix for Transportation Accidents

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact			**Medium**		High Risk

6.16.5.2 Impact and Risk Mitigation Measures

The risk significance of a transportation accident will be reduced by using the following management measures:

- Follow SSHE Integrated Management System Procedures.
- Limit the speed of project vehicles, according to the road condition.
- Maintain construction equipment and vehicles.
- Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
- Consult with community leaders on plan and transportation route before movement of large equipment.
- Restrict/ avoid movement of heavy equipment during rush hours. In case emergency, inform local government authorities.
- Provide traffic signs or flags at junction of access road and main road.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Strictly enforce training programs to reduce transport and drilling incidents by its contractors.
- Restore any damage to roads caused by project vehicles.
- Implement emergency response training, fire training and response drills.
- Prohibit trespassers from entering the construction site.
- Referral system with external medical facilities for serious injuries or emergencies.

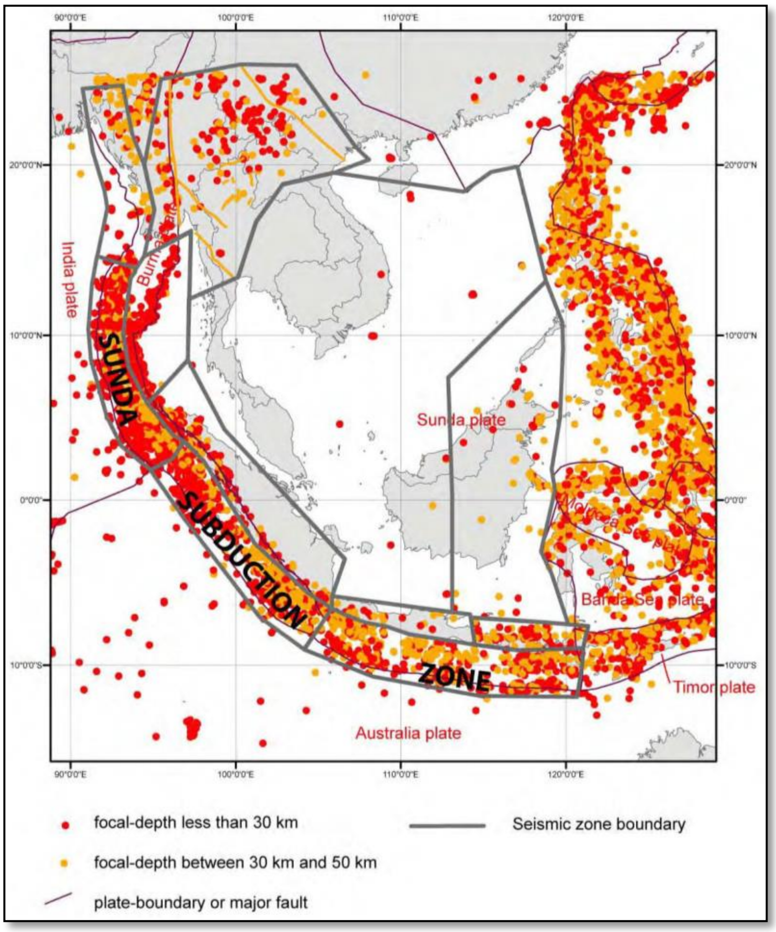
6.16.5.3 Residual Impacts and Risks

With the implementation of management measures, the residual risk from Transportation Accidents is ranked as **Medium**.

Residual Significance	Positive	Negligible	Low	Medium	High
				■	

6.16.6 Assessment of Impacts from Earthquakes

Myanmar, on the eastern side of this collisional zone, lies east of the boundary between the Indian plate to the west, and the Sunda plate. Most of the differential motion between these two plates in Myanmar is concentrated on the Sagaing fault, which is a major north-striking, right-lateral fault that has a slip rate of approximately 18 mm/yr based on GPS data. (**Figure 6-10**) The Sagaing Fault is located 122 km to the east of Block MOGE-3. Numerous large earthquakes have occurred on the Sagaing fault in the past century, including an M 6.9 event in February 1991, which caused 2 fatalities (USGS, 2012).



Source: USGS, 2007

Figure 6-10: Map of Earthquakes with Shallow-Focus Epicentre for Period 1965-2005

An earthquake could result in environmental, social and health impacts. The worst-case scenario would be similar to a blowout, fire or explosion.

6.16.6.1 Significance of Impacts

As earthquakes are possible in the region but rare, their frequency has been rated as “Unlikely”**.**

The significance of earthquake related accidents considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of **Medium**. (**Table 6-112**)

Table 6-112: Risk Assessment Matrix for Earthquakes

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact		**Medium**			High Risk

6.16.6.2 Impact and Risk Mitigation Measures

Although earthquakes cannot be directly mitigated, the effects on operations can be managed through design and management measures as follows:

- Implement PTTEP SA’s Emergency Response Plan.

6.16.6.3 Residual Impacts and Risks

With the implementation of management measures, the residual risk from earthquakes is ranked as **Low**.

Residual Risk	Positive	Negligible	Low	Medium	High

6.17 Summary of Residual Significance/Risk Rankings from Exploration Drilling

The residual risk rankings of the impact assessment of the Exploration Drilling unplanned events on environmental, social, health and unplanned aspects are summarized below in **Table 6-113** to **Table 6-117**.

Table 6-113: Construction and Installation Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1. Topography	2.1 Well Site and Camp Construction	1.2.1 Disturbance to local topography	Low
2. Air Quality	2.4 Well Site and Camp Construction	2.4.1 Deterioration of air quality due to dust.	Low
	2.5 Equipment use during Site and Road Construction	2.5.1 Deterioration of air quality due to vehicle emissions.	Low
	2.6 Equipment use during Site and Road Construction	2.6.1 GHG Release contributing to climate change	Low
3. Noise	3.1 Use of machines/engines during construction and transportation	3.1.1 Increase in noise levels from machines/engines	Low
4. Surface Water Hydrology	4.1 Construction of roads and well / camp sites	4.1.1 Alteration of surface water hydrology	Low
5. Surface Water Quality	5.1 Construction of roads and well / camp sites and site runoff and drainage	5.1.1 Degradation of surface water quality from runoff/drainage	Low
6. Groundwater Quality	6.1 Hazardous/Non Hazardous waste management and chemical handling	6.1.1 Contamination of groundwater from waste, chemicals and wastewater	Low
7. Soil quality	7.1 Construction of roads and well / camp sites	7.1.1 Degradation of soil quality through compaction or erosion during construction.	Low
Ecological Environmental Impact Assessment			
8. Flora and Fauna	8.1 Site Clearing for Construction of roads and well / camp sites	8.1.1 Degradation or destruction of natural habitat	Low
	8.2 Construction of roads and well / camp sites	8.2.1 Habitat degradation from construction	Low
	8.3 Site Runoff and Drainage	8.3.1 Habitat degradation of aquatic biota	Low
Social Impact Assessment			
9. Land Use	9.1 Purchase of land access road/well pad and camp site	9.1.1 Change of traditional use.	Positive
10. Transport	10.1 Rig Move and Equipment and Vehicle Use.	10.1.1 Disruption of traffic	Low
		10.1.2 Damage to roads	

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
11. Water Use	11.1 Use of water public utility for construction and domestic use	11.1.1 Compete for water use of communities	Low
12. Drainage and Flooding	12.1 Surface runoff from roads, site and camp site	12.1.1 Increase runoff and change local drainage patterns	Negligible
13. Waste Management	13.1 Non Hazardous waste management	13.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	Low
14. Socio-Economy	14.1 Services Supply for Construction Activities	14.1.1 Employment/income and procurement opportunities for people, business and services in surrounding area	Positive
	14.2 In-migration of labour and social interaction	14.2.1 Potential conflict between workers from other regions and local communities	Low
Cultural Impact Assessment			
15. Historical, Archaeological and Cultural Resources	15.1 Construction of access road/well pad and camp site	15.1.1 Archaeological/ fossil finds within project area.	Negligible
Visual Impact Assessment			
16. Tourism and Recreational experience	16.1 Well Site, Road and Camp Construction	16.1.1 Disturbance and reduction of tourism and recreational experience	Negligible
Health Impact Assessment			
17. Public and Occupational Health	17.1 Well Site, Road and Camp Construction	17.1.1 Respiratory irritation and Exacerbation of asthma impact from dust	Medium
	17.2 Vehicle and Equipment Use during construction	17.2.1 Hearing impairment for workers and annoyance for public.	Negligible
	17.3 Construction Activities & Transportation	17.3.1 Traffic Accidents	Medium
	17.4 Non-Hazardous Waste Management	17.4.1 Food safety, Increase in vector-borne diseases: malaria, typhus and dengue and others.	Negligible

Table 6-114: Drilling Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1. Air Quality	1.1. Vehicle and Equipment Use	1.1.1. Deterioration of air quality due to dust.	Low
	1.2. Vehicle and Equipment Use	1.2.1. Deterioration of air quality due to vehicle emissions.	Low
	1.3. Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	Low
	1.4. Vehicle and Equipment Use	1.4.1. *Climate Change due to GHG*	Low
2. Noise	2.1. Well Drilling and Vehicle and Equipment Use	2.1.1. Increase in noise levels during exploration drilling.	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
3. Heat and Light	3.1. Functional lighting on vehicles and drill rig, camp site and well site during Drilling Wells.	3.1.1. Lighting on the site at night	Negligible
4. Surface Water Quality	4.1. Site Runoff and Drainage	4.1.1. Contamination of surface water from runoff and drainage	Low
	4.2. Hazardous/non-hazardous waste management	4.2.1. Degradation of surface water quality from disposal of domestic sewage and grey water	Low
5. Soil Quality	5.1. Drill site Site Runoff and Drainage	5.1.1. Contamination of soil from runoff	Low
6. Groundwater Quality	6.1. Loss of circulation during Drilling wells	6.1.1. Groundwater degradation from drilling	Low
	6.2. Infiltration from the waste pit and sub-irrigation field	6.2.1. Deterioration of shallow Groundwater	Low
Ecological Environmental Impact Assessment			
7. Terrestrial Flora and Fauna	7.1. Drilling Activities and Labour and Accommodations	7.1.1. Aquatic biota and habitat disturbed from workers' activities	Low
Social Impact Assessment			
8. Transport	8.1. Heavy Equipment on Road	8.1.1. Damage to roads	Low
9. Water Use	9.1. Use of public utility for water resources	9.1.1. Water usage of project affects the community's water supply.	Low
10. Power Use	10.1. Power for drilling operations and work camp	10.1.1. Increase or decrease of available power for local community	Negligible
11. Waste Management	11.1. Non Hazardous waste management	11.1.1. Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and groundwater and vector for disease	Low
	11.2. Hazardous waste management	11.2.1. Hazard waste contaminate to environment.	Low
	11.3. Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1. Localized change in water quality and soil quality from chemical composition of drill fluids	Medium
12. Socio-Economy	12.1. Employment opportunities and Use of local goods and services	12.1.1. Employment and income	Positive
Health Impact Assessment			
13. Occupational and Public Health	13.1. Rig, Generators and Equipment	13.1.1. Health impact from noise	Negligible
	13.2. Well Drilling Support Activities & Transportation	13.2.1. Traffic Accidents	Medium

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
	13.3. Non Hazardous waste management	13.3.1. Health impact from Non-Hazardous Waste	Low
	13.4. Handling and Disposal of Hazardous Waste	13.4.1. Health impact from hazardous Waste	Low
	13.5. Hazardous waste management and chemical handling	13.5.1. Health impact from Mud, Chemicals and Drilling Waste	Low
	13.6. Labour and Accomodations	13.6.1. Health impact from Communicable Diseases	Low

Table 6-115: Well Testing Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environmental Impact Assessment			
1 Air Quality	1.1 Vehicle and Equipment Use	1.1.1 Deterioration of air quality due to dust.	Low
		1.1.2 Deterioration of air quality due to combustion of diesel fuel and flaring.	Low
	1.2 Well testing releasing hydrogen sulphide	1.2.1 Deterioration of air quality due to hydrogen sulphide	Low
	1.3 Flare Emissions	1.3.1 Climate Change due GHG	Low
2 Noise	2.1 Flaring during Well Testing	2.1.1 Increase in noise levels during well testing.	Low
3 Light and Heat	3.1 Flaring during Well testing	3.1.1 Increase in light at night from flaring	Low
4 Surface Water Quality	4.1 Non Hazardous waste management	4.1.1 Contamination of surface water from drained domestic waste and grey water	Low
5 Soil Quality	5.1 Non Hazardous waste management	5.1.1 Contamination of soil from drained domestic waste and grey water	Low
Ecological Environmental Impact Assessment			
6 Terrestrial Flora and Fauna	6.1 Labour and Accommodations	6.1.1 Habitat degradation from workers' activities	Low
	6.2 Flaring during Well Testing	6.2.1 Habitat degradation from light and heat	Low
Social Impact Assessment			
7 Transport	7.1 Vehicle and Equipment Use	7.1.1 Disruption of traffic	Low
		7.1.2 Damage to roads.	
8 Waste Management	8.1 Hazardous/Non Hazardous waste management	8.1.1 Domestic waste can be a fire hazard, constitute. windblown litter, attract vermin, contaminate surface and groundwater and be a vector for disease	Low
		8.1.2 Hazard waste i.e. condensate	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
9 Socio-Economy	9.1 Labour and Accomidations	9.1.1 Employment and Income	Positive
Health Impact Assessment			
10 Occupational and Public Health	10.1 Flaring	10.1.1 Heat exposure and Nuisance light from Light and heat	Low
	10.2 Flaring	10.2.1 Increase in respiratory illnesses/diseases, asthma, Disturbance psychological wellbeing from flaring emissions	Low
	10.3 Well Testing Support Activities & Transportation	10.3.1 Traffic Accidents	Medium
	10.4 Non-hazardous waste management	10.4.1 Waste can be a contaminate surface and groundwater, and be a vector for disease.	Low
	10.5 Hazardous waste management	10.5.1 Health impacts from Hazardous Waste	Low

Table 6-116: Well Abandonment Phase Significance Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
Physical Environment Impact Assessment			
18. Topography	*18.1* Site and Road abandonment and restoration	18.1.1 Disturbance to local topography	Low
19. Air Quality	*19.1* Vehicle and Equipment Use	19.1.1 Deterioration of air quality due to dust.	Low
		19.1.2 Deterioration of air quality due to combustion of diesel fuel.	
		19.1.3 Climate Change due to GHG	
20. Noise	*20.1* Vehicle and Equipment Use	20.1.1 Increase in noise levels from machines/engines during site demolition & restoration and transportation.	Low
21. Surface Water Hydrology	21.1 Hazardous/non-hazardous waste management	21.1.1 Potential contamination from spills or wastewater drainage to nearby water bodies during site restoration	Low
22. Surface Water Quality	22.1 Restore Site	22.1.1 Alteration of surface water hydrology	Low
23. Soil Quality	*23.1* Soil excavation for site restoration	23.1.1 Degradation of soil quality through compaction or erosion during site demolition & restoration.	Low
24. Groundwater Quality	24.1 Hazardous/Non Hazardous waste management and	24.1.1 Contamination of	Low

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
	chemical handling	groundwater from waste, chemicals and wastewater	
Ecological Environment Impact Assessment			
25. Terrestrial Flora and Fauna	*25.1* Labour and Accomodations	25.1.1 Degradation or destruction of natural habitat and harvesting wild plants / animals	Low
	25.2 Site-Run off and drainage	25.2.1 Potential degradation or destruction of aquatic biota	Low
Social Impact Assessment			
26. Land Use	26.1 Return of Well site Land	26.1.1 Change of traditional use.	Positive
27. Transportation	*27.1* Vehicle and Equipment Use	27.1.1 Disruption of traffic.	Low
	27.2 Site restoration	27.2.1 Damage to roads.	
28. Waste Management	*28.1* Hazardous/non-hazardous waste management	28.1.1 Non-hazardous waste can be a contaminate surface and groundwater, and be a vector for disease.	Low
Health Impact Assessment			
29. Public and Occupational Health	29.1 Well Abandonment Support Activities & Transportation	29.1.1 Traffic Accidents	Medium
	29.2 Non-hazardous waste management	29.2.1 Exposure to contamination from non-hazardous wastes,	Negligible

Table 6-117: Unplanned Events Residual Risk Rankings

Environmental Factors/Events	Activity	Potential Impacts	Residual Risk
1. Blowout	1.1 Drilling	1.1.1 Release of uncontrolled volumes of hydrocarbons, Fire and Explosion	Medium
2. Fire or Explosion (not associated with Blowout)	2.1 Fuel Storage and Ignition Sources	2.1.1 Possible explosion or fire of drilling rig or at campsite, or fuel storage area	Medium
3. Fuel, Chemical or Hazardous Waste/Materials Spill	3.1 Storage of Fuel, chemicals, hazardous materials or waste	3.1.1 Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people	Medium
4. Transportation Accidents	4.1 Vehicle and Equipment Use	4.1.1 Possible injury or death to personnel; and localized contamination of environment	Medium
5. Earthquakes	5.1 Physical shifting of earths surface	5.1.1 Potential physical disruption cause building collapse, blowouts, fires or spills	Low

6.18 Conclusion

All environmental issues are ranked as negligible or low and can be managed to minimize potential impacts. A number of Social issues are ranked as medium, including Traffic, Waste Disposal, and Labour in-migration. These activities will need to be monitored closely as communities are quite near to a number of the potential drill sites.

Health issues including Non-hazardous waste, mud chemicals and drilling waste, communicable diseases and flare emissions are ranked as medium. These will need to be monitored closely at those sites where communities are nearby. Health service infrastructure is not well developed in the communities and PTTEP SA will maintain its own clinic onsite during the entire exploration program. A specific waste management plan will be prepared to ensure that all wastes are managed to international standards. Hydrogen Sulphide is a potentially serious issue that requires monitoring equipment to be installed and tested, as well as having personnel trained on use of emergency response equipment.

Unplanned Events have all been ranked as having a medium residual risk, with the exception of earthquakes which are rare. Key to ensuring that unplanned events do not happen is linked to ongoing training programs and a site specific emergency response plan. Drug testing is recommended.

To mitigate the potential for a blowout, a BOP needs to be installed and tested. Drilling procedures need to be carefully implemented. The risk of fire and related explosions requires that regular monitoring and inspection measures are in place, as well as fire extinguishers strategically placed to minimize any damage should a fire occur.

This region has had earthquakes in the past and design considerations need to be taken to minimize the impact of an earthquake should it occur. Site specific emergency response plans for all unplanned events need to be in place and training conducted for all staff as appropriate prior to the start of the exploration drilling program.

Recommendations:

The following recommendations are provided:

- Implement recommended stakeholder engagement program before site construction.
- Prepare a site specific waste management plan.
- Apply PTTEP's Emergency Response Plan.
- Conduct recommended training program prior to project initiation.
- Evaluate water resource potential to ensure it does not impact local community.
- Identify, clean-up and restore any legacy well sites located within the block and hand back to MOGE.
- Adopt and implement the EMP provided in **Chapter 8**.

7. CUMULATIVE IMPACTS ASSESSMENT

7.1. Methodology and Approach

The IFC notes that good practice requires that, at a minimum, project sponsors assess during the EIA process whether their development may contribute to cumulative impacts on Valued environmental and social components (VECs) and/or may be at risk from cumulative effects on VECs they depend on.

VECs are environmental and social attributes that are considered to be important in assessing risks; they may be:

- physical features, habitats, wildlife populations (e.g., biodiversity),
- ecosystem services,
- natural processes (e.g., water and nutrient cycles, microclimate),
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

The IFC suggests a useful preliminary approach for developers in emerging markets to conduct of a rapid cumulative impact assessment (RCIA). It entails a desk review that, in consultation with the affected communities and other stakeholders, enables the developer to determine whether its activities are likely to significantly affect the viability or sustainability of selected VECs. The proposed approach recognizes that, especially in emerging markets, the many challenges associated with managing a good CIA process include lack of basic baseline data, uncertainty associated with anticipated developments, limited government capacity, and absence of strategic regional, sectoral, or integrated resource planning schemes.

The approach includes:

- follow a six-step RCIA process,
- engage stakeholders as early as possible and throughout the decision-making process, and
- clearly record the fundamental reasoning behind each important decision made, supporting it with as much technical evidence as possible.

The RCIA logical framework, which is an iterative six-step process including: scoping (Steps 1 and 2), VEC baseline determination (Step 3), assessment of the contribution of the development 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). IFC defines cumulative impacts as those that result from the successive, incremental, and/or combined effects of developments when added to other existing, planned, and/or reasonably anticipated future ones.

The objective of the cumulative impact assessment is to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s).

Cumulative impact factors, include project resources and receptors, geographic and temporal boundaries, and other projects or developments near the planned project.

7.2. Cumulative Impact Assessment

7.2.1. Projects and Developments in Vicinity of Proposed Well Sites

Block MOGE-3 lies within Thayet, Kanma and Aunglan Townships of Thayet District in the Magway Region in Myanmar. The exploration drilling wells are located only in the Thayet Township. The administrative centre is the town of Thayet, which is located in the Thayet District. Thayet District is a district of the Magway Regional government in central Myanmar. The total area of this block is 1198 sq. km (463 sq. miles) and is located 270 km northwest of Yangon and 100 km southwest of Myanmar's capital Nay Phi Taw.

Geography of Block MOGE-3 consists of river valleys, paddy fields, forest areas and hill/mountain terrain. Geologically Block MOGE-3 is situated between the Pyay Embayment sub-basin and the Pegu-Yoma Sittuang Basin in central Myanmar. Regional mapping of native vegetation cover and land use in Block MOGE-3 shows the land is classified as scrubland. However, the predominance of land has been converted to agricultural purposes for most of the block.

The Thayet Cement Plant was operating since 1935 producing 0.27 million tonnes of cement annually. However, the plant stopped operations in 2016. The limestone mining started sometime in the 1960s to supply a cement factory in Thayet Town. The limestone quarries were rehabilitated in the early 1980s with German help (GTZ) when the aerial ropeway was replaced by trucks as the principal means of limestone transport from the quarry to the factory.[1] The cement factory and limestone quarry have been shutdown since 2016. The cement factory used to by powered by gas, however gas supplies are low so the factory proposed to switch to coal. The local people due to air quality concerns protested this. Therefore, the factory has not been operational since then

Hand dug oil wells are scattered throughout the Block MOGE-3 as shown in **Table 7-1**. The state-owned enterprise consists of 5-acre blocks inside Thayet Township. These state-owned enterprises have been granted for 6 hand dug oil & gas companies. These hand-dug operations are drilling less than 1000 ft.

Table 7-1: Hand-dug State Owned Enterprises in Thayet

No.	Name	Information
1	Sa Khan Gyi Hand Dug Well Area Approximately 1 square mile	Approximately 150 to 200 wells drilled Over 50 Production Wells. 37 are Under drilling stage including 10 with Rotary drilling the rest with Local machine
2	Pa Dauk Pin Hand Dug Well Area Approximately 1.5 square mile	Approximately 50 Production Wells
3	Nga Khu I Hand Dug Well Area Approximately 5 Acre	Over 200 wells Under drilling stage; 8 well in Production
4	Ban Pyin Hand Dug Well Area Approximately 2 square mile	Approximately 400 to 500 Wells. Over 35 production Well and over 20 with local machine
5	Baw Hand Dug Well Area Approximately 2 square furlong	Approximately 300+ Wells, 12 are under drilling stage and 30-35 production wells.
6	Oak Pon Hand Dug Well Area	Abandoned

[1] REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

Prior to exploration drilling plans, seismic activities were conducted within MOGE-3.

Outside of the MOGE-3 area various heavy industries are operating within the Magway Region. These include heavy industry near Hlhlataung Village, 75 MW power plant at Satotaya Township, 53 MW at Pakautku Township, 74 MW at Pwint Phu Township, 40 MW at Gangaw Township, and 36.9 MW at Minbu Township. Exiting industries include the Kyaunchaung Fertilizer Plant as well other industries including cement, cotton weaving, and tobacco, iron and bronze. No large scale industrial projects are within Block MOGE-3.

Our area of focus is within Block MOGE-3 and more specifically within the areas near the planned well sites. Our time frame is focused around the planned 4 well program which from mid 2018 to late 2019. Each of the 4 wells will have similar drilling schedule that can be divided into following phases.

- Construction Phase: ± 180 days (90 days for road and 90 days for well site)
- Drilling Phase ± 60 days
- Well Testing Operations and Flaring (22 days max. for flaring): ± 30 days
- Well Suspension/Abandonment Phase and Site Restoration: ± 30 days

Figures 6-2 to 6-9 in Chapter 6 Impact Assessment: Section 6.3, wells sites are shown in relation to villages and sensitive areas. Wellsite 08 has a community within 0.8 km.; Wellsite 02 has a community within 0.7 km. The 6 other proposed well sites do not have any communities within 1 km. No other factories or developments are observed within 1 km of the 8 proposed well sites.

7.2.2. Assessment of the Potential Cumulative Impacts

The screening/scoping of planned and unplanned project related activities assisted to identify potential environmental, social, health aspects where cumulative impacts could possibly occur. These areas include: Public and Occupational Health; Socioeconomic; Waste Management, Transportation; Flora and Fauna (including aquatic); Ground Water Quality; Surface Water Hydrology, Surface Water Quality, Soil, Noise and Air Quality. The key activities potentially causing these cumulative effects include: hazardous and non-hazardous waste; site runoff and drainage; handling of materials and chemicals; access roads and site construction; vehicles and equipment use, labour and accommodation and unplanned events (blowout, fire and explosion, chemical/hazardous materials spill).

From the scoping and impact analysis of the environmental, social, health and unplanned events and the determination of the residual risk, it is concluded that the management measures defined for each aspect will prevent cumulative effects from occurring for this exploration drilling project. The EIA Management Plan too outlines monitoring measures that will ensure that mitigation measures are effective and that any change or impact to the environment is detected.

Environmental Parameters		Physical Resources								Biological Resources		Social								Cultural		Health	
Project Activities/Events		Topography	Air Quality / GHG emissions	Noise	Heat and Light	Surface Water Hydrology	Surface Water Quality	Ground Water Quality	Soil Quality	Flora & Fauna	Aquatic Flora and Fauna	Land Use	Transportation	Water Supply	Power Supply	Drainage and Flooding	Waste Management	Tourism	Socio-economic	Cultural-Archaeological	Visual Aesthetics	Public Health	Occupational Health and Safety
	Projects/Activities																						
1	MOGE-3 2D&3D Seismic Project		P	P		P	P	P	P	P			P				P		P			P	P
2	MOGE-3 Exploration Drilling Project		P	P	P	P	P	P	P	P			P	P			P		P			P	P
3	Hand Dug Oil Wells		P	P		P	P	P	P	P		P	P				P		P			P	P
4	Thayet Cement Factory		P	P		P	P	P	P	P			P		P		P		P			P	P
5	Manufacturing Facilities		P	P		P	P	P	P	P			P		P		P		P			P	P
6	**Key Areas of Potential Cummulative Impacts**		P	P		P	P	P	P	P			P				P		P			P	P

(blank)	No Impact
P	Potential Impact
(black)	Probable Impact

7.2.3. Influence of Exploration Drilling Project on Related Potential Cumulative Impacts

The planned 4 exploration wells have been assessed within a 1 km and up to a 5 km radius from the project site. These exploration wells will be drilled in late 2018 to late 2019.

Within Block MOGE-3 related seismic operations have been conducted over the past year. During two rounds of public involvement discussions, one issue raised was related to compensation. As a formal compensation process was implemented involving community representatives, it is considered that this issue has been adequately dealt with.

Also through our public involvement discussions the issue of hand dug wells in the area has also been raised. The concern here is more related to the possible restriction of local hand dug well activities. PTTEP confirmed that this would not happen.

The other possible issue of concern is related to the increase in traffic that first resulted when seismic activities were initiated and now exploration drilling activities. PTTEP has addressed this with appropriate mitigation and monitoring measures.

From the screening of potential cumulative impacts, the location of the planned four (4) exploration wells, the location of other industrial and community locations, and timing of the planned project it is concluded that no cumulative impacts will occur.

7.2.4. Measures to Mitigate the Project's Contribution to Possible Cumulative Impacts

The cumulative impact assessment has determined that no cumulative impacts will occur. In addition it is determined that existing defined mitigation and monitoring measures for the planned four (4) well exploration drilling project will further prevent cumulative impacts from occurring.

8. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 Introduction

This environmental management plan has been developed to prevent, minimize and monitor potential environmental, social and health impacts associated with PTTEP SA's planned exploration drilling program.

For each project activity, management measures have been defined to prevent and/or reduce the likelihood or magnitude of impacts and/or to limit the extent of an impact if one does occur. The proposed management measures will take into account applicable policies, guidelines, regulations, industry best practices, expert judgment, design techniques, and operational control. Monitoring measures too have been defined to determine if there are changes to the environment and to ensure that mitigation measures are effective.

The following hierarchy of control will be used to identify appropriate management measures:

- Eliminate the risk by removing the hazard.
- Substitute of a hazard with a less hazardous one.
- Prevention of potential events.
- Control the magnitude of an impact.
- Mitigation of the impact of an event on the environment e.g. (bunding for potential hydrocarbon spills).
- Monitoring environmental change and mitigation effectiveness.
- Emergency response and contingency planning to enable recovery from the impact of an event.
- Public consultation and disclosure.

8.2 Scope Of This Document

The purpose of this EMP is to provide SSHE management actions, monitoring requirements and roles and responsibilities for ensuring that this drilling program is implemented in a sustainable manner. In particular, the EMP will provide:

- Project Description by Project phase (pre-construction, construction, operation, decommissioning, closure and post-closure);
- Project's Environmental, Socio-economic and, where relevant, Health Policies and Commitments, legal requirements and institutional arrangements;
- Summary of Impacts and Mitigation Measures;
- Overall budget for implementation of the EMP;
- Management and Monitoring Sub-Plans by Project phase (pre-construction, construction, operation, decommissioning, closure and post-closure); the Management and Monitoring Sub-Plans will address relevant environmental and social management and monitoring issues such as but not limited to;
    - noise and vibrations,

- waste and hazardous waste,
- wastewater and storm water,
- air quality,
- odor,
- chemicals,
- water quality,
- erosion, sedimentation and biodiversity,
- occupational, community health and safety,
- cultural heritage,
- employment and training, and
- emergency response.

8.3 Project Description by Project Phase

In August 2014, PTTEP South Asia Limited (PTTEP SA) has been granted the petroleum concession onshore Block MOGE-3, owned by Myanma Oil & Gas Enterprise (MOGE). PTTEP SA has completed 2D and 3D Seismic Acquisition in Block MOGE-3 and vicinity area during 2016-2017. Regarding the Production Sharing Contract (PSC), PTTEP SA will conduct an exploration drilling campaign in Block MOGE-3. The EIA will be investigating eight (8) locations with four (4) wells being selected for exploration well drilling in 2018-2019. PTTEP SA is planning to spud the first well in December 2018. The exploration well will be drilled as a standard well with conventional drilling methods. The exploration drilling will be conducted with a typical land-drilling rig.

This EIA will address PTTEP SA's plans to drill four (4) exploration drilling wells in Block MOGE-3 located in Thayet Township, Magway Region, Myanmar. The primary objectives of the onshore exploration drilling project in Block MOGE-3 are to:

1. Explore the hydrocarbon potential in Block MOGE-3;
2. Fulfill the PSC commitments.

Each well will have similar drilling schedule that can be divided into 4 phases.

1. Construction Phase ± 150 days (60 days for road and 90 days for well site)
2. Drilling Phase ± 60 days/well
3. Well Testing Operations and Flaring (22 days max. for flaring): ± 30 days
4. Well Suspension/Abandonment Phase and Site Restoration: ± 30 days

The wells will be drilled with a conventional hole size. A conventional hole size is required because of the depths being drilled, the type of formations being drilled, the kinds of pressures expected, and for hole stability.

PTTEP SA drilling program is currently expecting to use either Water Based Mud or Synthetic Based Mud (SBM) depending on subsurface characteristic resuling from data interpretation.

8.4 Project's Environmental and Social Policies, Legal Requirements and Institutional

The Project's Environmental and Social Policies, Legal Requirements and Institutional requirements have been detailed in **Chapter 3**.

8.5 Summary of Environmental Impacts, Mitigation & Monitoring Measures

During the environmental impact assessment, a number of potentially significant impacts were identified. In some cases, even though the impacts were of low significance, mitigation measures were provided as part of PTTEP SA's environmental management guidelines. This section outlines the mitigation measures that are to be employed to reduce the likelihood of impacts and/or to limit the extent of impact if one does occur. In addition, environmental monitoring measures will be undertaken to assess whether the mitigation measures are effective and if performance meets EIA commitments; these are outlined in the next section.

8.5.1 General Mitigation Measures for Project Operation

Table 8-1 shows the general mitigation measures for project operation.

Table 8-1: General Mitigation Measures for Project Operation

General Measures
1 . Mitigation and monitoring measures set forth in this document must be incorporated into contractual agreements for all contractors, including: design, construction, and operation in order to obtain practical and effective execution of the project.
2. Report compliance with these mitigation and monitoring measures to MOGE in congruence with schedule.
3. Provide stakeholder relation plans to explain about the project when needed for communication of construction and drilling activities.
4. Operator must set up a contact point to receive any complaints from the stakeholder regarding its exploration activities. Further, the Operator must provide assistance and rectify the cause of such complaints as determined appropriate, as soon as possible.
5. If impacts and/or damages result from project activities, the Operator must implement all necessary measures to mitigate these impacts and/or damages as soon as possible.
6. MOGE will investigate complaints lodged by people living in the surrounding area concerning any disturbance by project activities, or any damage of public infrastructure resulting from project operations. The Operator will inform the public within 30 days if the investigation proves that the Operator did not comply with mitigation and monitoring measures.
7. During the project period, if archaeological finds or fossils are encountered in the project area, the project team must immediately report the findings to the appropriate government office, e.g. District and Township Administrator, Local Archeological Department, Fossil Research Center and Geological Museum. In addition, the project team must cooperate with the government agencies in an effort to verify the findings in the project area. If it is proven that these findings are archaeological finds or fossils, the Operator must follow the regulations strictly.
8. The Operator will start operations only when the Operator has received the necessary approval, permit or agreement from the landowner or responsible agency. Moreover, the Operator will improve or construct access roads when approved by the authorized local government agencies and/or landowner. All activities will operate under the control of MOGE.

8.5.2 Environmental, Social, and Health Mitigation Measures

A summary of the mitigation measures and specific action commitments for Construction and Installation Phase, Drilling Phase, Well Testing Phase, Abandonment Phase, and Unplanned Events is presented in **Table 8-2** to **Table 8-6**.

Table 8-2: Mitigation Measures and Required Actions During Construction and Installation Phase

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
Physical Environmental Impact Assessment									
1. Topography	1.1 Well Site and Camp Construction	1.1.1 Disturbance to local topography	1.1.1.1	Limit construction activities to well sites and access roads only.	Low	Limit construction activities to well sites and access roads area only.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
2. Air Quality	2.1 Well Site and Camp Construction	2.1.1 Deterioration of air quality due to dust.	2.1.1.1	Minimize land clearance to a minimum especially during the dry season.	Low	Minimize land clearance during dry season.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			2.1.1.2	Limit vehicle speed on access road and site site to minimize dust formation.		Limit vehicle speed on access road and site to minimize dust formation.			
			2.1.1.3	Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.		Cover all trucks transporting materials with tarpaulins or plastic.			
			2.1.1.4	Spray water on roads when needed to keep dust down. At least 1 time/day especially during dry season		Spray water on roads when needed to reduce dust.			
			2.1.1.5	Clean tires of the vehicles before leaving site if needed.		Cleaning of vehicles' tires before leaving site if needed.			
			2.1.1.6	Provide personal protective equipment to exposed field workers.		Provide all required personal protective equipment.			
			2.1.1.7	Use vehicles with dust flaps to prevent dust during driving.		Provide dust flaps to vehicles.			
	2.2 Equipment use during Site and	2.2.1 Deterioration of air quality due to vehicle	2.2.1.1	Ensure all machinery and vehicles are properly checked and inspected.	Low	All machinery and vehicles will be properly checked and inspected.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	Road Construction	emissions.						
	2.3 Equipment use during Site and Road Construction	2.3.1 GHG Release contributing to climate change	2.3.1.1 Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.		Drivers will be instructed to turn off all vehicles and equipment when not in use.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
3. Noise	3.1 Use of machines /engines during construction and transportation	3.1.1 Increase in noise levels from machines/engines	3.1.1.1 Minimize vehicles and rig transportation from sensitive environmental areas. (eg. Forest, Archeology area, Heritage area etc…)	Low	Minimize vehicles and rig transportation from sensitive environmental areas.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			3.1.1.2 Minimize construction activities and vehicle/rig movements in nighttime.		Minimize construction activities and vehicle/rig movements in night time.			
			3.1.1.3 Limit vegetation removal to a minimum at well site, camp site and access road.		Limit vegetation removal to a minimum.			
			3.1.1.4 Turn equipment/machinery off when not in use.		Turn equipment / machinery off when not in use.			
			3.1.1.5 Use enclosures when possible to contain noise on site.		Enclosures installed when possible to contain noise on site.			
			3.1.1.6 Implement transportation plan to avoid traffic issue that make noise pollution.		Journey Management Plan to be implement before operation start.			
			3.1.1.7 Materials to be lowered when practical and not dropped while transferring		Supervise materials lowered and not dropped while transferring.			
4. Surface Water Hydrology	4.1 Construction of	4.1.1 Alteration of surface	4.1.1.1 Avoid construction of well sites in areas that may cause	Low	Engineer to design well sites to ensure no	PTTEP SA	Throughout Construction	PTTEP SA's SSHE

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	roads and well / camp sites	water hydrology	obstacles to water drainage.		obstacles to water drainage.		Phase duration	Management System
			4.1.1.2 Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant authorities.		Engineer to design and construct water drainage lines (culverts/causeway) to maintain natural drainage.			
			4.1.1.3 Limiting access road gradients to reduce runoff-induced erosion.					
			4.1.1.4 Providing adequate road drainage based on road width, surface material, compaction, and maintenance.					
			4.1.1.5 Depending on the potential for adverse impacts, installing free-spanning structures (e.g., course way) for road watercourse crossings.					
			4.1.1.6 Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna					
			4.1.1.7 For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water.					
			4.1.1.8 Minimize areas to be cleared. Use hand cutting where possible, avoiding the use of heavy equipment such as					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			bulldozers, especially on steep slopes, water and wetland crossings, and forested and ecologically sensitive areas.					
5. Surface Water Quality	5.1 Construction of roads and well / camp sites and site runoff and drainage	5.1.1 Degradation of surface water quality from runoff / drainage	5.1.1.1 The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization.	Low	Engineer to design drill site and campsite to minimize areas requiring soil stabilization.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			5.1.1.2 Provide drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil.		Provide drip pans and absorbents to contain any spillage during fuel transferring and changing of engine oil.			
			5.1.1.3 Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.		Provide drainage and sediment traps around project area.			
			5.1.1.4 Avoid construction of the well pad in areas where such construction obstructs water drainage.		Engineer to design well sites to ensure no obstacles to water drainage.			
			5.1.1.5 Prohibit workers from cleaning machines/equipment in/near a water source.		Prohibit workers from cleaning machines/equipment in/near a water source.			
			5.1.1.6 Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.		Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			5.1.1.7 Provide a level storage area for construction materials (such as soil, sand, and stone) to limit soil erosion.		Suitale Storage area for construction materials, chemicals and oil to be built on site with proper burn if needed.			
			5.1.1.8 Scheduling construction in dry season to avoid heavy rainfall periods suspending activities during extreme rainfall and high winds to the extent practical.					
			5.1.1.9 Contouring the access road and causeway infrastructure to minimizing length and steepness of slopes					
			5.1.1.10 Mulching and Re-vegetating slopes promptly to stabilize exposed areas					
			5.1.1.11 Engineer Designing channels and ditches for post-construction flows					
			5.1.1.12 Lining steep channel and slopes (e.g. use jute matting)					
			5.1.1.13 Reducing or preventing off-site sediment transport through use of silt fences					
6. Soil quality	6.1 Construction of roads and well / camp sites	6.1.1 Degradation of soil quality through compaction or erosion during construction.	6.1.1.1 Limit soil compaction only to well sites and access roads.	Low	Ensure soil compaction only conduct to well sites and access roads.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			6.1.1.2 Exposed site areas to be kept to a minimum during		Ensure exposed site areas to be kept to a			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
				construction		minimum during construction			
			6.1.1.3	Provide effective construction site run-off control and design for good drainage.		Ensure to provide good drainage system around site.			
Ecological Environmental Impact Assessment									
7. Flora and Fauna	7.1 Site Clearing for Construction of roads and well / camp sites	7.1.1 Degradation or destruction of natural habitat	7.1.1.1	High valued habitat to be avoided where practicable in the design process.	Low	High valued habitat to be avoided.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			7.1.1.2	Remove vegetation in project areas only (roads, camp site, well site).		Remove vegetation in project areas only			
			7.1.1.3	Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.		Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.			
	7.2 Construction of roads and well / camp sites	7.2.1 Habitat degradation from construction	7.2.1.1	Minimize noisy construction work during daytime hours only.	Low	Minimize noisy construction work during daytime hours only.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			7.2.1.2	Limit vegetation removal to a minimum.		Limit vegetation removal to a minimum.			
			7.2.1.3	Limit to cut the tree only in well site and access road.		Limit to cut the tree only in well site and access road.			
			7.2.1.4	Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation or wildlife.		Contractors and personnel not allowed off site.			
			7.2.1.5	Hunting and trapping will be specifically prohibited.		Hunting and trapping will be specifically prohibited.			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
	7.3 Site Runoff and Drainage	7.3.1 Habitat degradation of aquatic biota	7.3.1.1	Avoid the construction of the well pads in areas where such construction obstructs a water route.	Low	Avoid the construction of the well pads in areas where such construction obstructs a water route.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			7.3.1.2	Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.		Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.			
			7.3.1.3	Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to aquatic biota. In addition, fishing will be specifically prohibited.		Contractors and personnel will not be allowed off site.			
			7.3.1.4	Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).		Suitale Storage area for construction materials, chemicals and oil to be built on site.			
			7.3.1.5	Provide drip pans and absorbents at fuel storage area to contain any spillage.		Provide drip pans and absorbents at fuel storage area to contain any spillage.			
			7.3.1.6	Strictly implement and follow mitigation measures for impacts to soil and surface water hydrology and quality.		Strictly implement mitigation measures on site to limit impacts to soil and surface water hydrology and quality.			
Social Impact Assessment									
8. Land Use	8.1 Purchase of land access road/well pad and	8.1.1 Change of traditional use.	8.1.1.1	Transparent and fair compensation to land owners and users according to land acquisition committee decision.	Positive	Ensure transparent and fair compensation to land owners and users.	PTTEP SA	Throughout Construction Phase duration	Land Compensation records

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	camp site							
			8.1.1.2 Ensure all permissions are obtained from landowners and local authorities.		All permissions must be obtained from landowners and local authorities.			
			8.1.1.3 Notify surrounding landowners before on location and time of project activities.		Notify surrounding landowners before on location and time of project activities.			
			8.1.1.4 Hand back the land to concerned parties with agreed condition after project completion.		Make sure to hand back the land with agreed condition after project completion.			
9. Transport	9.1 Construction Activites	9.1.1 Damage to roads	9.1.1.1 Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures		Check and restore for any damage to local roads.			
			9.1.1.2 Repair the road if found the damage is caused by project transportation					
10. Water Use	10.1 Use of water public utility for construction and domestic use	10.1.1 Compete for water use of communities	10.1.1.1 Inform authority for drilling a ground water well.	Low	Inform authority for drilling a ground water well.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			10.1.1.2 PTTEP SA to drill their own ground water wells on site.		PTTEP SA to drill their own ground water wells on site.			
			10.1.1.3 Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, must not affect the availability of water to locals.		Potable water and industrial water to site must not affect the availability of water to locals.			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
11. Drainage and Flooding	11.1 Surface runoff from roads, site and camp site	11.1.1 Increase runoff and change local drainage patterns	11.1.1.1 Obtain approval from MOGE and appropriate government offices before constructing, upgrading or reroute access roads.	Negligible	Obtain approval from MOGE and appropriate government offices and implement Civil engineer's design for well site and access road construction.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			11.1.1.2 Follow civil engineer's recommendation on well site and access road construction design.					
			11.1.1.3 Avoid construction of well sites in areas that may cause obstacles to water drainage.					
			11.1.1.4 Water drainage lines (culverts/causeway) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.					
12. Waste Management	12.1 Non Hazardous waste management	12.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	12.1.1.1 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.	Low	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan
			12.1.1.2 Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring to waste disposer					
			12.1.1.3 Ensure treatment and disposal according to accepted					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			international standard.					
			12.1.1.4 Enforce "Good Housekeeping" practices at project area.					
			12.1.1.5 Domestic and general waste to be segregated and stored using suitability labeled.					
			12.1.1.6 Dispose of waste in labelled containers for possible recycling					
			12.1.1.7 Implement requirements for waste management and related laws					
			12.1.1.8 Install septic tanks and soak away pit for holding sewage.					
			12.1.1.9 Non-hazardous wastes will be disposed with local city development committee.					
13. Socio-Economy	13.1 Services Supply for Construction Activities	13.1.1 Employment/income and procurement opportunities for people, business and services in surrounding area	13.1.1.1 Employ qualified local workers.	Positive	Meet with local authorities to discuss and design local employment hiring and Employ qualified local workers.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			13.1.1.2 Purchase local supplies and services, whenever possible.					
			13.1.1.3 Terms of contract for recruitment of manpower in these project needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	13.2 In-migration of labour and social interaction	13.2.1 Potential conflict between workers from other regions and local communities	13.2.1.1 Restrict workers to within project boundaries and do not allow local interaction within the communities.	Medium	Restrict workers to within project boundaries and do not allow local interaction within the communities.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
Cultural Impact Assessment								
14. Historical, Archaeological and Cultural Resources	14.1 Construction of access road/well pad and camp site	14.1.1 Archaeological/ fossil finds within project area.	14.1.1.1 Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.	Negligible	Watch for artefacts during site construction and Report to the Thayet GAD if any archaeological evidence is discovered.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			14.1.1.2 Report to the Thayet GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed					
			14.1.1.3 If artefacts are found during the construction phase, PTTEP SA will inform the responsible local office immediately.					
			14.1.1.4 Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact.					
Visual Impact Assessment								
15. Tourism and Recreational	15.1 Well Site, Road	15.1.1 Disturbance and	15.1.1.1 Post and enforce speed limit.	Negligible	Road Hazard Assessment will be completed to reduce	PTTEP SA	Throughout Construction Phase	PTTEP SA's SSHE Management

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
experience	and Camp Construction	reduction of tourism and recreational experience			tourism and recreational impacts		duration	System
			15.1.1.2 Consult with local authority before major movement.					
			15.1.1.3 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.					
			15.1.1.4 Restrict/ avoid movement of heavy equipment during rush hours.					
			15.1.1.5 Provide traffic signs or flags at junction of access roads and main roads.					
			15.1.1.6 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.					
			15.1.1.7 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.					
			15.1.1.8 Strictly enforce training programs to reduce transport incident cases by its contractors.					
			15.1.1.9 Restore any damage to roads if caused by contractor or company.					
			15.1.1.10 Restrict local traffic on PTTEP SA private access road and					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			wellsite area.					
			15.1.1.11 When project complete, promptly (within 6 months), hand back the land to MOGE.					
Health Impact Assessment								
16. Public and Occupational Health	16.1 Well Site, Road and Camp Construction	16.1.1 Respiratory irritation and Exacerbation of asthma impact from dust	16.1.1.1 Implement construction and installation phase mitigation measures in 2.1.	Medium	Implement construction and installation phase mitigation measures in 2.1 to reduce dust impacts.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
	16.2 Vehicle and Equipment Use during construction	16.2.1 Hearing impairment for workers and annoyance for public.	16.2.1.1 Implement construction and installation phase mitigation measures in 3.1.	Negligible	Implement construction and installation phase mitigation measures in 3.1 to reduce noise impacts.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			16.2.1.2 Provide PPE to workers on site.		Provide all required PPE to workers on site.			
			16.2.1.3 Should complaints over noise be received, consideration will be given to the provision of noise barriers.		Install additional noise barriers if complaints over noise are received.			
	16.3 Construction Activities & Transportation	16.3.1 Traffic Accidents	16.3.1.1 Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			16.3.1.2 Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle 16.3.1.3 Ensuring moving equipment is outfitted with audible back-up alarms 16.3.1.4 Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations. 16.3.1.5 Limit the speed of project vehicles, according to the road condition. 16.3.1.6 Maintain construction equipment and vehicles. 16.3.1.7 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights. 16.3.1.8 Consult with community leaders on plan and transportation route before movement of large equipment. 16.3.1.9 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up. 16.3.1.10 Strictly enforce training programs to reduce transport					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			and drilling incidents by its contractors. 16.3.1.11 Implement emergency response training, fire training and response drills.					
	16.4 Non-Hazardous Waste Management	16.4.1 Food safety, Increase in vector-borne diseases: malaria, typhus and dengue and others.	16.4.1.1 Implement construction and installation phase mitigation measures in 12.1.	Negligible	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan

Table 8-3 : Mitigation Measures and Required Actions During Drilling Phase

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
Physical Environmental Impact Assessment								
1. Air Quality	1.1. Vehicle and Equipment Use	1.1.1. Deterioration of air quality due to dust.	1.1.1.1. Implement construction and installation phase mitigation measures in 2.1.	Low	Implement construction and installation phase mitigation measures in 2.1 to reduce dust impacts	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
	1.2. Vehicle and Equipment Use	1.2.1. Deterioration of air quality due to vehicle emissions.	1.2.1.1. Implement construction and installation phase mitigation measures in 2.2.	Low	Implement construction and installation phase mitigation measures in 2.2 to reduce emission impacts.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
	1.3. Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	1.3.1.1. Install Gas Detectors to response during emergency situation.	Low	H2S detection and safety equipment is standard issue. PTTEP SA's develop emergency response plan (ERP) and H2S Contingency Plan.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			1.3.1.2. If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).					
			1.3.1.3. All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.					
	1.4. Vehicle and Equipment Use	1.4.1. *Climate Change due to GHG*	1.4.1.1. Implement construction and installation phase mitigation measures in 2.3.	Low	Implement construction and installation phase mitigation measures in 2.3 to reduce GHG emissions.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
2. Noise	2.1. Well Drilling and Vehicle and Equipment Use	2.1.1. Increase in noise levels during exploration drilling.	2.1.1.1. Install noise barrier at the well site boundary toward nearest community	Low		PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures		Residual Risk	Specific Action	Responsible	Schedule	Records
			2.1.1.2.	Ensure use of mufflers on diesel/gas driven machinery.					
			2.1.1.3.	Ensure all machinery and vehicles are properly checked and inspected.					
3. Heat and Light	3.1. Functional lighting on vehicles and drill rig, camp site and well site during Drilling Wells.	3.1.1. Lighting on the site at night	3.1.1.1.	Drilling Rig located in area distant to sensitive receptors.	Negligible	Install well site in area distant to sensitive receptors and keep night lighting to a minimum.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			3.1.1.2.	Keep night lighting to a minimum, consistent with safety and security.					
			3.1.1.3.	Direct lighting to the inside of the well sites.					
4. Surface Water Quality	4.1. Site Runoff and Drainage	4.1.1. Contamination of surface water from runoff and drainage	4.1.1.1.	Implement construction and installation phase mitigation measures in 5.1.	Low	Provide drainage, buffer zone and earth bund surrounding well site area. Monitor and transport waste to prevent any overflow from waste pit before being transported for treatment and/or disposal by a certified waste oil disposal contractor.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			4.1.1.2.	Provide drainage, buffer zone and earth bund surrounding well site area.					
			4.1.1.3.	The fuel storage will be surrounded by a bund wall in case of spill.					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	4.2. Hazardous/non-hazardous waste management	4.2.1. Degradation of surface water quality from disposal of domestic sewage and grey water	4.2.1.1. Install concrete lined septic tank and soak away pit at the well site for holding & treating sewage.	Low	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
5. Soil Quality	5.1. Drill site Site Runoff and Drainage	5.1.1. Contamination of soil from runoff	5.1.1.1. Implement drilling phase mitigation measures in 4.1.	Low	Implement drilling phase mitigation measures in 4.1 to recude soil impacts.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
6. Groundwater Quality	6.1. Loss of circulation during Drilling wells	6.1.1. Groundwater degradation from drilling	6.1.1.1. Install steel casing and cement in place to prevent chemical leak or contaminate into rock formation. 6.1.1.2. Strict steel casing to well wall by cementing to prevent chemical contaminate to groundwater level.	Low	Install and design steel casing and cement to prevent chemical leak or contaminate into rock formation.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
	6.2. Infiltration from the waste pit and sub-irrigation field	6.2.1. Deterioration of shallow Groundwater	6.2.1.1. Install HDPE liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.	Low	Install HDPE liner in the cuttings and dirty water waste pit.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
Ecological Environmental Impact Assessment								
7. Terrestrial Flora and Fauna	7.1. Drilling Activities and Labour and Accommo	7.1.1. Aquatic biota and habitat disturbed from workers' activities	7.1.1.1. Fishing or Hunting will be prohibited to workers.	Low	Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	dations							
			7.1.1.2. Clearly mark signs showing the boundary of the project area.					
			7.1.1.3. Prohibit workers from cleaning machines/ equipment in a public water source.					
			7.1.1.4. Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.					
Social Impact Assessment								
8. Transport	8.1. Rig Move and Equipment and Vehicle Use.	8.1.1. Disruption of traffic	8.1.1.1. Ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect performance.	Low	Maintain all vehicles and comply with project safety standards., drug and alcohol policy	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			8.1.1.2. Strictly Follow Speed Limits		Follow speed limits			
			8.1.1.3. Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures.		Weight of the trucks checked to ensure they do not exceed the limit set by the Myanmar regulations.			
			8.1.1.4. Safety equipment and emergency equipment must be installed on vehicles such as tool box safety belts and portable fire extinguisher etc. as per company standards.		Safety equipment and emergency equipment must be installed on all vehicles.			
			8.1.1.5. Provide left hand drive car as priority.		Prioritize to get left hand drive car.			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			8.1.1.6. Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.		Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.			
			8.1.1.7. Consult with local authority before major movement.		Consult with local authority before major movement.			
			8.1.1.8. Restrict/ avoid movement of heavy equipment during rush hours.		Restrict/ avoid movement of heavy equipment during rush hours.			
			8.1.1.9. Provide traffic signs or flags at junction of access roads and main roads.		Provide traffic signs or flags at junction of access roads and main roads.			
			8.1.1.10. Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.		Investigate any complaints and handle appropriately to PTTEP SA & MOGE requirements.			
			8.1.1.11. Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.		Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.			
			8.1.1.12. Strictly enforce training programs to reduce transport incident cases by its contractors.		Implement training programs to reduce transport incident cases by its contractors.			
			8.1.1.13. Restore any damage to roads that is caused by contractors or Company.		Restore any damage to roads.			
			8.1.1.14. Restrict local traffic in well site area		Restrict local traffic in well site area			
			8.1.1.15. Road Hazard Assessment will be conducted before transporting any large equipment.		Conduct the Road Hazard Assessment before transporting any large equipment.			
			8.1.1.16. Vehicles will take direct routes where possible and avoid significant habitat		Vehicles will take direct routes where possible and avoid significant habitat			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			areas.		areas.			
			8.1.1.17. Construction vehicles will follow speed limits.		Construction vehicles will follow speed limits.			
		8.1.2. Damage to roads	8.1.2.1. Check and restore for any damage from project activities to local roads.		Check and restore for any damage to local roads.			
9. Water Use	9.1. Use of public utility for water resources	9.1.1. Water usage of project affects the community's water supply.	9.1.1.1. Implement construction and installation phase mitigation measures in 10.1.	Low	Investigate any complaints regarding water use and handle appropriately. Keep records of complaints and follow-up.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			9.1.1.2. Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.					
10. Power Use	10.1. Power for drilling operations and work camp	10.1.1. Increase or decrease of available power for local community	10.1.1.1. Install diesel-powered generators to supply all project power related needs.	Negligible	Install diesel-powered generators.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
11. Waste Management	11.1. Non Hazardous waste management	11.1.1. Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and groundwater and vector for disease	11.1.1.1. Implement construction and installation phase mitigation measures in 12.1.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
	11.2. Hazardous waste management	11.2.1. Hazard waste contaminate to environment.	11.2.1.1. Ensure treatment and disposal of hazardous waste by licensed contractor.	Medium	Implement the PTTEP SA Waste Management Plan on site. Ensure treatment and	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
					disposal of hazardous waste by licensed contractor All hazardous waste will be collected in skips ready for treatment and disposal. Hazardous wastes will be transported for disposal approved waste management facility.			Waste Management Plan Waste Manifest
			11.2.1.2. Segregate and store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring. Make sure all containers are clearly labeled.					
			11.2.1.3. Always check and record the type(s) and amount of hazardous waste generated.					
			11.2.1.4. Dispose of waste in labeled containers for possible recycling or reuse.					
			11.2.1.5. Prohibit open burning of any waste at project site.					
			11.2.1.6. Enforce "Good Housekeeping" practices.					
			11.2.1.7. All hazardous waste will be collected in skips ready for treatment and disposal. Hazardous wastes will be transported and disposed at approved waste management facility.					
			11.2.1.8. Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	11.3. Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1. Localized change in water quality and soil quality from chemical composition of drill fluids	11.3.1.1. Drill cuttings and adhered fluids will not be discharged to surrounding area. 11.3.1.2. Volume of cuttings and fluids discharged will be minimised through use of solids control equipment. 11.3.1.3. Store all chemicals in secured storage area. 11.3.1.4. Hazardous wastes materials will be handled and stored in accordance with the corresponding SDS. 11.3.1.5. Implement awareness training on the hazards of the chemicals. 11.3.1.6. Enforce use of PPE. 11.3.1.7. Handle chemicals only in well-ventilated and controlled areas 11.3.1.8. Fuel storage tanks to be surrounded by bund wall. 11.3.1.9. Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the concrete pit.	Medium	Implement the PTTEP SA Waste Management Plan on site. Ensure treatment and disposal of hazardous waste by licensed contractor and taken to Yangon for disposal at approved waste management facility.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			11.3.1.10. Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).					
			11.3.1.11. Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan.					
			11.3.1.12. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.					
			11.3.1.13. Monitor level of cuttings and dirty water in waste pit.					
			11.3.1.14. Implement land transportation procedure.					
12. Socio-Economy	12.1. Employment opportunities and Use of local goods and services	12.1.1. Employment and income	12.1.1.1. Employ qualified local workers if possible.	Postive	Employ qualified local workers and purchase local supplies and services	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			12.1.1.2. Purchase local supplies and services, whenever possible.					
Health Impact Assessment								
13. Occupational and Public Health	13.1. Rig, Generators and Equipment	13.1.1. Health impact from noise	13.1.1.1. Implement drilling phase mitigation measures in 2.1.	Negligible	Provide all required PPE to workers on site.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System
			13.1.1.2. Provide PPE to workers on					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			site 13.1.1.3.					
	13.2. Drilling Support Activities & Transportation	13.2.1. Traffic Accidents	13.2.1.1. Adoption of best transport safety practices across all drilling operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public including: • Emphasizing safety aspects among drivers • Improving driving skills and requiring licensing of drivers • Adopting limits for trip duration and arranging driver rosters to avoid overtiredness • Avoiding dangerous routes and times of day to reduce the risk of accidents 13.2.1.2. Use of speed control devices (governors) on trucks, and remote monitoring of driver actions	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
			13.2.1.3. Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.					
			13.2.1.4. Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			located near schools or other locations where children may be present. Collaborating with local communities on					
			13.2.1.5. Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents					
			13.2.1.6. Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker transport to minimizing external traffic					
			13.2.1.7. Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions					
	13.3. Non Hazardous waste management	13.3.1. Health impact from Non-Hazardous Waste	13.3.1.1. Implement construction and installation phase mitigation measures in 12.1.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
	13.4. Handling and Disposal of	13.4.1. Health impact from hazardous Waste	13.4.1.1. Implement drilling phase mitigation measures in 11.2.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	Hazardous Waste							Waste Management Plan Waste Manifest
	13.5. Hazardous waste management and chemical handling	13.5.1. Health impact from Mud, Chemicals and Drilling Waste	13.5.1.1. Implement drilling phase mitigation measures in 11.3.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
	13.6. Labour and Accomodations	13.6.1. Health impact from Communicable Diseases	13.6.1.1. Implement construction and installation phase mitigation measures in 12.1. 13.6.1.2. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility. 13.6.1.3. Drainage and removal of waste from waste pit upon completion of drilling. 13.6.1.4. Health screening of workers before employment. 13.6.1.5. On-site health clinic (drilling operations) and referral	Medium	Install and Maintain an On-site health clinic and referral system during to ensure timely diagnosis and treatment of workers' illness and injury.	PTTEP SA	Throughout Drilling Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.					
			13.6.1.6. Considering on hiring of qualified local workers to reduce reliance on outside labour and increase local employment.					
			13.6.1.7. Do not allow workers to enter communities near the drill site.					
			13.6.1.8. Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.					

Table 8-4: Mitigation Measures and Required Actions During Well Testing Phase

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
Physical Environmental Impact Assessment								
1 Air Quality	1.1 Vehicle and Equipment Use	1.1.1 Deterioration of air quality due to dust.	1.1.1.1 Implement construction and installation phase mitigation measures in 2.1.	Low	Implement construction and installation phase mitigation measures in 2.1 to reduce dust impacts.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
		1.1.2 Deterioration of air quality due to combustion of diesel fuel and flaring.	1.1.2.1 Implement construction and installation phase mitigation measures in 2.2.		Implement construction and installation phase mitigation measures in 2.2 to reduce air emission impacts.			
			1.1.2.2 Process control to minimize flaring.		Process control to minimize flaring and Verify the operation's flaring system to highest efficiency.			
			1.1.2.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.					
			1.1.2.4 Verify the operation's flaring system to highest efficiency.					
	1.2 Well testing releasing hydrogen sulphide	1.2.1 Deterioration of air quality due to hydrogen sulphide	1.2.1.1 Install Gas Detectors to response during emergency situation.	Low	H2S detection and safety equipment is standard issue. PTTEP SA's emergency response plan (ERP) includes anH2S Contingency Plan	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			1.2.1.2 If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).					
			1.2.1.3 All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			for H2S awareness.					
			1.2.1.4 Limit well testing period where possible.					
	1.3 Flare Emissions	1.3.1 Climate Change due GHG	1.3.1.1 To maximize energy efficiency and design facilities to minimize energy use	Low	Maximize energy efficiency and design facilities to minimize energy use. Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			1.3.1.2 Operating flare to control odor and visible smoke emissions.					
			1.3.1.3 Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.					
			1.3.1.4 Implementation of burner maintenance and replacement, programs to ensure continuous maximum flare efficiency.					
			1.3.1.5 Metering flare gas.					
			1.3.1.6 Keep installation and functioning of flare gas system safe according to the good engineering practice.					
			1.3.1.7 Ensure flare system has efficient combustion.					
			1.3.1.8 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.					
			1.3.1.9 Verify the operation's					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			flaring system.					
			1.3.1.10 Minimize the duration of flaring when possible					
2 Noise	2.1 Flaring during Well Testing	2.1.1 Increase in noise levels during well testing.	2.1.1.1 Implement construction and installation phase mitigation measures in 3.1.	Low	Implement construction and installation phase mitigation measures in 3.1 to reduce noise impacts.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			2.1.1.2 Verify the operation's flaring system.					
			2.1.1.3 Minimize the duration of flaring when possible.					
3 Heat and Light	3.1 Flaring during Well testing	3.1.1 Increase in light at night from flaring	3.1.1.1 Position flare away from sensitive receptors.	Negligible	Position flare away from sensitive receptors and Maintain safety distance between flare stack and well site facilities and adjacent crops	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			3.1.1.2 Direction the light into wellpad as much as possible.					
			3.1.1.3 Minimize the duration of flaring process when possible					
		3.1.2 Increase heat from flaring	3.1.2.1 Clear vegetation around the flare stack and build earth bermed flare pit.					
			3.1.2.2 Minimize flare duration when possible.					
			3.1.2.3 Maintain safety distance between flare stack and well site facilities and adjacent crops					
			3.1.2.4 Follow flare management procedures to ensure optimum management of fare system					
4 Surface	4.1 Non	4.1.1 Contaminatio	4.1.1.1 Prohibit workers from	Low	Implement the PTTEP SA	PTTEP SA	Throughout	PTTEP SA's

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
Water Quality	Hazardous waste management	n of surface water from drained domestic waste and gray water	cleaning machines/ equipment in a public water source. 4.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources. 4.1.1.3 Install septic tank and soak away pit on each well site for holding sewage.		Waste Management Plan on site.		Construction Phase duration	SSHE Management System and Waste Management Plan Waste Manifest
5 Soil Quality	5.1 Non Hazardous waste management	5.1.1 Contamination of soil from drained domestic waste and gray water	5.1.1.1 Prohibit workers from cleaning machines/ equipment in non designated areas. 5.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, oil in non designated areas. 5.1.1.3 Install septic tank and soak away pit on each well site for holding sewage.	Low	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
Ecological Environmental Impact Assessment								
6 Terrestrial Flora and Fauna	6.1 Labour and Accommodations	6.1.1 Habitat degradation from workers' activities	6.1.1.1 Mark well site clearly and prohibit vehicles from moving off site onto surrounding land. 6.1.1.2 Forest incursions will be specifically prohibited.	Low	Contractors and personnel will not be allowed off site.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			6.1.1.3 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation.					
	6.2 Flaring during Well Testing	6.2.1 Habitat degradation from light and heat	6.2.1.1 Implement well testing phase mitigation measures 3.1.	Low	Implement well testing phase mitigation measures 3.1 to reduce light and heat impacts.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
Social Impact Assessment								
7 Transport	7.1 Vehicle and Equipment Use	7.1.1 Disruption of traffic	7.1.1.1 Implement construction and installation phase mitigation measures in 9.1.	Medium	Implement construction and installation phase mitigation measures in 9.1 to reduce disruption to traffic.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
		7.1.2 Damage to roads.	7.1.2.1 Regularly restore any damaged roads from project activities to good condition.					
8 Waste Manageme nt	8.1 Hazardous/ Non Hazardous waste manageme nt	8.1.1 Domestic waste can be a fire hazard, constitute. windblown litter, attract vermin, contaminate surface and groundwater and be a vector for disease	8.1.1.1 Implement construction and installation phase mitigation measures in 12.1.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
		8.1.2 Hazard waste	8.1.2.1 Implement from drilling phase in 13.4.					
			8.1.2.2 Transport produced water to dispose by licensed water treatment facility.					
9 Socio-Economy	9.1 Labour and Accomidatio	9.1.1 Employment and Income	9.1.1.1 Implement drilling phase mitigation measures in	Positive	Implement drilling phase mitigation measures in 12.1	PTTEP SA	Throughout Well Testing	PTTEP SA's SSHE

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	ns		12.1.		to increase socio-economic benefits.		Phase duration	Management System
Health Impact Assessment								
10 Occupational and Public Health	10.1 Flaring	10.1.1 Heat exposure and Nuisance light from Light and heat	10.1.1.1 Implement well testing phase mitigation measures 3.1.	Medium	Implement PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			10.1.1.2 Implement PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.					
			10.1.1.3 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).					
			10.1.1.4 Heat impacts from the flare stack will be minimised by having a protected flare pit.					
			10.1.1.5 Maintain a safe distance from nearest sensitive receptor.					
	10.2 Flaring	10.2.1 Increase in respiratory illnesses/diseases, asthma, Disturbance psychological wellbeing from flaring emissions	10.2.1.1 Ensure flare system has efficient combustion.	Medium	H2S detection and safety equipment is standard issue. PTTEP SA's emergency response plan (ERP) includes an H2S Contingency Plan	PTTEP SA	Throughout Well Testing Phase duration	PTTEP SA's SSHE Management System
			10.2.1.2 Clear vegetation around the flare stack and build					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			earth bermed flare pit.					
			10.2.1.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.					
			10.2.1.4 H2S detection and safety equipment is standard issue. PTTEP SA's develop emergency response plan (ERP) and H2S Contingency Plan.					
			10.2.1.5 Monitor H2S during well testing.					
			10.2.1.6 Staff trained in H2S procedures.					
	10.3 Well Testing Support Activities	10.3.1 Traffic Accidents	10.3.1.1 Implement drilling phase mitigation measures in 18.1.	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
	10.4 Non-hazardous waste management	10.4.1 Waste can be a contaminate surface and groundwater, and be a vector for disease.	10.4.1.1 Implement construction and installation phase mitigation measures in 12.1.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
	10.5 Hazardous waste management	10.5.1 Health impacts from Hazardous Waste	10.5.1.1 Implement drilling phase mitigation measures in 11.2.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest

Table 8-5: Mitigation Measures and Required Actions During Well Abandonment Phase

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
Physical Environment Impact Assessment								
1 Topography	1.1 Site and Road abandonment and restoration	1.1.1 Disturbance to local topography	1.1.1.1 Limit site-clearing activities to well sites and access roads only.	Low	Limit site-clearing activities to well sites and access roads and hand back to MOGE as per agreed conditions.	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			1.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.					
2 Air Quality	2.1 Vehicle and Equipment Use	2.1.1 Deterioration of air quality due to dust.	2.1.1.1 Implement construction and installation phase mitigation measures in 2.1.	Low	Implement construction and installation phase mitigation measures in 2.1 to ensure reduction of dust, air pollution and GHG during abandonment phase	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
		2.1.2 Deterioration of air quality due to combustion of diesel fuel.	2.1.2.1 Implement construction and installation phase mitigation measures in 2.2.					
		2.1.3 *Climate Change due to GHG*	2.1.3.1 Implement n construction and installation phase mitigation measures in 2.3.					
3 Noise	3.1 Vehicle and Equipment Use	3.1.1 Increase in noise levels from machines/engines during site demolition & restoration and transportation	3.1.1.1 Implement construction and installation phase mitigation measures in 3.1.	Low	Implement construction and installation phase mitigation measures in 3.1 ensure reduction noise during abandonment phase	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
		.						
4 Surface Water Hydrology	4.1 Restore site	4.1.1 Alteration of surface water hydrology	4.1.1.1 During restoration, avoid causing obstacles to water drainage	Low	Implement construction and installation phase mitigation measures in 5.1 ensure protection of surface water hydrology during abandonment phase	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			4.1.1.2 Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies.		Restore the site and hand back to MOGE as per agreed conditions.			
			4.1.1.3 Vegetate site with native species					
5 Surface Water Quality	5.1 Hazardous/non-hazardous waste management	5.1.1 Potential contamination from spills or wastewater drainage to nearby water bodies during site restoration	5.1.1.1 Implement construction and installation phase mitigation measures in 5.1.	Low	Implement construction and installation phase mitigation measures in 5.1 ensure protection of surface water hydrology during abandonment phase	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			5.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.		Restore the site and hand back to MOGE as per agreed conditions.			
6 Soil Quality	6.1 Soil excavation for site restoration	6.1.1 Degradation of soil quality through compaction or erosion during site demolition	6.1.1.1 Limit site demolition & restoration only to well sites and access roads.	Low	Limit site demolition & restoration to well sites and access roads only.	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			6.1.1.2 Restore the site		Restore the site and hand			

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
		& restoration.	and hand back to MOGE as per agreed conditions.		back to MOGE as per agreed conditions.			
			6.1.1.3 Test and Managing potentially contaminated areas with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post decommissioning.					
			6.1.1.4 Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with international hazardous waste management guidelines.					
7 Groundwater Qualtiy	7.1 Hazardous/Non Hazardous waste management and chemical handling	7.1.1 Contamination of groundwater from waste, chemicals and wastewater	7.1.1.1 Prohibit workers from cleaning machines/ equipment in unauthorized locations.	Low	Prohibit workers from cleaning machines/ equipment, discharging or discarding project waste, chemicals, or oil in unauthorized locations.	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			7.1.1.2 Prohibit workers and contractors					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			discharging or discarding project waste, chemicals, or oil in unauthorized locations. 7.1.1.3 Install septic tank on each well site for holding sewage and grey water. 7.1.1.4 Store wastes and chemicals in a secure area that has a hard surface and closed drains.					
Ecological Environment Impact Assessment								
8 Terrestrial Flora and Fauna	8.1 Labour and Accomodations	8.1.1 Degradation or destruction of natural habitat and harvesting wild plants / animals	8.1.1.1 Limit abandonment to daytime hours only.		Limit construction equipment to daytime hours only.	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
			8.1.1.2 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to flora and fauna. In addition, fishing and hunting will be specifically prohibited.		Contractors and personnel will not be allowed off site.			
	8.2 Site-Run off and drainage	8.2.1 Potential degradation or destruction of	8.2.1.1 Implement construction and installation phase	Low	Implement construction and installation phase mitigation measures in 7.3	PTTEP SA	Throughout Well Abandonment	PTTEP SA's SSHE Management

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
		aquatic biota	mitigation measures in 7.3.		to ensure no site-run off and drainage impacts.		Phase duration	System
Social Impact Assessment								
9 Land Use	9.1	9.1.1	9.1.1.1 Restore the site and hand back to MOGE as per agreed conditions.		Hand back wellsite to MOGE as per agreed conditions.			
10 Transportation	10.1 Vehicle and Equipment Use	10.1.1 Disruption of traffic.	10.1.1.1 Implement construction and installation phase mitigation measures in 9.1.	Mediun	Implement construction and installation phase mitigation measures in 9.1 to reduce distuption to traffic.	PTTEP SA	Throughout Well Abandonment Phase duration	PTTEP SA's SSHE Management System
	10.2 Site restoration	10.2.1 Damage to roads.	10.2.1.1 Restore any damage to roads.		Restore all damage to roads.			
11 Waste Management	11.1 Hazardous/non-hazardous waste management	11.1.1 Non-hazardous waste can be a contaminate surface and groundwater, and be a vector for disease.	11.1.1.1 Implement construction and installation phase mitigation measures in 12.1.	Medium	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System and Waste Management Plan Waste Manifest
11 Socio-Economy	11.1 Labour and Accomidations	11.1.1 Employment and Income	11.1.1.1 Implement drilling phase mitigation measures in 12.1.	Positive	Implement construction phase mitigation measures to increase socio-economic benefits.	PTTEP SA	Throughout Abandonment Phase duration	PTTEP SA's SSHE Management System
Health Impact Assessment								
12 Public and Occupational Health	12.1 Well Abandonment Support Activities & Transportation	12.1.1 Traffic Accidents	12.1.1.1 Implement construction and installation phase mitigation measures in 17.1.	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout Construction Phase duration	PTTEP SA's SSHE Management System
	12.2 Non-hazardous waste management	12.2.1 Exposure to contaminati	12.2.1.1 Implement construction and installation phase	Negligible	Implement the PTTEP SA Waste Management Plan on site.	PTTEP SA	Throughout Construction Phase	PTTEP SA's SSHE Management

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
		on from non-hazardous wastes,	mitigation measures in 12.1.				duration	System and Waste Management Plan Waste Manifest

Table 8-6: Mitigation Measures and Required Actions During Unplanned Event

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
1. Blowout	1.1 Drilling	1.1.1 Release of uncontrolled volumes of hydrocarbons, Fire and Explosion	1.1.1.1 Examination of existing wells to identify shallow gas hazards.	Medium	Ensure PTTEP SA's SSHE Integrated Management System Procedures and Emergency Response Plan operational controls are enfored to prevent a blowout/explosion	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			1.1.1.2 Drilling and Well Control Standard Operating Procedures and extensive SSHE Management System procedures and operational controls in place.					
			1.1.1.3 Internal hazardous operations reviews and "Table Top Drilling" exercises to test procedures and individual personnel performances against the drilling plan.					
			1.1.1.4 Select proper drill fluid formulation, provide well kill fluids/systems, loss control and weighting agents.					
			1.1.1.5 Very careful monitoring of down hole conditions and mud returns.					
			1.1.1.6 Use of appropriate, high quality materials in well construction (casing and cement grades).					
			1.1.1.7 Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			maximum formation pressure; and test as per procedures.					
			1.1.1.8 Follow PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan					
			1.1.1.9 PTTEP SA's SSHE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.					
2. Fire or Explosion (not associated with Blowout)	2.1 Fuel Storage and Ignition Sources	2.1.1 Possible explosion or fire of drilling rig or at campsite, or fuel storage area	2.1.1.1 PTTEP SA's SSHE Integrated Management System Procedures and operational controls to prevent a fire/explosion.	Medium	Ensure PTTEP SA's SSHE Integrated Management System Procedures and Emergency Response Plan operational controls are enfored to prevent a fire/explosion.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			2.1.1.2 PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs.					
			2.1.1.3 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).					
			2.1.1.4 Pre-arranged call out support from local fire brigades.					
3. Fuel, Chemical or Hazardous Waste/Materials Spill	3.1 Storage of Fuel, chemicals, hazardous materials or	3.1.1 Potential risk of spills to the environment affecting air quality, soil	3.1.1.1 Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating	Medium	Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures with Procedures	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
	waste	quality, surface water, groundwater, biota and people	procedures.		for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP.			
			3.1.1.2 Spill containment and recovery equipment will be available near storage areas.					
			3.1.1.3 Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP and Spill Contingency Plan.					
			3.1.1.4 SDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the SSHE Officer.					
			3.1.1.5 Construct drainage system around well sites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the concrete pit.					
			3.1.1.6 Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).					
			3.1.1.7 Provide drip pans and absorbents to contain any spillage.					
			3.1.1.8 Provide spill cleanup kits					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP.					
			3.1.1.9 Prohibit workers from cleaning machines/equipment in/near a public water source.					
			3.1.1.10 Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.					
			3.1.1.11 Maintain oil traps along perimeter drainage around concrete pad to prevent any spills from flowing off site.					
			3.1.1.12 Isolate any area(s) that might be contaminated from non-contaminated areas.					
			3.1.1.13 Store Chemicals and hazardous materials on concrete pad.					
			3.1.1.14 Procedures for response to chemical spills will be included in PTTEP SA's ERP.					
			3.1.1.15 Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			facility.					
			3.1.1.16 Implement transportation plan.					
4. Transportation Accidents	4.1 Vehicle and Equipment Use	4.1.1 Possible injury or death to personnel; and localized contamination of environment	4.1.1.1 Follow SSHE Integrated Management System Procedures.	Medium	Implement PTTEP SA's SSHE Integrated Management System Procedures to prevent transportation accident.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System
			4.1.1.2 Limit the speed of project vehicles, according to the road condition.					
			4.1.1.3 Maintain construction equipment and vehicles.					
			4.1.1.4 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.					
			4.1.1.5 Consult with community leaders on plan and transportation route before movement of large equipment.					
			4.1.1.6 Restrict/ avoid movement of heavy equipment during rush hours.					
			4.1.1.7 Provide traffic signs or flags at junction of access road and main road.					
			4.1.1.8 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.					
			4.1.1.9 Strictly enforce training					

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Residual Risk	Specific Action	Responsible	Schedule	Records
			programs to reduce transport and drilling incidents by its contractors.					
			4.1.1.10 Restore any damage to roads caused by project vehicles.					
			4.1.1.11 Implement emergency response training, fire training and response drills.					
			4.1.1.12 Prohibit trespassers from entering the construction site.					
			4.1.1.13 Referral system with external medical facilities for serious injuries or emergencies.					
5. Earthquakes	5.1 Physical shifting of earths surface	5.1.1 Potential physical disruption cause building collapse, blowouts, fires or spills	5.1.1.1 Implement PTTEP SA's Emergency Response Plan.	Low	Implement PTTEP SA's Emergency Response Plan.	PTTEP SA	Throughout project duration	PTTEP SA's SSHE Management System

8.5.3 Environmental, Social, and Health Impacts and Monitoring Measures

A summary of EHS impact and monitoring measures for the onshore exploration drilling are shown **Table 8-7** to **Table 8-10**.

Table 8-7: Environmental, Social, and Health Monitoring Measures for Construction and Installation Phase

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • Once during construction and installation phase • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn}	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • Once during construction and installation phase • If within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• Throughout construction and installation phase	• Project area, community around project area, and transportation route
Public and Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation • Monthly occupational health and safety statistics have to be informed to "Factories and General Labour Laws Inspection Department".	• Throughout construction and installation phase	• Project area, community around project area, and transportation route

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

Table 8-8: Environmental, Social, and Health Monitoring Measures for Drilling Phase

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • Once during drilling phase • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn}	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • Once during drilling phase • If within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig
Cuttings from drilling (in case of further using cuttings)	• Chloride (for WBM) • Oil on Cuttings (for SBM) • Mercury (in stock Barite) • Cadmium (in stock Barite)	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012,	• Upon Completion of Drilling Phase before mixing / burial disposal in waste pit.	• Exploration drilling well

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Chemical use for drilling	• Type of chemical • Volume of use	• Daily record type of chemicals and volume used.	• Daily and report after drilling is completed	• Project area
Hazardous and Non-hazardous waste	• Manifest Disposal and Tracking Report	• Track waste volume by type and disposal location daily	• During Drilling Phase	• At all project locations
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• Throughout drilling phase	• Project area, community around project area, and transportation route
Public and Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation • Monthly occupational health and safety statistics have to be informed to "Factories and General Labour Laws Inspection Department".	• Throughout drilling phase	• Project area, community around project area and transportation route

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

Table 8-9: Environmental, Social, and Health Monitoring Measures for Well Testing Phase

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • Once during well testing phase • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn}	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • Once during well testing phase • If within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig
Social	• Complaint • Monitoring and solving	• Record complaints. • Monitor and address problems satisfactory.	• Throughout well testing phase	• Project area, community around project area, and transportation route
Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures. • Conduct a summary report for accident investigation. • Monthly occupational health and safety statistics have to be informed to "Factories and General Labour Laws Inspection Department".	• Throughout well testing phase	• Project area, community around project area, and transportation route

Table 8-10: Environmental, Social, and Health Monitoring Measures for Well Abandonment Phase

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn}	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Soil	Physical parameters: • pH • Soil texture • Salinity • Conductivity • Temperature • Cl^{-} Chemical Parameters: • Petroleum Hydrocarbons • Total PAH, Total DDT, Total PCBS. • Heavy Metals: As, Cd and Cd-compound, Cr^{6+}, Pb, Hg, Ni, Cu, Zn, Vanadium, Total Nitrogen and Total Phosphorus,	Method • Follow U.S. EPA Analytical Method per parameter • Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health • Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008 • Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada	• Once after well abandoned and site restored within 3 months. • In an event of spillage and leakage	Project site At the spillage or leakage areas
Surface water	Physical parameters: • pH • Conductivity • Temperature • SS • TDS • Salinity Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn Biological parameters: • TCB	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • World Health Organization's (WHO) Guidelines for drinking-water quality (GDWQ)	• Once after well abandoned and site restored within 3 months. • In an event of spillage and leakage	• At the same surface water sampling station before having project (Baseline) • Water sources which are potentially affected (in case of spillage of leakage)

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Groundwater	Physical parameters: • pH • Conductivity • Temperature • TDS • Salinity Chemical Parameters: • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • World Health Organization's (WHO) Guidelines for drinking-water quality (GDWQ)	• Once after well abandoned and site restored within 3 months. • In event of spillage and leakage	• Nearest groundwater well or just off well pad area • Area of possible spill
Social	• Complaint • Monitoring and solving	• Record complaints. • Monitor and address problems satisfactory.	• Once after well abandoned and site restored within 3 months.	• Project area, community around project area, and transportation route
Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation • Monthly occupational health and safety statistics have to be informed to "Factories and General Labour Laws Inspection Department".	• Throughout well abandonment phase	• Project area, community around project area and transportation route

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

8.6 Overall Management and Monitoring Plan Budgets

Management actions are defined to prevent or mitigate potential issues from occurring and monitoring will provide:

(1) Data on waste-stream emissions to ensure an ongoing assessment of operating standards and to measure performance against established requirements (objectives, targets, and performance criteria).
(2) Data on the environment to measure changes from the original environmental conditions.

The baseline survey reported in this EIA provided information on the relevant chemical, biological and social environment before start-up of operations. Follow-up monitoring will be done to determine any possible changes as a result of the proposed PTTEP SA Exploration Drilling Project.

Discharges and emissions from the proposed project are monitored to determine compliance with regulations and/or company standards.

Monitoring therefore includes ambient monitoring of the environment and monitoring of discharges.

An independent monitor will be in the field for the duration of project activities. The monitor too will audit compliance with guidelines, regulations and mitigation measures. Monitoring measures for the construction, drilling, and abandonment are outlined in the following plans.

The following list presents the specific management plans foreseen for the Project, based on the outcomes of the impact assessment and PTTEP SA's standards.

- Air Quality Management Plan
- Noise & Vibration Management Plan
- Soil Management Plan
- Water Management Plan
- Waste Management Plan
- Emergency Response Plan
- Biodiversity Action Plan
- Public Consultation Plan
- Cultural Heritage Management Plan
- Occupational Health/Public Health Plan
- Corporate Social Responsibility Plan (CSR)
- Land Compensation Plan

The overall budget required to implement the specific management plans based on the outcomes of the impact assessment and PTTEP SA's SSHE standards is estimated at **1,445,000 USD**.

8.7 Overview Maps of Well Site Monitoring Locations and Sensitive Receptors

8.7.1 Monitoring Locations

The final well four (4) locations are still being determined. The locations will be related to the actual well location and be taken from the baseline sampling locations. The monitoring results will describe in the 6 monthly monitoring report to ECD.

The minimum required sampling for each monitoring report will include:

- Soil - 1 at well site location
- Sediment – 1 at water source downstream of well
- Ambient air / Ambient noise – 1 station for 24 hrs located near 2 well locations
- Surface water - 2 per well site
- Groundwater – 2 per well site

The following maps identify the potential wellsite location, near by villages and proposed monitoring sampling points. The sample code is defined below:

Sample CODE:

S – Soil   Se – Sediment

A – Ambient air   N - Ambient noise

SW – Surface water   GW – Groundwater

Aq – Aquatic Biota

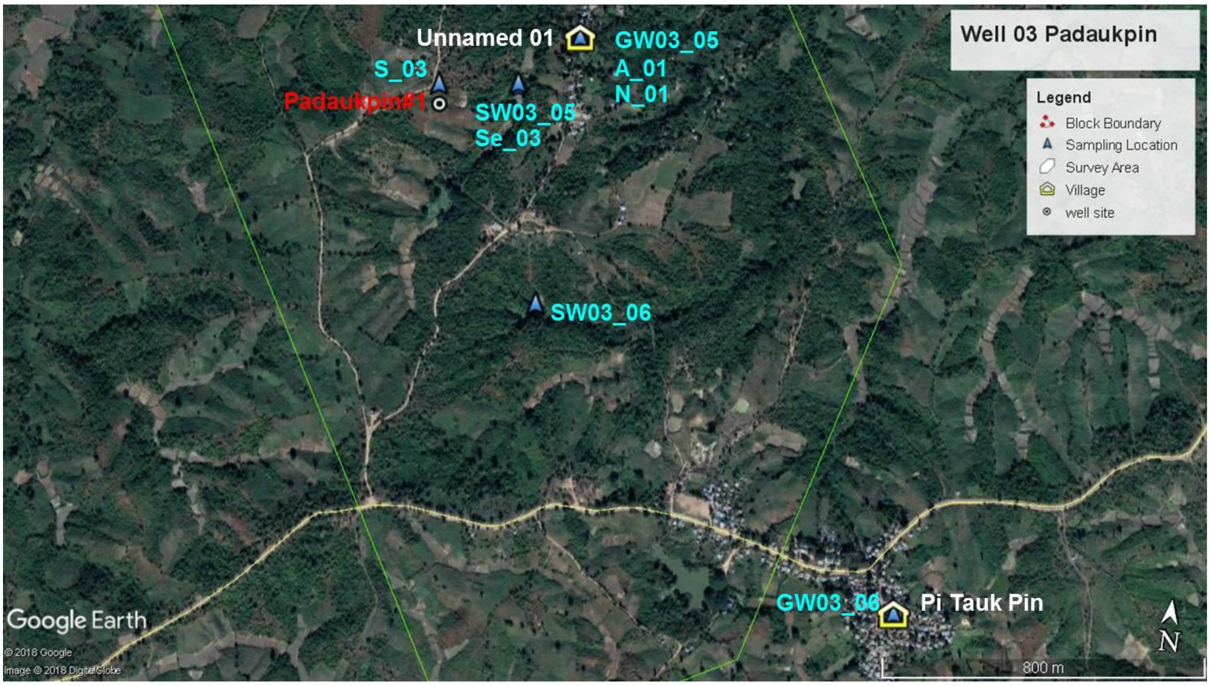


Figure 8-1: Wellsite 03 Padaukpin

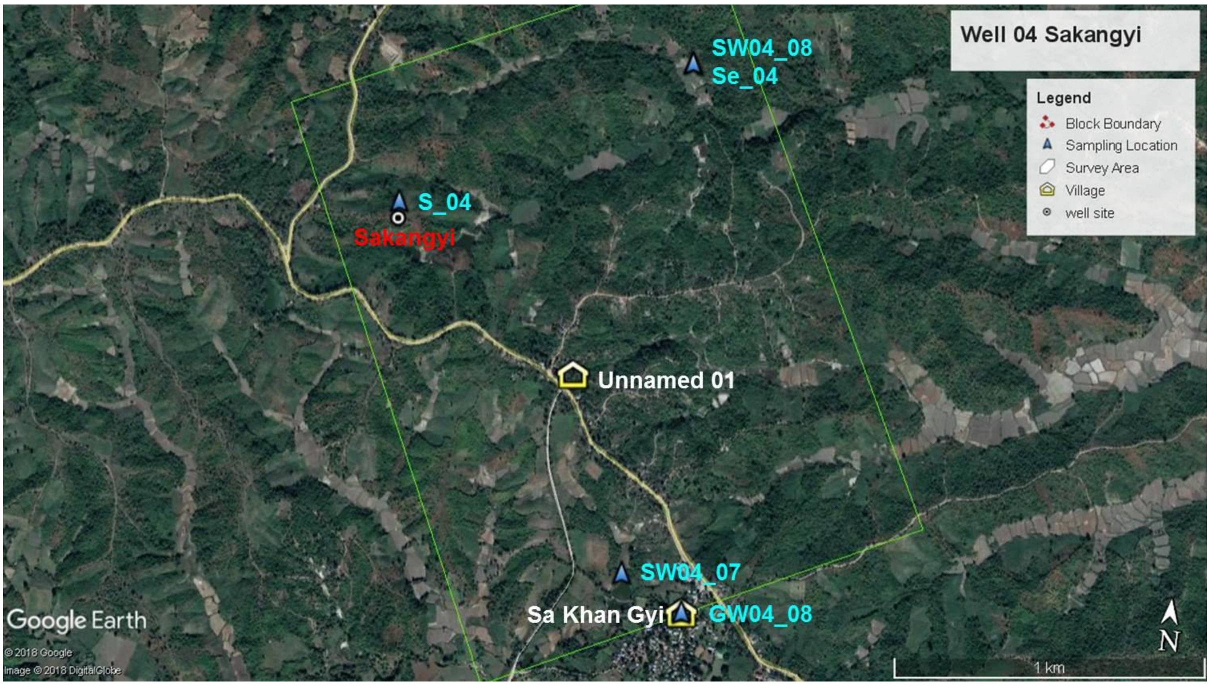


Figure 8-2: Wellsite 04 Sakangyi

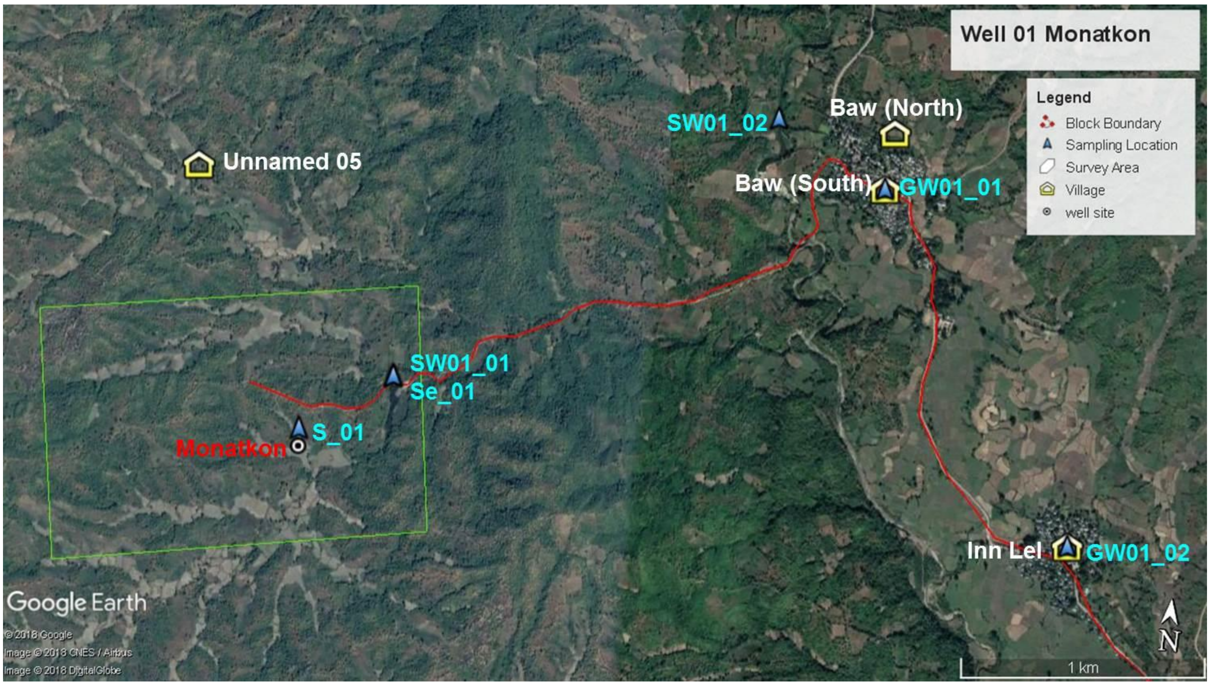


Figure 8-3 Wellsite 01 Monatkon

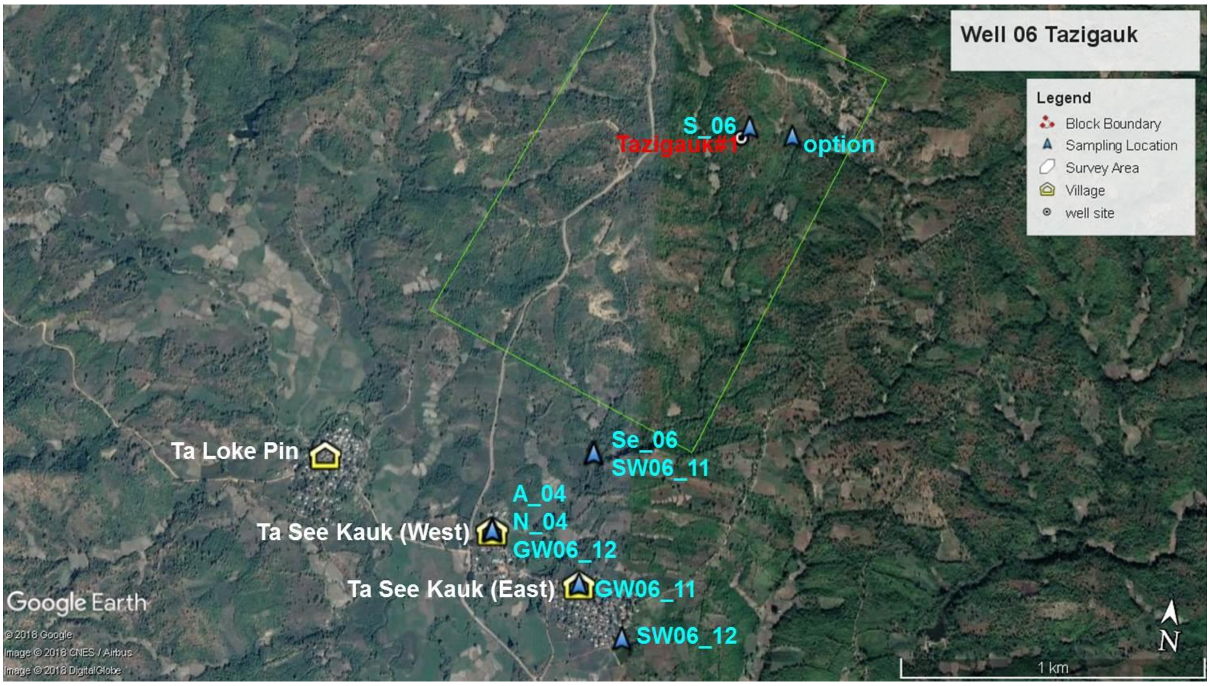


Figure 8-4 Wellsite 06 Tazigauk

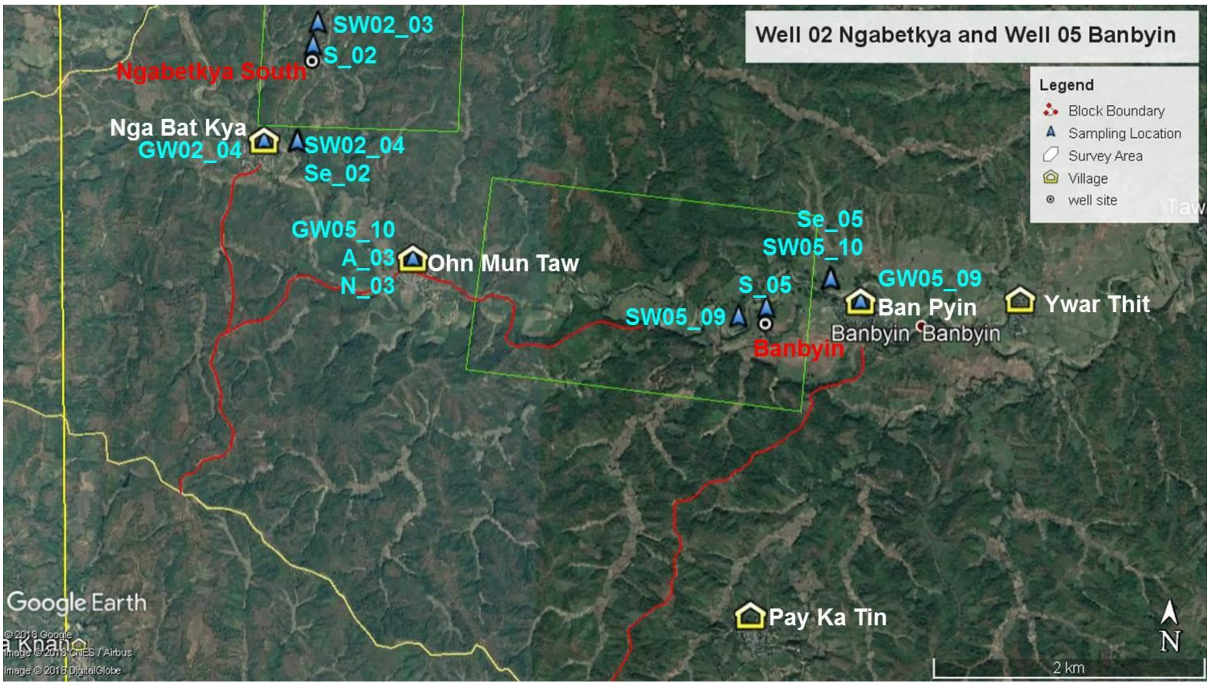


Figure 8-5 Wellsite 02 Ngabetkya and Wellsite 05 Banbyin

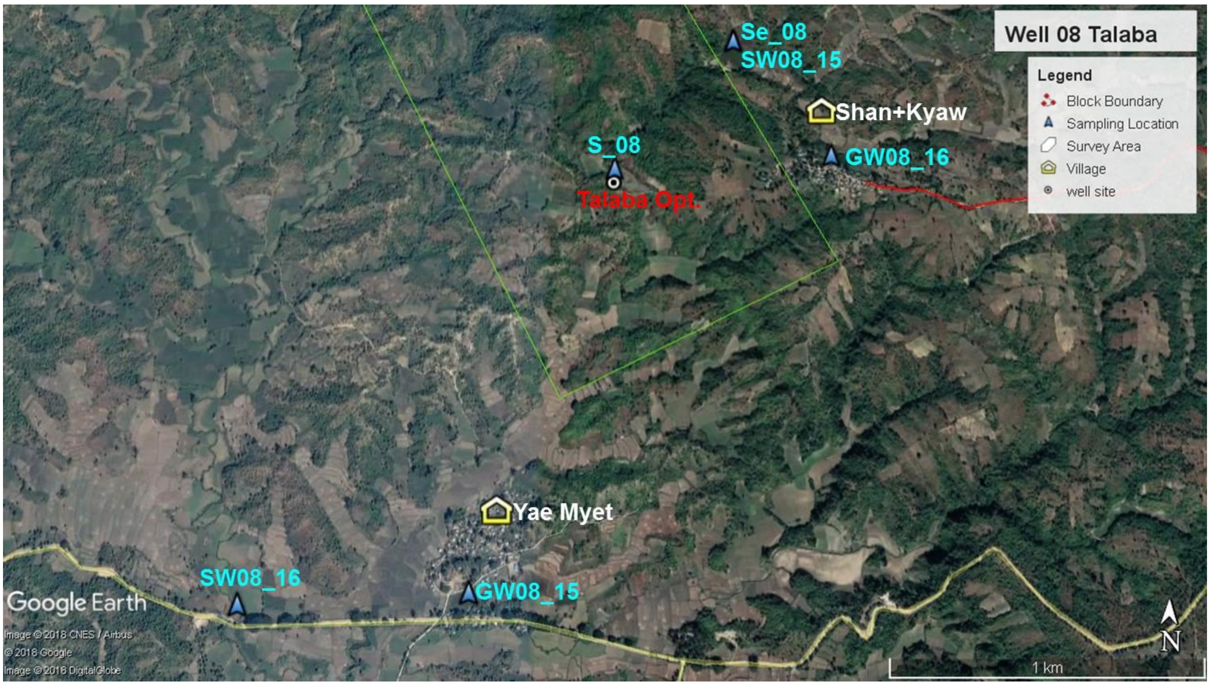


Figure 8-6 Wellsite 08 Talaba

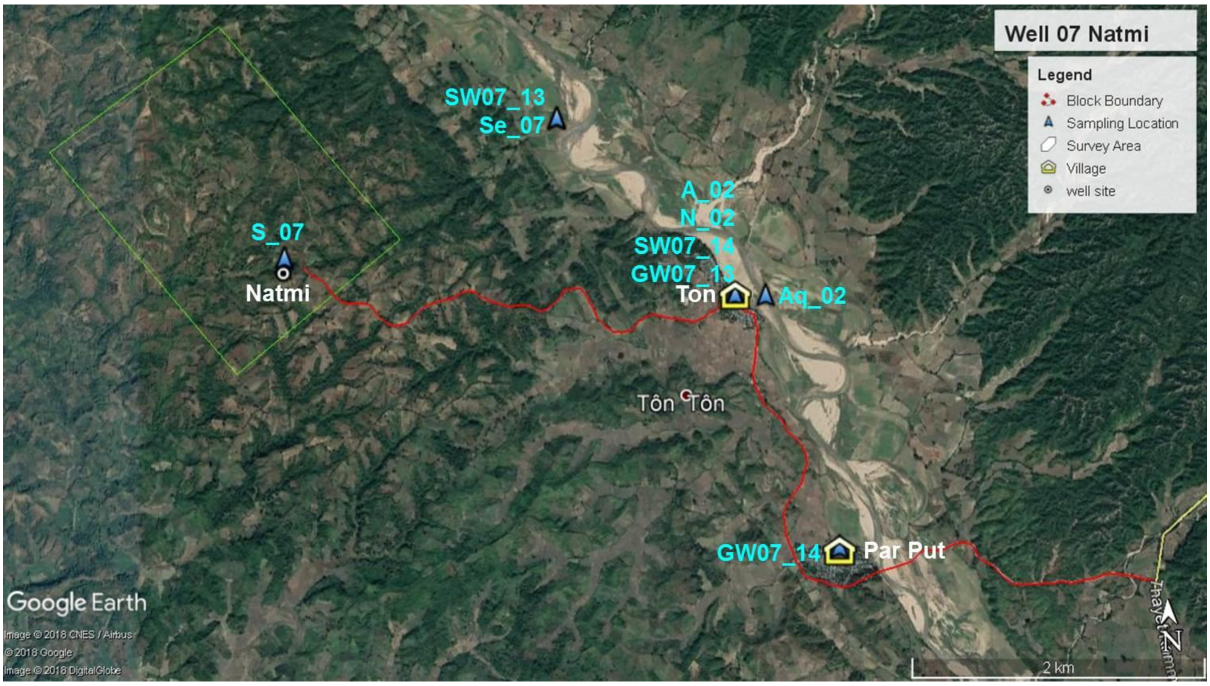


Figure 8-7 Wellsite 07 Natmi North

8.7.2 Sensitive Receptors

When reviewing the management plan, please refer to the following maps of the sensitive receptors near each of the planned potential well sites.

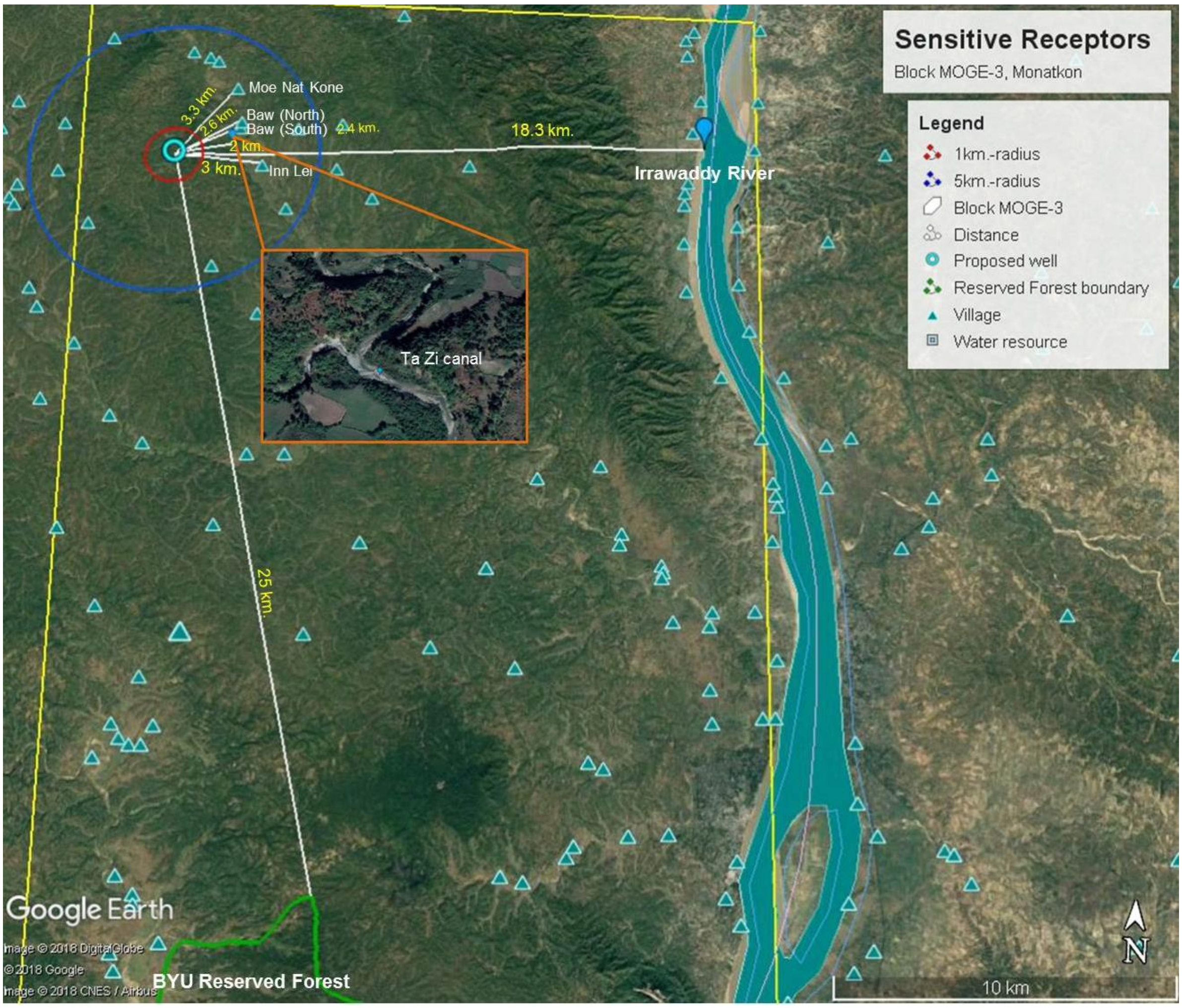


Figure 8-8: Wellsite 01 Monatkon Sensitive Receptors

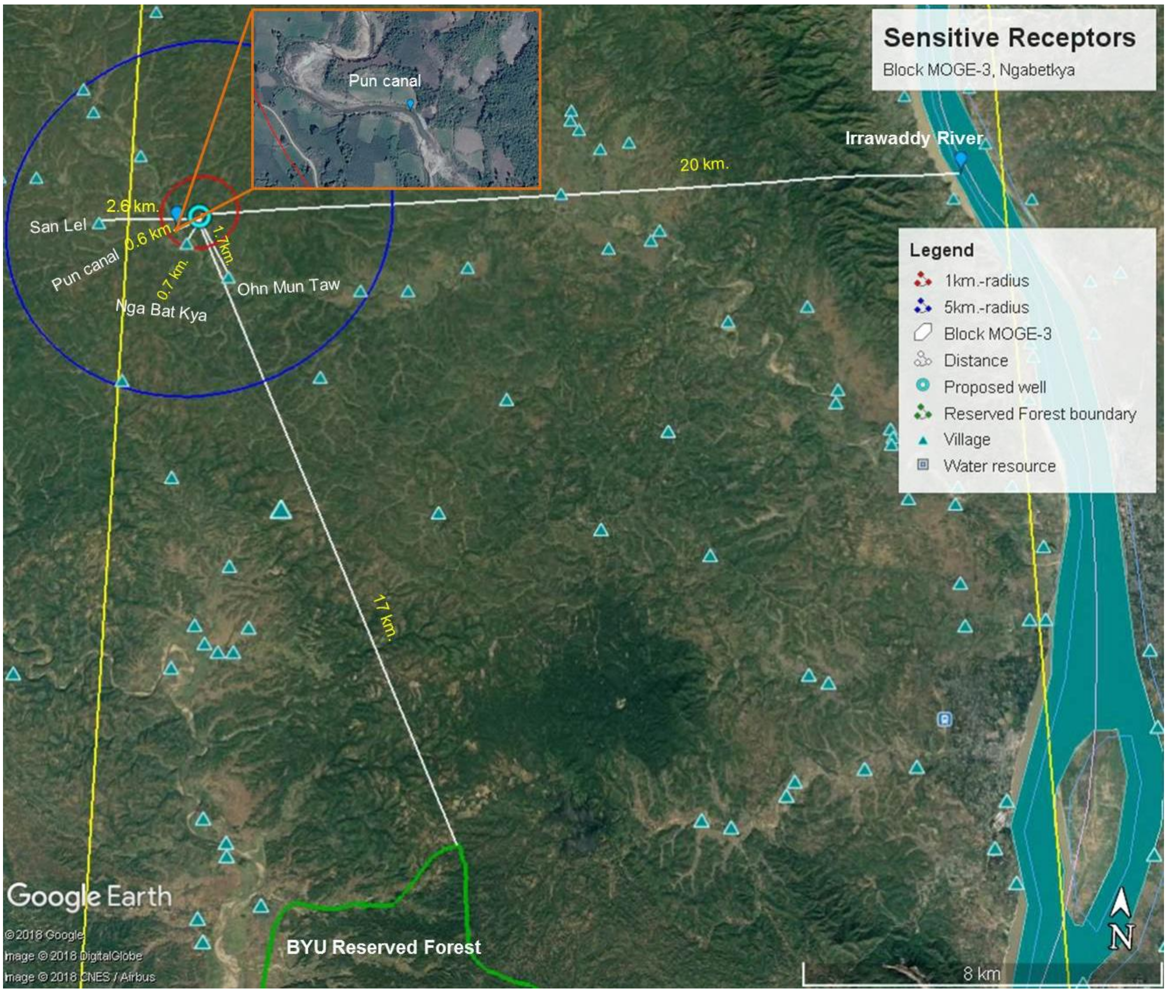


Figure 8-9: Wellsite 02 Ngabetkya

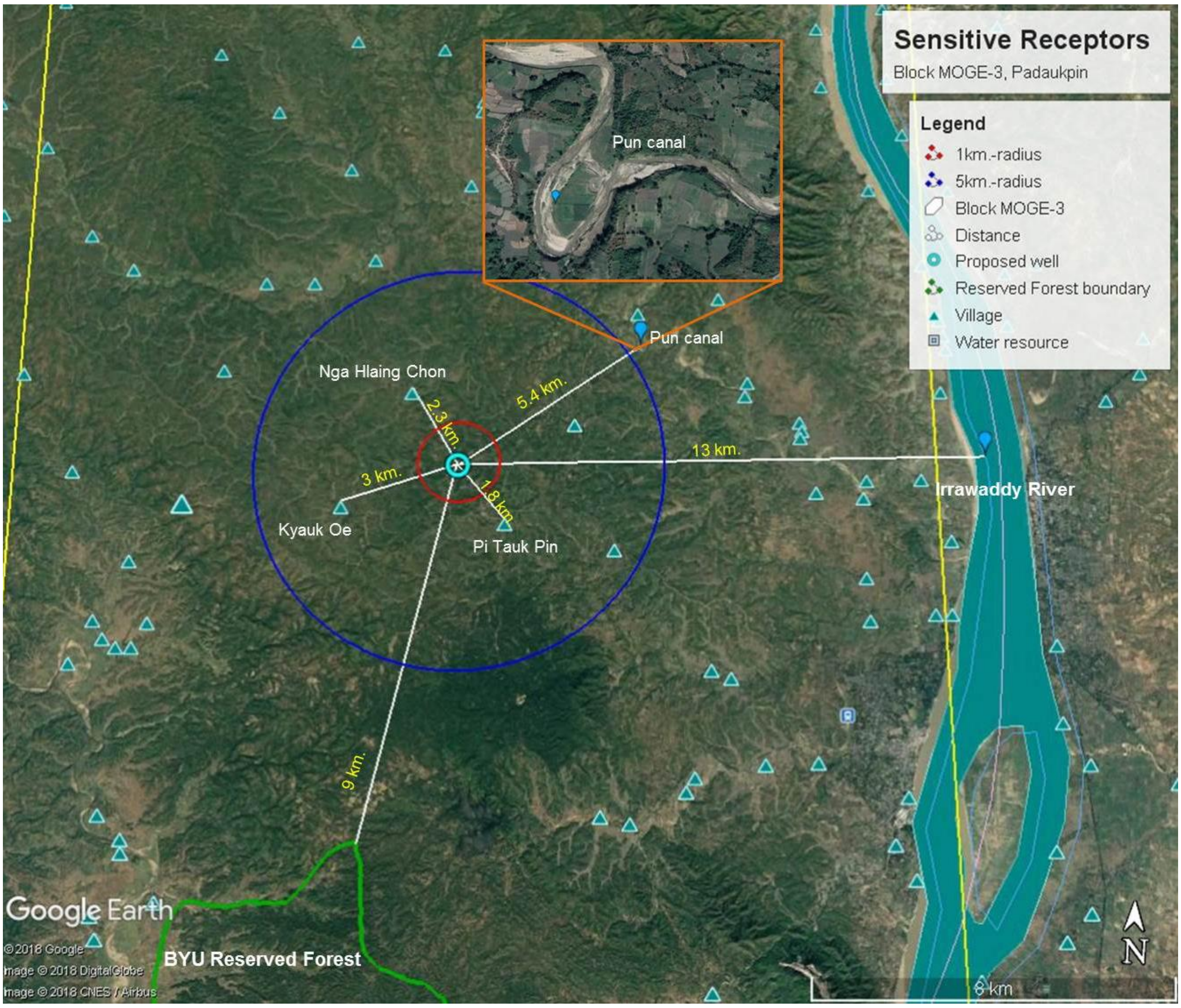


Figure 8-10: Wellsite 03 Padaukpin Sensitive Receptors

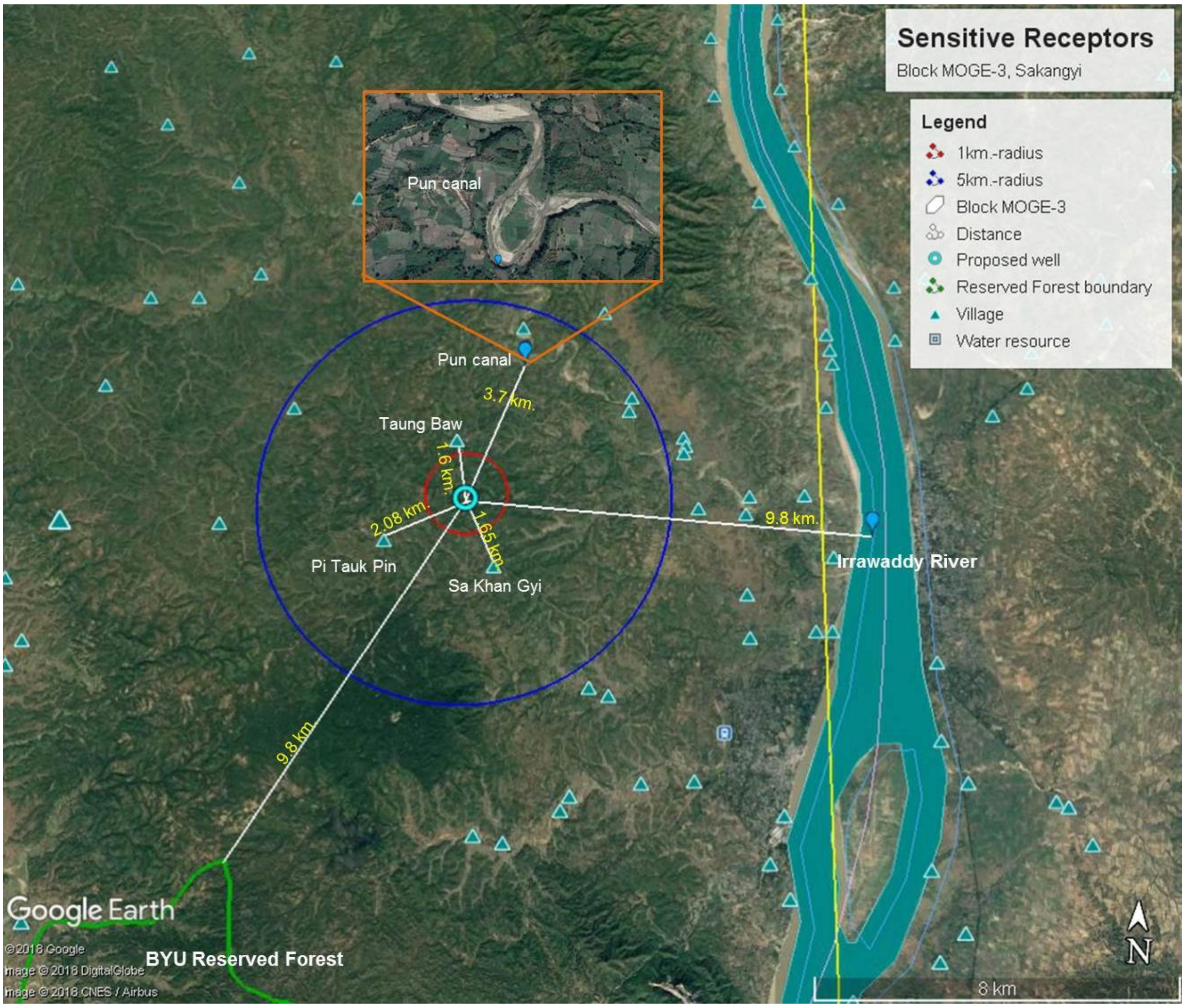


Figure 8-11: Wellsite 04 Sakangyi Sensitive Receptors

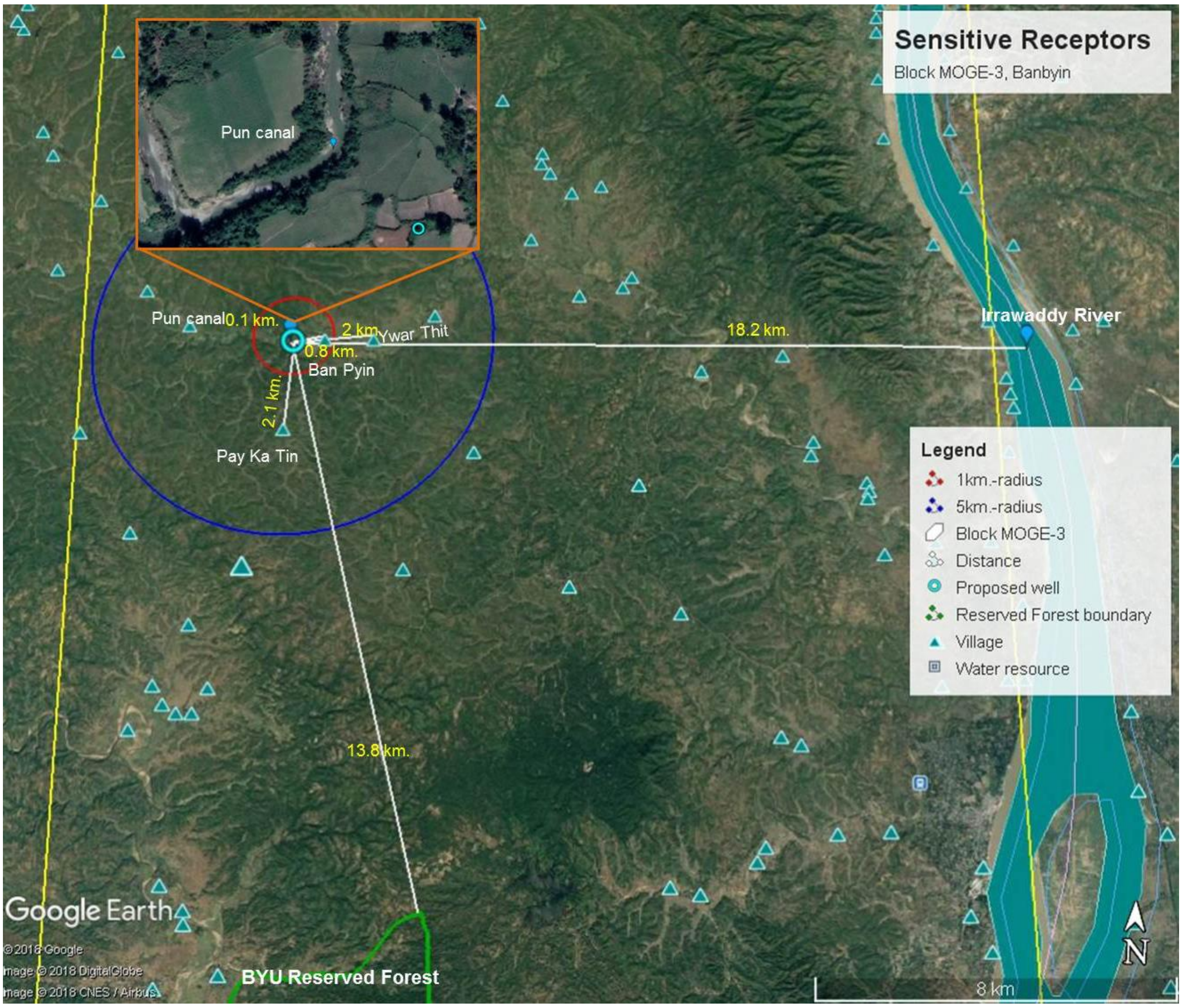


Figure 8-12: Wellsite 05 Banbyin Sensitive Receptors

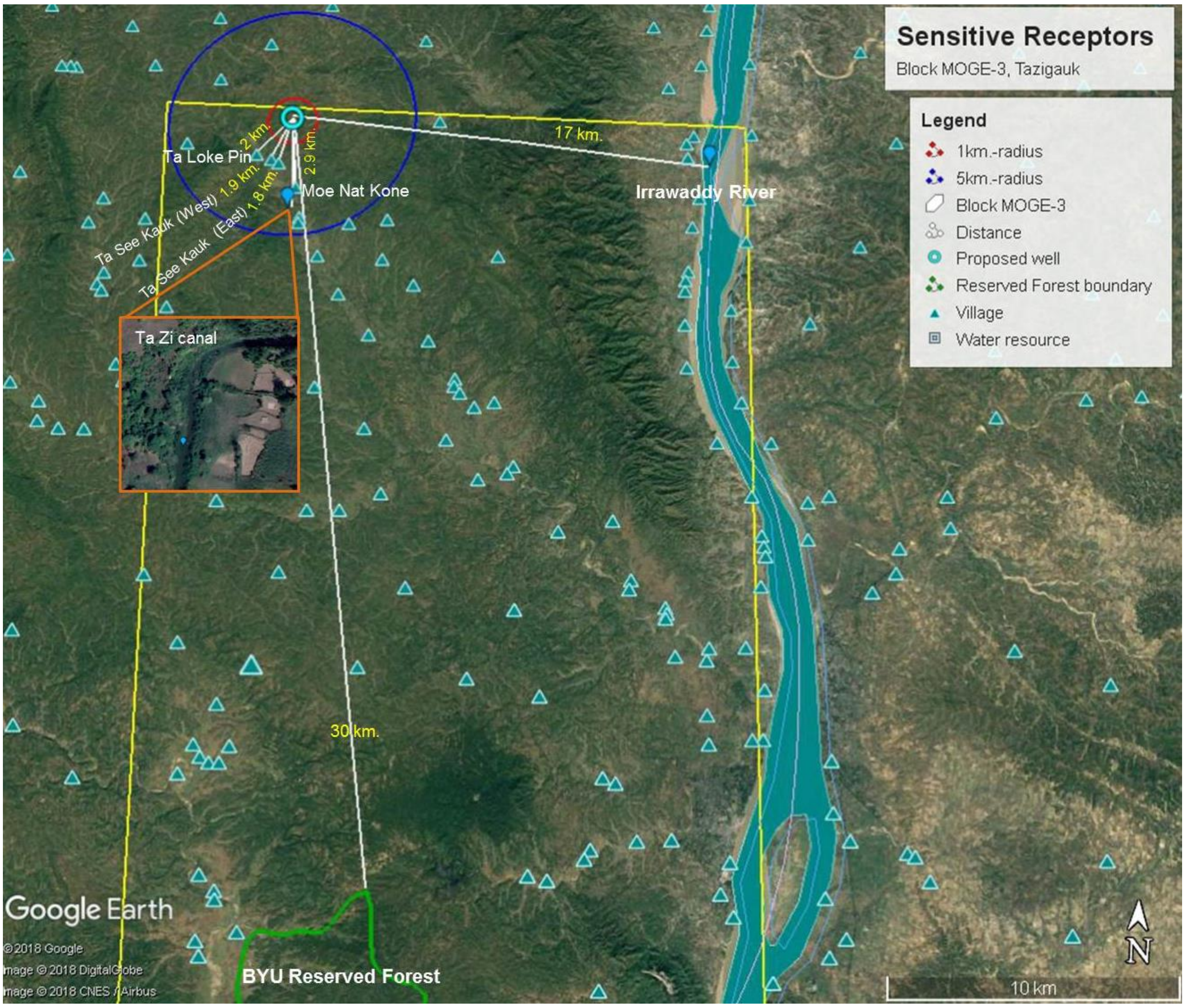


Figure 8-13: Wellsite 06 Tazigauk Sensitive Receptors

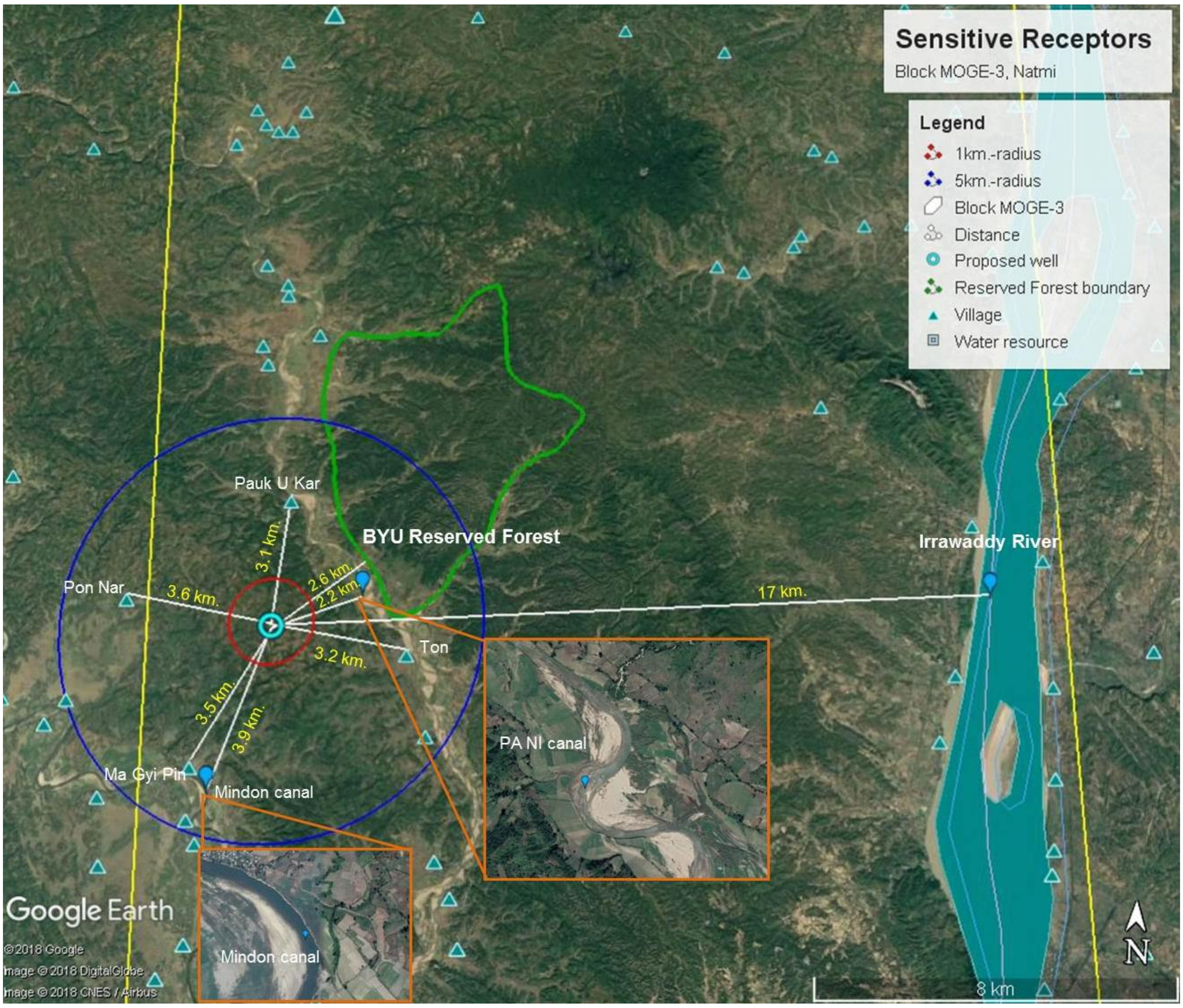


Figure 8-14: Wellsite 07 Natmi North Sensitive Receptors

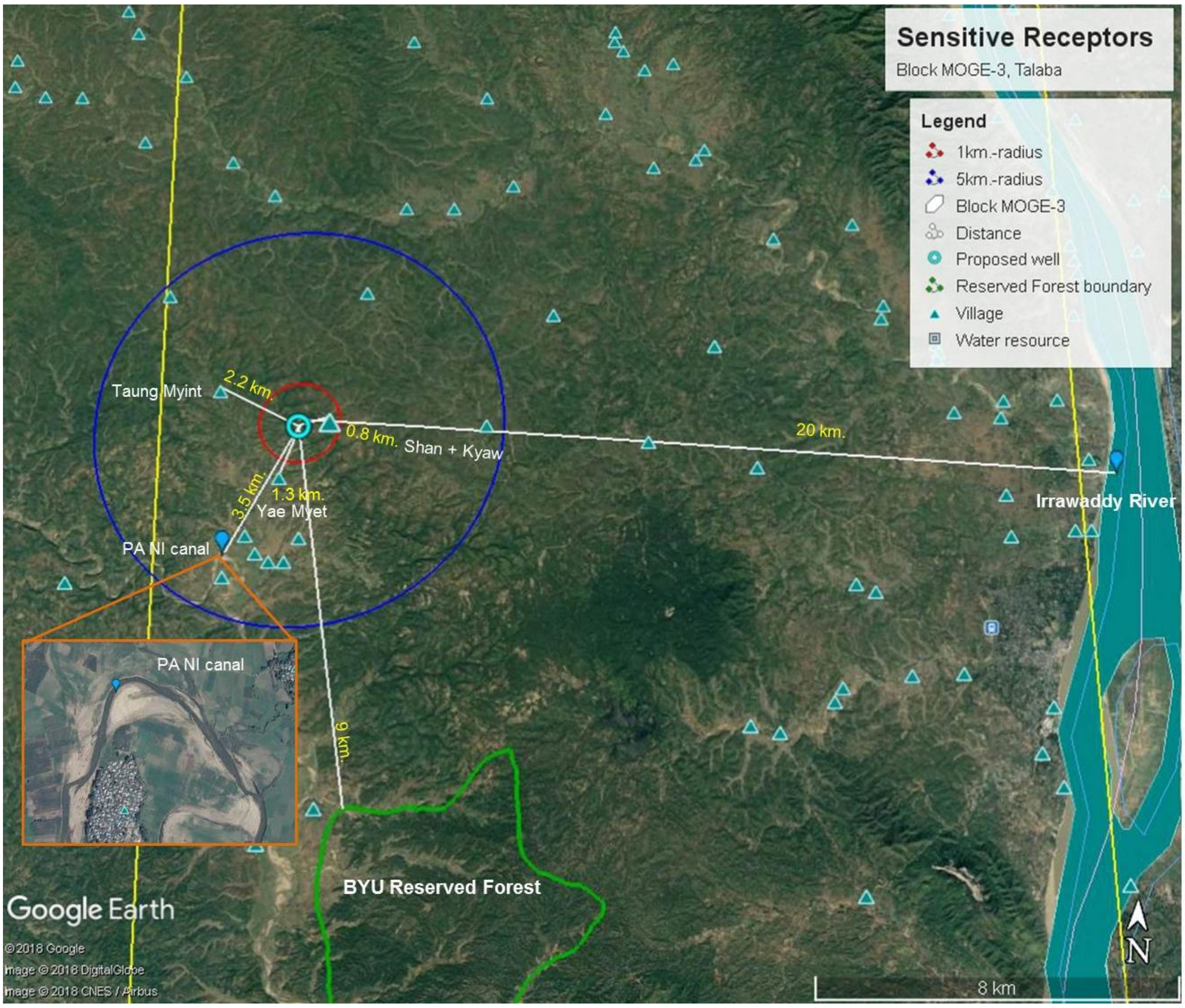


Figure 8-15: Wellsite 08 Talaba Sensitive Receptors

8.8 Air Quality Management Plan

8.8.1 Objectives

Monitor air quality to ensure compliance with national and international air quality standards.

8.8.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- National Environmental Quality (Emission) Guideline (2015).

MONREC has established environmental quality standards, the National Environmental Quality Standard with Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and specifically Hydrogen sulfide below 5 mg/Nm^3.

International air quality standards are set by the *IFC Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality* published on 2007, which refers to the WHO Air Quality Guidelines[1].

Table 8-11: IFC/WHO Air Quality Standards

Parameter	Averaging Time	Concentration (µg/m^3)	Notes
Nitrogen dioxides (NO2)	Annual	40	
	1-hour	200	
Photochemical Oxidants: Ozone (O_3)	8-hour daily maximum	100	
Particulate Matter (PM10)	Annual	20	
	24-hours	50	
Particulate Matter (PM2.5)	Annual	10	
	24-hours	25	
Sulphur Dioxide (SO2)	24-hours	20	
	10 minute	500	
Carbon Monoxide (CO)	1-hour	30 (mg/m^3)	Carbon monoxide was not included in the WHO Air Quality Guidelines 2005. As a result, the 2000 WHO guidelines per European Air Quality Guideline for CO remain in effect.
	8-hours	10 (mg/m^3)	
Benzene	Annual	5	European directive 2008/50/EC

The WHO has established the following air quality criteria to be considered when selecting substances (or pollutant indicators) to be included in an air quality monitoring network:

[1] WHO Air Quality Guidelines are available at http://www.who.int/en

- The selection of the substances shall be based on the current air pollution issues potentially affecting the area, and on those expected for the future.
- The substances shall be measured extensively, or the extent of monitoring shall be increased due to emerging concerns (for example: PM_{10} and $PM_{2.5}$).
- Only substances for which quality assurance and control procedures exist or are being developed shall be included.

8.8.3 Overview Maps and Site Layout

The sensitive receptors near the site for air quality are the local communities and agricultural area within 1 km of the well site as shown in **Figures 8-1** to **8-15**.

8.8.4 Management Actions

Environment Impact Assessment –Construction and Installation Phase			
2. Air Quality	2.1 Well Site and Camp Construction	2.1.1 Deterioration of air quality due to dust.	2.1.1.1 Minimize land clearance to a minimum especially during the dry season.
			2.1.1.2 Limit vehicle speed on access road and site.
			2.1.1.3 Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.
			2.1.1.4 Spray water on roads when needed to keep dust down.
			2.1.1.5 Clean tires of the vehicles before leaving site if needed.
			2.1.1.6 Provide personal protective equipment to exposed field workers.
			2.1.1.7 Use vehicles with dust flaps.
	2.2 Equipment use during Site and Road Construction	2.2.1 Deterioration of air quality due to vehicle emissions.	2.2.1.1 Ensure all machinery and vehicles are properly checked and inspected.
	2.3 Equipment use during Site and Road Construction	2.3.1 GHG Release contributing to climate change	2.3.1.1 Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.
Environment Impact Assessment –Drilling Phase			
1. Air Quality	1.1. Vehicle and Equipment Use	1.1.1. Deterioration of air quality due to dust.	1.1.1.1. Implement construction and installation phase mitigation measures in 2.1.
	1.2. Vehicle and Equipment Use	1.2.1. Deterioration of air quality due to vehicle emissions.	1.2.1.1. Implement construction and installation phase mitigation measures in 2.2.

	1.3. Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	1.3.1.1. Install Gas Detectors to response during emergency situation.
			1.3.1.2. If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).
			1.3.1.3. All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.
	1.4. Vehicle and Equipment Use	1.4.1. *Climate Change due to GHG*	1.4.1.1. Implement construction and installation phase mitigation measures in 2.1.
Environment Impact Assessment –Well Testing Phase			
1 Air Quality	1.1 Vehicle and Equipment Use	1.1.1 Deterioration of air quality due to dust.	1.1.1.1 Implement construction and installation phase mitigation measures in 2.1.
		1.1.2 Deterioration of air quality due to combustion of diesel fuel and flaring.	1.1.2.1 Implement construction and installation phase mitigation measures in 2.2.
			1.1.2.2 Process control to minimize flaring.
			1.1.2.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			1.1.2.4 Verify the operation's flaring system to highest efficiency.
	1.2 Well testing releasing hydrogen sulphide	1.2.1 Deterioration of air quality due to hydrogen sulphide	1.2.1.1 Install Gas Detectors to response during emergency situation.
			1.2.1.2 If H2S levels exceed 10 ppm in the gas stream, appropriate safety zone to be established (8 hr TWA).
			1.2.1.3 All crew are instructed and rehearsed in H2S procedures. Provide training, drill and exercise for H2S awareness.
			1.2.1.4 Limit well testing period where possible.
	1.3 Flare Emissions	1.3.1 Climate Change due GHG	1.3.1.1 To maximize energy efficiency and design facilities to minimize energy use
			1.3.1.2 Operating flare to control odor and visible smoke emissions.
			1.3.1.3 Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.
			1.3.1.4 Implementation of burner maintenance and replacement,

			programs to ensure continuous maximum flare efficiency.
			1.3.1.5 Metering flare gas.
			1.3.1.6 Keep installation and functioning of flare gas system safe according to the good engineering practice.
			1.3.1.7 Ensure flare system has efficient combustion.
			1.3.1.8 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			1.3.1.9 Verify the operation's flaring system.
			1.3.1.10 Minimize the duration of flaring when possible
Environment Impact Assessment –Well Abandonment Phase			
2 Air Quality	2.1 Vehicle and Equipment Use	2.1.1 Deterioration of air quality due to dust.	2.1.1.1 Implement construction and installation phase mitigation measures in 2.1.
		2.1.2 Deterioration of air quality due to combustion of diesel fuel.	2.1.2.1 Implement construction and installation phase mitigation measures in 2.2.
		2.1.3 *Climate Change due to GHG*	2.1.3.1 Implement n construction and installation phase mitigation measures in 2.3.

8.8.5 Monitoring Plans

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• PM-10 • PM-2.5 • NOx, • SOx, • Ozone • H2S	Method • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • WHO Air quality guideline (2006) and amendment.	**Duration:** 1 day continuously **Frequency:** • Once during construction and installation, drilling and well testing phases • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)

8.8.6 Implementation Schedule

Air quality monitoring will be conducted once during construction and drilling phase. If communities are located in close proximity to drilling sites, regular monitoring (instead of once) of air emissions may be necessary during drilling and construction. In addition, if complaints are received, an additional air quality monitoring may be conducted in response to specific complaints. Air quality monitoring will be conducted at the same location previously measured during the baseline survey and/or at the location of the complaint. The monitoring shall be conducted as defined by the Myanmar standards and or international guidelines. The parameters measured will be NOx, SOx, Ozone, PM10 and other parameters as specified and agreed by the COMPANY.

8.8.7 Projected Budgets and Responsibilities

Budget

USD 10,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor SSHE Manager.
- PTTEP SA Manager, Safety, Security, Health and Environment (SSHE)

8.9 Noise & Vibration Management Plan

8.9.1 Objectives

To minimize noise disturbance to fauna.

8.9.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- National Environmental Quality (Emission) Guideline (2015)

In the absence of relevant national laws, the Project will comply with international standards. The IFC General EHS Guidelines, Section 1.7 – Noise and Vibration Emissions as detailed in **Table 8-12**.

Table 8-12: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed project or for verifying emission noise levels during project execution. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.

Noise pollution is not currently regulated at national level; hence international guidelines (e.g., IFC) shall be applied to the Project. The noise limits established by the World Bank Group/International Finance Corporation (IFC) for residential areas are the following [2]:

- **55 dBA during daytime** (daytime hours 07:00 to 22:00).
- **45 dBA during night-time** (night-time hours 22:00 to 07:00).

8.9.3 Overview Maps and Site Layout

The sensitive receptors for noise and vibration are the communities near the basecamp and well site areas. See **Figures 8-1 to 8-15**.

[2] IFC doesn't discriminate between temporary and permanent Project operations. Conservatively, in consideration of the survey period and all associated activities, it is considered that the IFC threshold levels for the daytime and for the nighttime would be appropriate for the entire project phase.

8.9.4 Management Actions

Environment Impact Assessment –Construction and Installation Phase			
3. Noise	3.1 Use of machines/engines during construction and transportation	3.1.1 Increase in noise levels from machines/engines	3.1.1.1 Minimize vehicles and rig transportation from sensitive environmental areas.
			3.1.1.2 Minimize construction activities and vehicle/rig movements in night time.
			3.1.1.3 Limit vegetation removal to a minimum.
			3.1.1.4 Turn equipment off when not in use.
			3.1.1.5 Use enclosures when possible to contain noise on site.
			3.1.1.6 Implement transportation plan to avoid traffic issue that make noise pollution.
			3.1.1.7 Materials to be lowered when practical and not dropped while transferring
Environment Impact Assessment –Drilling Phase			
2. Noise	2.1. Well Drilling and Vehicle and Equipment Use	2.1.1. Increase in noise levels during exploration drilling.	2.1.1.1. Install noise barrier at the well site boundary toward nearest community
			2.1.1.2. Ensure use of mufflers on diesel/gas driven machinery.
			2.1.1.3. Ensure all machinery and vehicles are properly checked and inspected.
Environment Impact Assessment –Well Testing Phase			
2 Noise	2.1 Flaring during Well Testing	2.1.1 Increase in noise levels during well testing.	2.1.1.1 Implement construction and installation phase mitigation measures in 3.1.
			2.1.1.2 Verify the operation's flaring system.
			2.1.1.3 Minimize the duration of flaring when possible.
Environment Impact Assessment –Well Abandonment Phase			
3 Noise	3.1 Vehicle and Equipment Use	3.1.1 Increase in noise levels from machines/engines during site demolition & restoration and transportation.	3.1.1.1 Implement construction and installation phase mitigation measures in 3.1.

8.9.5 Monitoring Plans

Noise will be measured once during drilling phase to monitor noise level generated from drilling activities. If communities are located in close proximity to drilling sites, regular monitoring (instead of once) of noise may be necessary during drilling and construction. In addition, if complaints are received, an additional noise measurement may be conducted in response to specific complaints. Noise levels (24 hour Leq) will be monitored at the same location previously measured during the baseline survey and/or at the location of the complaint. If monitoring indicates noise levels over the WHO standards (70 dB (A)) at the receptor as a result of drilling, specific mitigation measures will be implemented. The noise levels will be measured as defined by the Myanmar or international standards.

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Noise	• L_{eq}24 hr. • L_{max} • L_{dn} •	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 day continuously **Frequency:** • Once during construction and installation, drilling and well testing phases • If within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig

8.9.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.9.7 Projected Budgets and Responsibilities

Budget

USD $10,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor SSHE Manager.
- PTTEP SA Manager, Safety, Security, Health and Environment (SSHE)

8.10 Soil Management Plan

8.10.1 Objectives

Construction and operation activities will be managed to prevent soil contamination or erosion.

8.10.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Land Acquisition Act 1894
- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to provide relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The IFC guidelines regarding waste management are applicable to protecting soil quality (Environmental Health and Social Guidelines, IFC 2007) as detailed in **Table 8-13**.

Table 8-13: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management to be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials to be treated and disposed and all measures be taken to avoid potential impacts to human health and the environment.

8.10.3 Overview Maps and Site Layout

The area is dominated by agricultural area and open forest land areas as shown in **Figures 8-1 to 8-15**.

8.10.4 Management Actions

Environment Impact Assessment –Construction and Installation Phase			
1. Topography	2.1 Well Site and Camp Construction	1.2.1 Disturbance to local topography	1.2.1.1 Limit construction activities to well sites and access roads only.
Environment Impact Assessment –Well Abandonment Phase			
1 Topography	1.1 Site and Road abandonment and restoration	1.1.1 Disturbance to local topography	1.1.1.1 Limit site clearing activities to well sites and access roads only.
			1.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.

Environment Impact Assessment –Construction and Installation Phase			
6. Soil quality	6.1 Construction of roads and well / camp sites	6.1.1 Degradation of soil quality through compaction or erosion during construction.	6.1.1.1 Limit soil compaction only to well sites and access roads.
			6.1.1.2 Exposed site areas to be kept to a minimum during construction
			6.1.1.3 Provide effective construction site run-off control and design.
Environment Impact Assessment – Drilling Phase			
5. Soil Quality	5.1. Drill site Site Runoff and Drainage	5.1.1. Contamination of soil from runoff	5.1.1.1. Implement drilling phase mitigation measures in 4.1.
Environment Impact Assessment –Well Testing Phase			
2 Soil Quality	5.2. Non Hazardous waste management	5.2.1. Contamination of surface water from drained domestic waste and gray water	5.2.1.1. Prohibit workers from cleaning machines/ equipment in a public water source.
			5.2.1.2. Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.
			5.2.1.3. Install septic tank and soak away pit on each well site for holding sewage.
Environment Impact Assessment – Well abandonment Phase			
5 Soil Quality	5.1 Soil excavation for site restoration	5.1.1 Degradation of soil quality through compaction or	5.1.1.1 Limit site demolition & restoration only to well sites and access roads.

		erosion during site demolition & restoration.	5.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.
			5.1.1.3 Test and Managing potentially contaminated areas with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post decommissioning.
			5.1.1.4 Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with international hazardous waste management guidelines.

8.10.5 Monitoring Plans

Under normal circumstances there is no pathway for contaminants to reach soils off-site. However, soils will be sampled once within one month after well shut-in or as determined appropriate. In addition, soils will be sampled in the event of spillage or leakage.

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Soil	Physical parameters: • pH • Soil texture • Salinity • Conductivity • Temperature • Cl- Chemical Parameters: • Petroleum Hydrocarbons • Total PAH, Total DDT, Total PCBS. • Heavy Metals: As, Cd and Cd-compound, Cr6+, Pb, Hg, Ni, Cu, Zn, Vanadium, Total Nitrogen and Total Phosphorus,	Method • Follow U.S. EPA Analytical Method per parameter • Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health • Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008 • Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada	• Once after well abandoned and site restored within 3 months. • In an event of spillage and leakage	Project site At the spillage or leakage areas

8.10.6 Implementation Schedule

Under normal circumstances there is no pathway for contaminants to reach soils off-site. However, soils will be sampled once within one month after well shut-in or as determined appropriate. In addition, soils will be sampled in the event of spillage or leakage.

8.10.7 Projected Budgets and Responsibilities

Budget

USD 20,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor SSHE Manager.
- PTTEP SA Manager, Safety, Security, Health and Environment (SSHE)

8.11 Water Management Plan

8.11.1 Objectives

The Water Management Plan will have the following objectives:

- Monitor water use: the Plan will set procedures for estimating water used by the project, identifying activities that use this resource, and following a reporting procedure for registering volumes of water used;
- Minimise water use: the Plan will provide a series of measures to be considered for minimising the use of water;
- Log water suppliers: the supply, the volume and the type of water provided will be identified and registered in the Plan.
- Monitor surface water quality
- Monitor ground water quality

8.11.2 Legal Requirements

Myanmar applicable legislation and regulation regarding the water resources include:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- Land Acquisition Act 1894
- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993, Section 15 and 16
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)
- The Underground Water Act, 1930, Section 3 and 6(a)
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013, Section 16,17,23 and 27

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016]. ECD / MONREC have indicated that the discharge standards shown in **Table 8-14** below would be applicable for Onshore Oil and Gas activities. These are in accordance with international standards.

Table 8-14: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9

	– Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff to be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent must result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

The IFC General EHS Guidelines considered relevant to the project are General EHS Guidelines, Section 1.3 – Wastewater and Ambient Water Quality and Onshore Oil and Gas Development Guidelines as detailed in **Table 8-15**.

Table 8-15: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk to be considered in a disposal plan; • discharges to be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.

Environmental topic	Applicable EHS Guidelines
Onshore Oil and Gas Development	The EHS Guidelines for Onshore Oil and Gas Development include information relevant to exploration drilling These Guidelines include the following key recommendations regarding wastewater / effluent discharges: • Separate drainage systems for drainage water from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains) to be installed; • Equipment and vehicle wash waters to be directed to the closed drainage system; • Oily water from drip trays and liquid slugs from process equipment to be routed to the closed drainage system

8.11.3 Overview Maps and Site Layout

The water resources in the area can be identified in **Figures 8-1 to 8-15** where groundwater and surface water samples were taken typically from small ponds and streams in the area.

8.11.4 Management Actions

Environment Impact Assessment –Construction and Installation Phase				
4. Surface Water Hydrology	4.1 Construction of roads and well / camp sites	4.1.1 Alteration of surface water hydrology	4.1.1.1	Avoid construction of well sites in areas that may cause obstacles to water drainage.
			4.1.1.2	Construct water drainage lines (culverts/causeway) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies.

Environment Impact Assessment –Construction and Installation Phase				
5. Surface Water Quality	5.1 Construction of roads and well / camp sites and site runoff and drainage	5.1.1 Degradation of surface water quality from runoff/drainage	5.1.1.1	The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization.
			5.1.1.2	Provide drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil.
			5.1.1.3	Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.
			5.1.1.4	Avoid construction of the well pad in areas where such

			construction obstructs water drainage.
			5.1.1.5 Prohibit workers from cleaning machines/equipment in/near a water source.
			5.1.1.6 Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
			5.1.1.7 Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
Environment Impact Assessment –Drilling Phase			
4. Surface Water Quality	4.1. Site Runoff and Drainage	4.1.1. Contamination of surface water from runoff and drainage	4.1.1.1. Implement construction and installation phase mitigation measures in 5.1.
			4.1.1.2. Provide drainage, buffer zone and earth bund surrounding well site area.
			4.1.1.3. The fuel storage will be surrounded by a bund wall in case of spill.
	4.2. Hazardous/non-hazardous waste management	4.2.1. Degradation of surface water quality from disposal of domestic sewage and grey water	4.2.1.1. Install concrete lined septic tank and soak away pit at the well site for holding & treating sewage.
Environment Impact Assessment –Well Testing Phase			
4 Surface Water and Soil Quality	4.1 Non Hazardous waste management	4.1.1 Contamination of surface water from drained domestic waste and gray water	4.1.1.1 Prohibit workers from cleaning machines/ equipment in a public water source.
			4.1.1.2 Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.
			4.1.1.3 Install septic tank and soak away pit on each well site for holding sewage.
Environment Impact Assessment –Well abandonment Phase			
4 Surface Water Quality and Surface Water Hydrology	4.1 Hazardous/non-hazardous waste management	4.1.1 Potential contamination from spills or wastewater drainage to nearby water bodies during site restoration	4.1.1.1 Implement construction and installation phase mitigation measures in 5.1.
			4.1.1.2 Restore the site and hand back to MOGE as per agreed conditions.

Environment Impact Assessment – Drilling Phase			
6. Groundwater Quality	6.1. Loss of circulation during Drilling wells	6.1.1. Groundwater degradation from drilling	6.1.1.1. Install steel casing and cement in place to prevent chemical leak or contaminate into rock formation.
			6.1.1.2. Strict steel casing to well wall by cementing to prevent chemical contaminate to groundwater level.
	6.2. Infiltration from the waste pit and sub-irrigation field	6.2.1. Deterioration of shallow Groundwater	6.2.1.1. Install HDPE liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.

Social Impact Assessment – Construction and Installation Phase			
11. Drainage and Flooding	11.1Surface runoff from roads, site and camp site	11.1.1 Increase runoff and change local drainage patterns	11.1.1.1 Obtain approval from MOGE and appropriate government offices before constructing, upgrading or reroute access roads.
			11.1.1.2 Follow civil engineer's recommendation on well site and access road construction design.
			11.1.1.3 Avoid construction of well sites in areas that may cause obstacles to water drainage.
			11.1.1.4 Water drainage lines (culverts/causeway) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.

8.11.5 Monitoring Plans

Surface Water

Monitoring of surface water in the immediate vicinity of the drill site or campsite will be conducted at appropriate intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to surface water quality. This is particularly important if the well sites are located in close proximity to areas where there are beneficial uses of surface water. However, in the event of spillage or leakage, potentially affected watercourses will be sampled and analysed for the substance spilt.

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Surface water	Physical parameters: • pH • Conductivity • Temperature • SS	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater,	• Once after well abandoned and site restored within 3 months. • In an event of spillage and	• At the same surface water sampling station before having project

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
	• TDS • Salinity Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn Biological parameters: • TCB	recommended by APHA-AWWA-WEF • Compare to Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater) and US EPA National Recommended Water Quality Criteria - Human Health Criteria Table for consumption of water and organism.	leakage	(Baseline) • Water sources which are potentially affected (in case of spillage of leakage)

Groundwater

Monitoring of groundwater in the immediate vicinity of the sites will be conducted at regular intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to groundwater quality. In addition, groundwater will be sampled in the event of spillage or leakage.

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Groundwater	Physical parameters: • pH • Conductivity • Temperature • TDS • Salinity Chemical Parameters: • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • Compare to US EPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009. • UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended). • Ontario Soil, Ground Water and Sediment Standards for Ontario, Use under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada	• Once after well abandoned and site restored within 3 months. • In event of spillage and leakage	• Nearest groundwater well or just off well pad area • Area of possible spill

8.11.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

Monitoring of surface and groundwater in the immediate vicinity of the sites will be conducted at regular intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to surface or ground water quality. However, in the event of spillage or leakage, potentially affected groundwater or watercourses will be sampled and analysed for substance spilt.

8.11.7 Projected Budgets and Responsibilities

Budget

USD 20,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor SSHE Manager.
- PTTEP SA Manager, Safety, Security, Health and Environment (SSHE)

8.12 Waste Management Plan

8.12.1 Objectives

The WMP is designed for use in all activities associated with this drilling project. The Waste Management Plan has been developed on the basis of EIA report provided by PTTEP SA. All Drilling Contractor, PTTEP SA, MOGE and sub contractor staff must ensure that they become familiar with the requirements and strictly follow them contained in this procedure.

The purpose of the procedure is to describe the Waste Management Standards that must be implemented where **the Drilling Contractor** has operational control. The implementation of these Waste Management Standards is aimed to ensure:

- Full compliance with local environmental requirements
- To eliminate where as possible and to minimize as low as reasonable practicable the number of serious environmental incidents

This Plan applies to all sectors and activities related to the drilling operations for MOGE-3, throughout all operations and includes:

- collection, handling and temporary storage of wastes; and
- management and transportation to treatment/disposal of the waste at authorized facilities.

8.12.2 Legal Requirements

The section provides a description of the legal framework relevant to the management of the wastes produced during drilling activities.

International Conventions And Agreements

Basel Convention: The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22nd March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. The provisions of the Convention center around the following principal aims:

- the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management;
- a regulatory system applying to cases where transboundary movements are permissible.

Myanmar Laws And Regulations

The Ministry of Natural Resources and Environmental Conservation is the main institutional body responsible for setting a framework for waste management at the national level. Similarly, all major cities across Myanmar are administrated by City Development Committees that are responsible for providing municipal waste management services.

Existing Policy And Regulations

Existing Laws and Regulations are as follows:

National Level

- The Constitution of the Republic of the Union of Myanmar (2008);
- National Government Policy (1994);
- Environmental Conversation Law (March, 2012);
- Environmental Conservation Rules (June 2014);
- Environmental Impact Assessment procedures (Dec, 2015);
- National Environmental Quality (Emission) Guideline (2015);
- Factories Act (1951) ;
- Public Health Law (1972);

Yangon

- The Yangon Civil Development Law (2013);
- The City of Yangon Development Law (1990);
- The Underground Water Act (1930);
- The Water Power Act (1927);
- The City of Yangon Municipal Act (1922);
- The Yangon Water-work Act (1885).

In addition, City and Township Development Committees promulgated the solid waste disposal and collection by-law providing the legal basis at the local level. For the Ayeyarwady Region Regional Level, there is the "Ayeyarwady Region Municipal Act" which is concerned with the whole region. For each township, there are local by-laws specific to town. These by-laws are based on the township level situation. Thus the by-laws are different between each township.

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016]. ECD / MONREC have indicated that the discharge standards shown in **Table 8-16** below would be applicable for Onshore Oil and Gas activities. These are in accordance with international standards.

Table 8-16: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced sand	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9 – Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with

	applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff to be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent to result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements
Air emissions	Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and: – Hydrogen sulfide 5 mg/Nm^3

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

Standards And Guidelines

The following Standards and Guidelines are to be considered:

- ISO 14001:2015, Environmental Management Systems - Requirements with Guidance for use;
- International Finance Corporation (IFC), General Environmental, Health, and Safety General Guide-lines, 2007;
- International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Onshore Oil And Gas Development, 2017;

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) are detailed in **Table 8-17**.

Table 8-17: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk to be considered in a disposal plan; • discharges to be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.

Environmental topic	Applicable EHS Guidelines
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management to be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials to be treated and disposed and all measures to be taken to avoid potential impacts to human health and the environment.

8.12.3 Waste Management Principles

The Drilling Contractor will be responsible for waste management during the drilling program, and will be required to be in compliance with the local legislation and Environmental Management and Monitoring Plan (EMP). PTTEP SA will regularly conduct inspections and audits during operations to ensure compliance to contract requirements. .

General Waste Management Principles

The following guidance applies to the management of nonhazardous and hazardous waste. Waste management to be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

IFC (2007) notes that Facilities that generate and store wastes to practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences.
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable.
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste.
- Where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environ-mentally sound manner.

The waste management hierarchy below considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes:

- prevention (don't generate waste);
- reduction (generate less waste by better management and by material substitution);
- reuse (reuse in its original form);
- recovery (extract material or energy from a waste);
- recycle (recycle and reprocess the waste to incorporate it into a new product or new use);
- disposal (mitigate the hazard through treatment, relocate the waste to another location).

Efforts to be made to eliminate, reduce or recycle wastes at all times, in line with the waste hierarchy. At a minimum, the waste materials must be segregated into non-hazardous and hazardous wastes for consideration for reuse, recycling, or disposal.

Waste management planning will establish a clear strategy for wastes that will be generated including options for waste elimination, reduction or recycling or treatment and disposal, before any wastes are generated.

Waste Management And Minimisation Plan

Waste minimization practices are to be applied to all types of waste. In addition, the conservation of re-sources (energy, water, gas, and fuel) will be addressed. The waste minimization plan is one part in the overall programme of responsible waste management.

Training

All contractor personnel will be trained on the PTTEP SA Waste Management Plan, so they can become familiar with the reporting procedures and the entities involved in the management of the wastes derived by the drilling activities. Training of personnel will take place at the following frequency:

- New Personnel will be initially trained to ensure familiarity with the Waste Management Plan prior to beginning their job assignments (applicable to all shift changes);
- Specific training will be provided for the management of hazardous wastes;
- Refresher training will be conducted whenever there are inadequacies in management of waste (classification, storage, handing) or when deviations from the Waste Management Plan are observed.

Due Diligence

Steps toward the establishment of due diligence includes:

- Regular performance of environmental audits or inspections
- The establishment of periodic exercising of contingency plans
- Knowledge and compliance with applicable legislation
- Employee/contractor training
- Establishing and maintaining codes and operating procedures, and
- Maintaining detailed records and inventories

WASTE CLASSIFICATION

The classification of PTTEP SA waste generated shall be categorized in 2 main groups according to criteria of danger as non-hazardous waste and hazardous waste **Classification**. However, laboratory analysis of its waste component is sometime required for certain wastes.

It is noted that only ship waste is allowed to transfer and offload at Ranong Support Base (RSB) in Thailand for further disposal.

Non-Hazardous Waste
Non-Hazardous waste is the waste which is not harmless but they present a lower level of risk to human health and the environment. There are 2 types of non-hazardous waste as follows:

1) General non-hazardous wastes from office, catering services, laundry, household and similar ones from industrial activities, e.g.

- General waste (e.g. scrap metal, non-biodegradable waste, gardening waste, construction material)
- Recyclable or reusable waste (e.g. paper, wood, drinking plastic bottle, glass)
- Biodegradable waste (e.g. food waste, sewage)

2) Waste containing or contaminated with hazardous substance in concentration before or after treatment to meet the specified international or regulatory discharge criteria which do not exceed the standard limit of country, e.g.

- Produced water
- Produced sand
- Drilled cutting

Hazardous Waste

Hazardous waste defines as any waste which cause danger or likely to cause danger to health or the environment by reason of their chemical activity or toxic, flammable, explosive, corrosive, or other characteristics, whether alone or when coming into contact with other wastes. Form of hazardous waste comprises solids, sludge, liquid and containerized gas and hydrocarbon waste.
Hazardous waste shall be categorized into 2 main types as follows:

1) Wastes creating nuisance due to flammability, reactivity, corrosiveness, radioactive, infection, toxicity for humans & the environment or , e.g.

- General hazardous wastes (e.g. chemical waste and residue, paint, spent and used oil, contaminated packing material, special maintenance waste, contaminated sludge, combustion residue, photocopy machine, PC printers polluting cartridge, medical waste, filter, fluorescent, bulb)
- Heavy metal wastes (e.g. mercury, arsenic, cadmium)
- Batteries

Gas canisters have to be thoroughly bled off if possible prior to being disposes of.

It is noted that if there will be a presence of incoming heavy metal from reservoir, the incurred wastes in contact with the incoming gas or fluid shall be considered as the heavy metal (e.g. mercury, arsenic, cadmium) waste which will require specific handing procedure apart from this procedure.

2) Waste containing or contaminated with hazardous substance in concentration which exceeds the standard limit of country regulation or international hazardous waste standard for example oil concentration or heavy metals containing waste. Laboratory analysis of its waste component shall be applied to properly classify this type of waste. Furthermore any wastes that belong to any category in the country regulation.

8.12.4 Color Coding and Labelling

The following waste segregation system will be implemented:

Table 8-18: Waste Segregation System

Color	Waste description
Red	Hazardous waste
Blue	General Non-hazardous waste
Yellow	Recyclable waste
Green	Food Waste
Black	Spent oils waste

8.12.5 Containers

All containers to be as follows;

- Make from durable materials compatible with the waste to be collected, leakage proof, sturdy, stable and easily handled,
- Design to prevent the ingress of animals, escaping odor and place under cover if necessary to avoid leachate
- Dedicated containers (bins, skips, etc.) to be labeled clearly by type of waste for example by homogeneous color-coding and illustrated by pictographs, and the potential need for multiple language labeling (English and Myanmar)
- Install adequately in the vicinity of working area, accommodation and office area,

Containers used for medical or clinical waste shall be marked prominently with universal warning signs and/or the word "**Medical Waste**". Used needles and syringes represent a particular threat as failure to dispose of them safely may lead to recycling and repacking which in turn lead to unsafe re-use. Where possible, management of medical/clinical wastes must be integrated into existing healthcare waste management system. Infectious waste must be collected and shipped in suitable containers.

Each on duty of site doctor must handle the medical/clinical wastes shipment for further final disposal at the end of his/her rotation. All medical wastes / clinical wastes will be managed in compliance with the Health the Care Waste Management Guideline once stipulated by Ministry of Health and Sports.

8.12.6 Management Actions

Social Impact Assessment – Construction and Installation Phase			
12. Waste Management	12.1 Non Hazardous waste management	12.1.1 Domestic waste result in windblown litter, attract vermin and be a vector for disease	12.1.1.1 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
			12.1.1.2 Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring to waste disposer
			12.1.1.3 Ensure treatment and disposal according to accepted international standard.
			12.1.1.4 Enforce "Good Housekeeping" practices at project area.
			12.1.1.5 Domestic and general waste to be segregated and stored using suitability labeled.
			12.1.1.6 Dispose of waste in labelled containers for possible recycling
			12.1.1.7 Implement requirements for waste management and related laws
			12.1.1.8 Install septic tanks and soak away pit for holding sewage.
			12.1.1.9 Non-hazardous wastes will be disposed with local city development committee.
			12.1.1.10 A PTTEP SA Waste Management Plan for this drilling campaign will be developed.
Social Impact Assessment – Drilling Phase			
11. Waste Management	11.1. Non Hazardous waste management	11.1.1. Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and groundwater and vector for disease	11.1.1.1. Implement construction and installation phase mitigation measures in 12.1.
	11.2. Hazardous waste management	11.2.1. Hazard waste contaminate to environment.	11.2.1.1. Ensure treatment and disposal of hazardous waste by licensed contractor.
			11.2.1.2. Segregate and store hazardous waste in appropriate and safe

			containers that are suitable for transporting/transferring. Make sure all containers are clearly labeled.
			11.2.1.3. Always check and record the type(s) and amount of hazardous waste generated.
			11.2.1.4. Dispose of waste in labeled containers for possible recycling or reuse.
			11.2.1.5. Prohibit open burning of any waste at project site.
			11.2.1.6. Enforce "Good Housekeeping" practices.
			11.2.1.7. All hazardous waste will be collected in skips ready for treatment and disposal. Hazardous wastes will be transported and disposed at approved waste management facility.
			11.2.1.8. Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.
	11.3. Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1. Localized change in water quality and soil quality from chemical composition of drill fluids	11.3.1.1. Drill cuttings and adhered fluids will not be discharged to surrounding area.
			11.3.1.2. Volume of cuttings and fluids discharged will be minimised through use of solids control equipment.
			11.3.1.3. Store all chemicals in secured storage area.
			11.3.1.4. Hazardous wastes materials will be handled and stored in accordance with the corresponding SDS.
			11.3.1.5. Implement awareness training on the hazards of the chemicals.
			11.3.1.6. Enforce use of PPE.
			11.3.1.7. Handle chemicals only in well-ventilated and controlled areas
			11.3.1.8. Fuel storage tanks to be surrounded by bund wall.
			11.3.1.9. Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for

			collecting water into the concrete pit.
			11.3.1.10. Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).
			11.3.1.11. Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan.
			11.3.1.12. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.
			11.3.1.13. Monitor level of cuttings and dirty water in waste pit.
			11.3.1.14. Implement land transportation procedure.
Social Impact Assessment – Well Testing Phase			
7 Waste Manageme nt	7.1 Hazardous/Non Hazardous waste management	7.1.1 Domestic waste can be a fire hazard, constitute. windblown litter, attract vermin, contaminate surface and groundwater and be a vector for disease	7.1.1.1 Implement construction and installation phase mitigation measures in 12.1.
		7.1.2 Hazard waste i.e. condensate	7.1.2.1 Implement from drilling phase in 13.4
			7.1.2.2 Transport produced water to dispose by licensed water treatment facility.
Social Impact Assessment – Well Abandonment Phase			
8 Waste Manageme nt	8.1 Hazardous/non-hazardous waste management	8.1.1 Non-hazardous waste can be a contaminate surface and groundwater, and be a vector for disease.	8.1.1.1 Implement construction and installation phase mitigation measures in 12.1.

8.12.7 Disposal Methods and Facilities

The waste disposal methods and facilities available for PTTEP SA wastes are as follows;

- Recycling or reusing whenever beneficial for local villagers and/or local recycling industry.

- TKA MOGE surface disposal yards and incinerators
- Yangon City Development Committee (YCDC) surface disposal yards and incinerators.
- Non-hazardous waste Incinerator at ZOC.
- Soak away pits (e.g. sewage from onshore sites)
- Qualified third party hazardous waste landfill location at Thilawa Industrial Estate.

8.12.8 Summary of Waste Inventory

PTTEP SA in consultation with their subcontractors is expecting the following type and volumes of waste:

Waste Type	Estimated Quantity	Disposal Plan
1) Drill cuttings	1000 m^3 per well	WMB will be dried onsite and dilution buried in cuttings pit or SBM will be transported to DOWA for disposal.
2) Drilling Mud (WBM or SBM or SBM)	5000 bbls per well	Drilling Mud will be re-used at next well site and at the end of drilling campaign any waste mud will be returned to Mud Contactor for re-use or disposal or use for PTTEP offshore drilling campaign..
3) Unused chemicals	N/A	Returned to supplier or kept for future drilling campaigns.
4) Domestic waste	Construction: 50 kg/day Drilling: 130 kg/day Well abandonment: 30 kg/day Site restoration: 25 kg/day	**Biodegradable waste** (food waste) will be segregated and transferred to local government waste disposal facilities (like YCDC in Yangon). **Recycle and General Non-Hazardous waste except recycle and biodegradable waste** shall be transferred to local government waste disposal facilities (like YCDC in Yangon) or disposed at a site approved by Local Authority.
5) Industrial waste (scrap metal, plastic, paper, wood, glass etc.)	N/A	Recyclable or reusable waste to be sold or donated. Other non-recyclable or reusable waste will be transferred to local government waste disposal facilities (like YCDC in Yangon).
6) Hazardous waste	Drilling: 500 kg/month	**Medical or clinical waste** shall be transferred to Yangon for disposal at approved location by YCDC or DOWA waste management facility **General Hazardous Waste** - Transported to Yangon for disposal at approved location by YCDC or DOWA waste management facility
7) Sanitary wastewater	Construction: ~3 .9 m^3/day Drilling: ~7.8 m^3/day Well Testing: ~7.8 m^3/day Site Restoration: ~3.9 m^3/day	**Grey water** will be treated in soak pit. **Black water** will be treated in septic tank and soak pit.

8.12.9 Monitoring Plans

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Cuttings from drilling (in case of further using cuttings)	• Chloride (for WBM) • Oil on Cuttings (for SBM) • Mercury (in stock Barite) • Cadmium (in stock Barite)	<u>Method</u> • Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012,	• Upon Completion of Drilling Phase before mixing / burial disposal in waste pit.	• Exploration drilling well
Chemical use for drilling	• Type of chemical • Volume of use	• Daily record type of chemicals and volume used.	• Daily and report after drilling is completed	• Project area
Hazardous and Non-hazardous waste	• Manifest Disposal and Tracking Report	• Track waste volume by type and disposal location daily	• During Drilling Phase	• At all project locations

8.12.10 Implementation Schedule

WASTE RECORD AND REPORTING

Tracking of waste types, quantities and methods and location of final disposal of these wastes shall be conducted as part of an overall waste management system to document the intended management of the waste.

There are 3 separate registers developed by PTTEP SA, namely, solids, liquids and gases. The objective is to record accurately every waste generated on site.

Solid

Waste is to be weighted on the weighing scales provides, where possible. Where it is not possible to weight the waste directly on the scales, the following steps shall be adopted in estimating the weight of the waste materials.

The collected drums of the wastes are multiple to the standard weight per drum of specific waste type (see Appendix 3"Non-Hazardous Waste Estimation and Hazardous Waste Table).

For example:

- Half-filled drum of oily rags is to be estimated as 0.5 drums X 84 kg/drum = 45 kg.

Some wastes are difficult to collect in the drum such as bulbs, fluorescent, aerosol cans, production filters etc. In such case, the counted numbers of items are to be multiplied with the estimated standard weight per number of items in 10 units.

For example:

- Production filters are to be estimated as 100 filters X 40 = 400 kg (10 filters = 40 kg standardized weight)

Weight evaluation can only be accurate if the wastes have been correctly segregated. It is thus essential that waste streams to be segregated with the appropriate monitoring to ensure that personnel comply with such requirements.

Liquid
Liquid discharges shall be calculated as daily measurement on the metering or monthly average based on daily production report. Specific note shall be made of any non-routine liquid discharges.

Gas
Any pressure relief or blow-downs shall also be reported by the site representative on the monthly waste and/or environmental report to allow involved parties to estimate the GHG emission.

Waste Tracking Documents and Report Preparation
Waste tracking documents or waste manifests shall give the exact description of the content of the skips/drums/containers.

The following routes have been identified as the key transit stations between:

- ZPQ to TKA
- ZOC to TKA
- Other onshore and offshore sites to TKA
- TKA to qualified disposal facilities for hazardous waste
- ZOC to qualified disposal facilities for hazardous waste disposal
- ZMS to ZOC
- TKA to government disposal facilities (MOGE or YCDC) for non-hazardous waste

The waste manifests shall be filled in and filed by both sender and receiving parties. Site SSHE representative and/or waste management operational personnel are in charge of the waste manifests. He/she shall calculate or weight the quantity of each waste stream transferred from their particular site. This shall be totaled on a monthly basis.

Site SSHE representative and/or waste management operational personnel shall prepare monthly waste management report to PMM/S and PMO/L for further waste reporting and disposal purposes which shall be included, as a minimum:

- Type of waste
- Location of waste generated
- Quantity or volume of waste including generating, storing and disposal.
- Method used for transferring waste.
- Method used at disposal facility.
- Final disposal location.
- Waste manifest

8.12.11 Projected Budgets and Responsibilities

Budget

USD 800,000

8.12.12 Roles and Responsibilities

PMM/S (MYANMAR ASSET SSHE DEPARTMENT)

- Ensure effective implementation of onsite waste management in accordance with this Procedure for all sites
- Technical advice and clarification upon request.
- Support PMO/L and site SSHE to implement this Procedure.
- Report Myanmar Asset Monthly Waste Records to Corporate SSHE

PMO/L (MYANMAR ASSET LOGISTICS DEPARTMENT

- Act as one single point of contract to execute the final waste disposal with the qualified third party waste disposal facilities of all sites (Onshore and offshore) and budget preparation.
- Provide support for waste transportation and storage at Thaketa Supply Base as required.

SITE SSHE OR WASTE MANAGEMENT OPERATIONAL PERSONNEL

- Ensure that waste is managed and implemented to comply with this procedure.
- Develop site specific waste management instruction/procedure to align with the procedure.
- Provide onsite training for the contractor personnel who will work on site location
- Routine site audit to ensure onsite waste generation is properly segregated and handling
- In charge of the waste manifests record system and monthly waste reporting

8.13 Emergency Response Plan

8.13.1 Objectives

The purpose of this Myanmar Asset Emergency Management Plan (EMP) (11027-PDR-SSHE-340-R01) April 2018 is to clearly define roles and responsibilities of Emergency Management Team (EMT) and to determine incident action plan, resources and processes before, during and after emergency situation. This plan is aligned and complied with Corporate PTTEP Emergency and Crisis Management Standard (SSHE-106-STD-500).

Similarly, the PTTEP Myanmar Asset Crisis Management Plan (11027-PDR-SSHE-340-006-R01) May 2018 may be relevant for responding to Crisis situations.

8.13.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- National Environmental Quality (Emission) Guideline (2015);
- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- The Petroleum and Petroleum Products Law, 2017, Section 10 (a, d), 15, 16, and 31 (a, d)
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- The Control of Smoking and Consumption of Tobacco Product Law, 2006, Section 9
- The Myanmar Fire Force Law, 2015, Section 25
- Shops and Establishments Law, 2016, Section 13 to 17, 21 and 24
- The Employment and Skill Development Law, 2013, Section 5, 14 and 30 (a and b)
- Oil Fields (Labour & Welfare) Act, 1951
- The Workmen Compensation Act, 1923, Section 10 (a, b) and 11
- The Labour Organization Law, 2011, Section 17 to 22
- The Settlement of Labour Disputes Law, 2012, Section 38, 39, 40 and 51
- Industrial use Explosive Substance, 2018, Section 6(c), 7(c), 12,13,15,16 and 18
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993, Section 15 and 16
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013, Section 16,17,23 and 27
- Import and Export Law, 2012, Section 7

8.13.3 Overview Maps and Site Layout

The sensitive receptors for the Emergency response plan are the well site areas and basecamp area in regard to the nearby communities (see **Figures 8-1 to 8-15**).

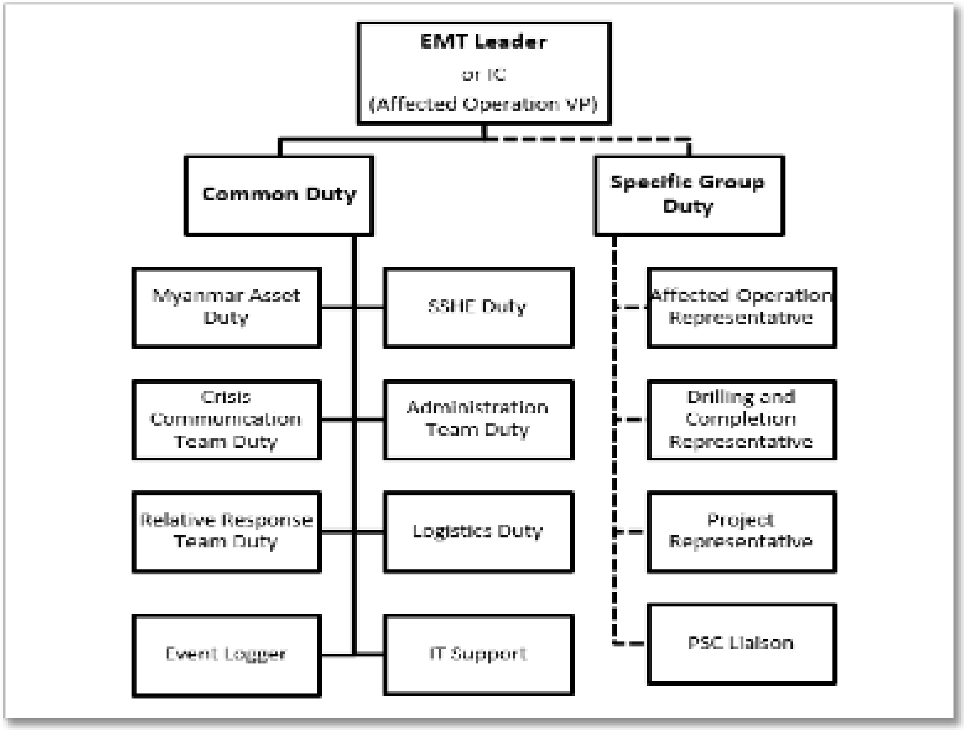
8.13.4 Key Activities and Processes of Emergency Management Team

The EMT is responsible for providing support and assistance to EMT Leader & on-site ERT and ensuring that all tasks assigned are tracked, followed up & completed in a safety & efficient manner.

The following table shall be utilized by EMT during planning process.

Phase	Activity
Evaluate the situation and progress of the response	• Gather, record, analyses and display situation and resource information • Obtain a clear picture of the scale and complexity of the incident, and assess the incident potential • Assess worst-case potential • Determine resources required to implement the Incident Action Plan
Establish and refresh incident objectives and strategy	• Formulate and prioritize response objectives. • Identify analyses and evaluate reasonable response strategies to accomplish the overall objectives of the response.
Develop the Incident Action Plan	• Determine the tactical direction (i.e. what, why, who, when, where and how) and the resources, logistics and strategies for the next operational period. • Define operational periods. • Identify resource status and availability. • Configure organizational structure to implement tactics, and determine work assignments and specific resource requirements. • As needed, develop and prioritize Incident Action Plan.
Prepare and disseminate the Incident Action Plan	• Format the Incident Action Plan in accordance with the level of complexity of the incident, and produce a well-prepared outline for an oral briefing or written plan. • Obtain Incident Action Plan attachments and review for completeness and approval. • Ensure the Incident Action Plan is up-to-date and complete in relation to the incident situation. • Reproduce the Incident Action Plan and distribute before the start of the next operational period.
Evaluate and revise the Incident Action Plan	• Compare planned progress with actual progress on a regular basis, and identify deviations or changes in resource availability, mission failure or unexpected success, and new safety and environmental considerations. • Input new information and changes in the situation into the first step of the planning process as necessary to modify the Incident • Action Plan for the current or subsequent operational period.

8.13.4.1 Emergency Management Organization Team



8.13.5 Team Roles and Responsibilities

EMT Leader (Affected Operation VP)
• Ensure that proper EMT is activated and ready to provide supports to the affected site. • Ensure that the formally notify JV Partner, MOGE and Duty Persons that an emergency has arisen are conducted. • Ensure to follow and comply with Myanmar legislation. • Seek additional supports from internal and / or external expertise if the situation requires. • Continual monitor and identify the situation of the emergency and decide whether the situation is or likely to escalate to become a crisis. • Provide a regular update (at least once an hour) of important events, commitments, decisions, etc., regarding the emergency status to Myanmar Asset GM. (Refer Myanmar Asset Emergency Plan - Appendix B: Emergency Hourly Situation Report Form). • Approve and follow up the Incident Action Plans. • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “EMT Leader specific tasks”.

Myanmar Asset Duty
• Liaise with affected Operation VP during first notification • Complete Emergency Report Form Myanmar Asset Emergency Plan - Appendix A up on receiving emergency report from OSC/CSR for internal communication • Act as EMT Leader during EMT Leader is unavailable in EMR • Ensure all required duty personnel are presented at Emergency Management Room (EMR) • Support EMT Leader to coordinate with other duty persons and EMT on Emergency supports • Work closely with other EMT members to ensure resources are effectively utilized • Work closely with the Event Logger to ensure they are provided with accurate information • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “Myanmar Asset Duty specific tasks”

Crisis Communication Team Duty (CCT)
• In conjunction with the EMT Leader, establish a pro-active media liaison and public affairs strategy. • To brief the EMT Leader on media interest, issues developing and requests from the media for information. • To assist in developing/ delivering a response to the media as directed by the EMT Leader • Notify and coordinate with Corporate PTTEP Crisis Communication Team duty (PTTEP Emergency Management Duty Roster). • Maintain communications with the Crisis Communication Team (CCT) and provide regular updates. • Maintain a personal log of events of all activities undertaken during the incident life cycle and pass completed log sheets to the Event Logger. • Follow Myanmar Crisis Communication Plan (Myanmar-0050-PDR-008). • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C "Crisis Communication Team specific tasks"

Relative Response Team Duty (RRT)
• Advise the EMT Leader on personnel and welfare issues relating to staff. • Maintain POB on site and the status of casualties. • Enact company personnel policies relating to staff welfare. • Arrange for necessary support for employees involved in emergency response and/or crisis management operations and their families. • Co-ordinate with hospitals for the treatment of injured persons, provide additional support of required. • Ensure appropriate legal advice is available for the EMT Leader when making critical decisions. • Follow Corporate PTTEP Relative Response Team Emergency Response Plan (PTTEP-MS- E04-P001). • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C "Relative Response Team specific tasks".

SSHE Duty
• Advice on SSHE related requirements to EMT Leader. • Identify parties (authorities) to be contacted or advised of the situation as dictated by statutory and other requirements. • When the emergency has been declared as finished, collect a copy of the Emergency Log, and originals of all other communications (e.g. other Log Sheets, Questionnaire Notes, Faxes, etc.) made by EMT members, for analysis and improvement of emergency preparedness. • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C "SSHE Duty specific tasks".

Administration Team Duty
• Ensure the Emergency Management Room, Crisis Communication Room and Relative Response Room ready for using. • Ensure that the room facilities are working properly. • Coordinate with IT support on IT and communication equipment readiness for using. • Ensure the electricity, lighting and air-conditioning is available. • Be a coordinator in the Myanmar Administrative Office Team. • Be a Affected Operation Representative Duty when incident has occurred at office buildings • Provide administrative supports to the EMT, i.e., search & supply necessary stationary • Provide foods, accommodations which may be required by the EMT, etc. • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C "Administration Duty specific tasks"

Logistics Duty
• Serve as advisor to EMT on all logistics related matters. • Provide workable solutions to all identified logistical issues & concerns arising from incident or emergency response operations • Be a Affected Operation Representative Duty when incident has occurred at site under Logistic Department responsible • Liaison with air transport service providers for transportation in an emergency. • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “Logistics Duty specific tasks”

Event Logger
• Ensure that POB, weather forecast information and other information on the relevant Log Boards. • Liaise with the all EMT to ensure that all information is recorded. • Ensure that all events are precisely and accurately recorded as they occur. • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “Event Logger specific tasks”

IT Support
• Ensure that IT and telecommunication equipment required by EMT in the Emergency Management Room, Crisis Communication Room and Relative Response Room ready for using. • Operate fax machine, computers, printers and to receive or send information as requested by the EMT. • Resolve any IT related issues requested by EMT. • If requested, provide additional IT & telecommunication equipment such as “Hot Line” to EMT / CMT • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “IT Support specific tasks”

8.13.5.1 Specific Group Duty

Affected Operation Representative Duty
• Act as focal point to communicate between the site ERT Leader and EMT Leader to handle the Emergency Situation • Support EMT as requested by the EMT Leader • Formally notify JV partner(s) • Complete specific tasks refer Myanmar Asset Emergency Plan - Appendix C “Affected Operation Representative specific tasks”

Other Specific Duty
Specific Duty Members will be called in when their assets have an emergency, or as required by EMT Leader discretion. • Provide advice to EMT Leader relating to concerned issues in support of emergency. The team will consist but not limit to the following members: o Affected Operation Representative (Duty responsibility see below table) o Drilling & Completion Representative o Project Representative o PSC Liaison o Medical Advisor o Security Specialist o Environmental Engineer

8.13.6 Notification and Communication

Notification and Communication at Myanmar Asset Site

According to the 3-Tier response levels, the activation of on-site ERT, EMT and CMT will be the responsibility of ERT Leader (OSC), EMT Leader (IC) and CMT Leader respectively.

A Weekly "Myanmar Asset Duty" is assigned as the first contact for any incident and emergency / crisis in Myanmar Asset.

Emergency Contact Numbers can be found on "Myanmar Asset Weekly Duty Call Sheet" which shall be distributed via e-mail to all concerned personnel every Thursday evening.

1) In emergency situation, the ERT Leader (OSC) shall contact Myanmar Asset Duty as soon as practical.
2) Upon receiving the emergency call, Myanmar Asset Duty will notify the Affected Operation VP. In case Myanmar Asset Duty cannot be contacted the next person to be contacted is an Affected Operation Duty or SSHE Manager.
3) ERT Leader (OSC) consults with Myanmar Asset Duty and Affected Operation VP to identify the Tier level, In case of Tier 1, Myanmar Asset Duty and Affected Operation VP closely follows up the situation with ERT Leader (OSC) until the normal situation is declared.
4) In case of Tier 2 or above, the Affected Operation VP activates Myanmar Asset EMT then Myanmar Asset Duty shall immediately call EMT members and or CMT Leader respectively via telephone operator or mobile phone as per Myanmar Asset Weekly Duty Call Sheet.
5) Affected Operation VP will then assume the role of the EMT Leader.

Notification and Communication at Contractor Sites under Myanmar Asset Operational Control

In case of an emergency occurring at contractor sites, for example:

- Drilling rig (Onshore / Offshore site)
- Work-over rig
- Seismic survey site
- Construction site (Onshore / Offshore site excluding contractor yard)
- Marine Vessels / Barges working in Myanmar Asset concessionaire area

In the above mentioned cases, contractor's OSC and contractor's on-site ERT will take initial response to control the incident / emergency situation. However, when the situation is escalated, additional supports are required, the contractor's OSC will normally request supports from contractor's EMT and Myanmar Asset Company Site Representative (CSR) respectively. The CSR will report to Myanmar Asset Duty who will notify and consult with Affected Operation VP as EMT Leader to activate Myanmar Asset EMT if the case is Tier 2 or above.

1) If the contractor's OSC & contractor's on-site ERT can put the situation under control then the case will be declared as Tier 1 meaning can be managed within site capacity without support required from external sources.
2) If the emergency is escalated to become Tier 2 or above, Myanmar Asset EMT Leader in consultation with CSR will activate Myanmar Asset EMP and keep Myanmar CMT Leader informed of the situation.
3) The contractor's OSC & the contractor's on-site ERT will cooperate & coordinate with the CSR for the following issues:

a. Local supports required such as authorities' notification, Myanmar Asset' logistics & other resources etc.
b. Specialist advice / technical support via the emergency organization between contractor's EMT and Myanmar Asset EMT.

It should be noted that joint emergency organization & arrangements, site specific ERP and contingency plans, between Myanmar Asset and its contractor, will be addressed, agreed upon and documented in the bridging document.

The structure of emergency organization and communication flowchart is shown in Figure below.

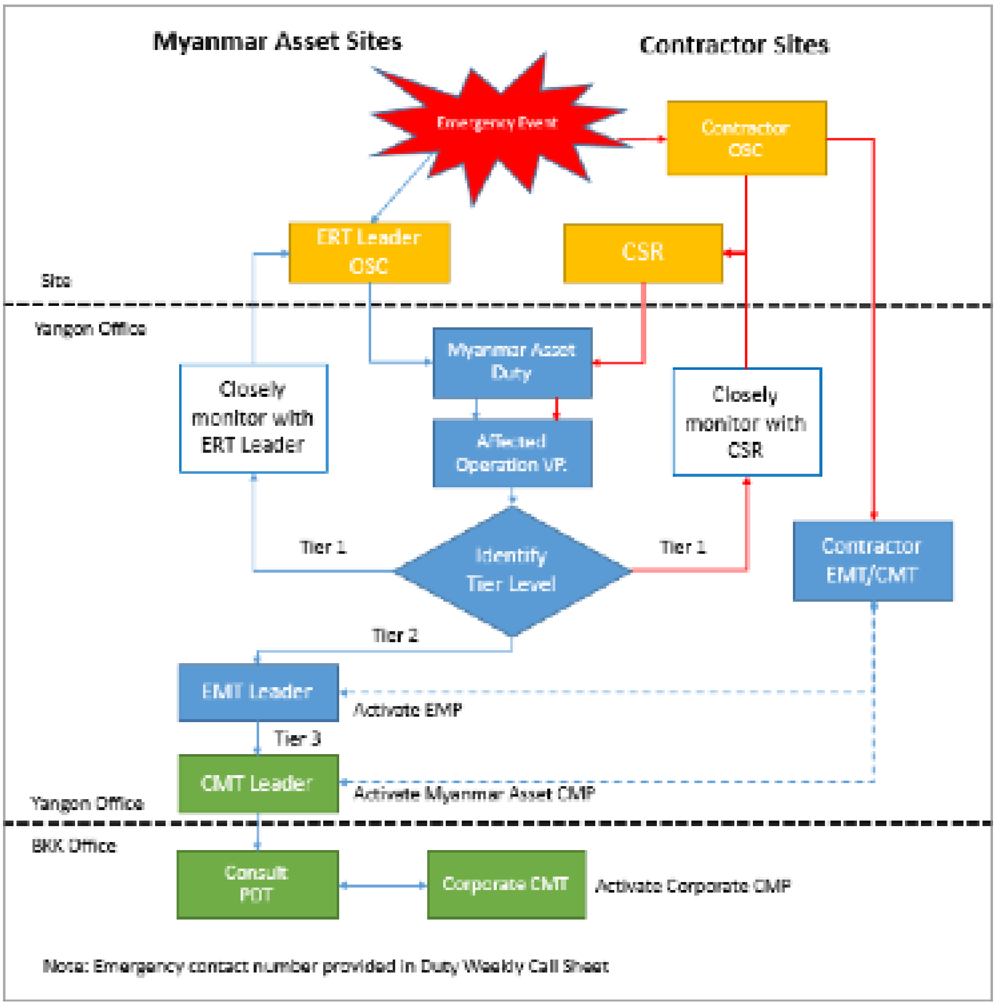


Figure 8-16: Notification and Communication flowchart

8.13.7 Activation and Deactivation

The activation of this plan shall be done by Affected Operation VP in consultation with ERT Leader (OSC) and Myanmar Asset Duty or by authorized person following the notification process, for deactivation the EMT Leader, in consultation with the OSC, is the sole authority for deactivating an emergency. Deactivation should only begin when the OSC and EMT Leader agree that the emergency has been contained, and satisfactorily overcome in all respects.

The activities and procedures which must be undertaken to recover from an emergency incident, the EMT Leader shall ensure that the OSC conduct the following activities include, but are not limited to:

- The clean-up, maintenance and testing of equipment.
- The re-commissioning of facilities, plant, and equipment.
- The replenishment of stocks (such as, firefighting foam, spill clean-up materials, replacement parts).
- The accounting for all expenses incurred as a result of the incident.
- The filing of insurance claims.
- Preparation and dispatch of final reports to relevant Shareholders, Government and Local Authorities.

8.13.8 Training and Exercises

Emergency Management Training

Myanmar Asset GM, Line Managers / VPs & SSHE Manager shall arrange and provide emergency management training and refresher training to EMT, duty personnel and other support teams. This aims to establish and maintain competency of all personnel assigned to perform emergency & crisis duties. Assigned staff are responsible for attending emergency management & refresher training arranged by the company.

Following table contains schedule of training:

Training

Topic	Target Group	Frequency	Responsible Party
Incident Command Training (EMT Leader)	Employees who will be assigned as EMT Leader and alternative EMT Leader	Yearly/When assign	Myanmar Asset GM
PTTEP Emergency Management Standard Introduction & Myanmar Asset Emergency Management Plan	All EMT personnel	Yearly/When assign	Myanmar Asset GM/ Line Managers/SSHE Manager

Emergency Management Exercise

SSHE Manager is responsible for arranging and scheduling of Tier 2 emergency exercises for EMT. All duty personnel must be participated in the exercise.

Tier 2 emergency exercises will cover the possible scenario which impact and could escalate to Tier 2 or above level to Myanmar Asset include Tropical Cyclone exercise.

After any exercise, an emergency exercise report is to be produced. The exercise report will recommend potential improvements to plans, policies, standards, systems / processes, closure of gap or additional training required. The identified corrective actions are to be tracked until properly closeout.

In addition, the report shall be reviewed by management in order to incorporate lessons learned and

best practices into the revised plans.

The 5 years plan of Tier 2 exercise programs requires at least one training session per year.

8.13.9 Monitoring Plans

Factors	Index/Parameter	Procedure	Proposed Duration and Frequency of Monitoring	Location
Public and Occupational health and safety	• Accident statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• Throughout all project phase	• Project area, community around project area, and transportation route

8.13.10 Implementation Schedule

The emergency response plan must be customized for the location one month prior to project initiation to ensure that personnel are trained as required.

8.13.11 Projected Budget

Budget

USD $100,000

8.14 Biodiversity Action Plan

8.14.1 Objectives

The objective is to protect and conserve biodiversity, maintain ecosystem services, and sustainably managing living natural resources that are fundamental to sustainable development within the project area.

The main consequences of impacts on biodiversity during drilling phase are.

1. Clearing of existing vegetation for drill site, camp site or roads may lead to the loss of habitat. Loss of habitat may lead to the loss of fauna species and/or temporary or permanent displacement of fauna species. It may also lead to food scarcity for fauna species.

8.14.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- National Environmental Quality (Emission) Guideline (2015);
- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Land Acquisition Act 1894
- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)

The IFC General EHS Guidelines for air quality, noise, waste management and wastewater are relevant for biodiversity protection.

The International Finance Corporation (IFC) has developed a series of Performance Standards that aim at protecting the environment. Performance Standard 6 "recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development". The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems" (IFC, October 2012).

The guidance notes accompanying Performance Standard 6 indicate that in situations where there is the potential of significant negative impacts to biodiversity the project proponent will develop a Biodiversity Action Plan (BAP), to guide its activities so as to protect the natural environment.

8.14.3 Overview Maps and Site Layout

The global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. This key biodiversity areas runs along the eastern edge of the Block and is located far away from the proposed well locations. The Thae Phyu Reserved Forest is located within Block MOGE-3. None of the proposed well sites are located within the Thae Phyu Reserved Forest.

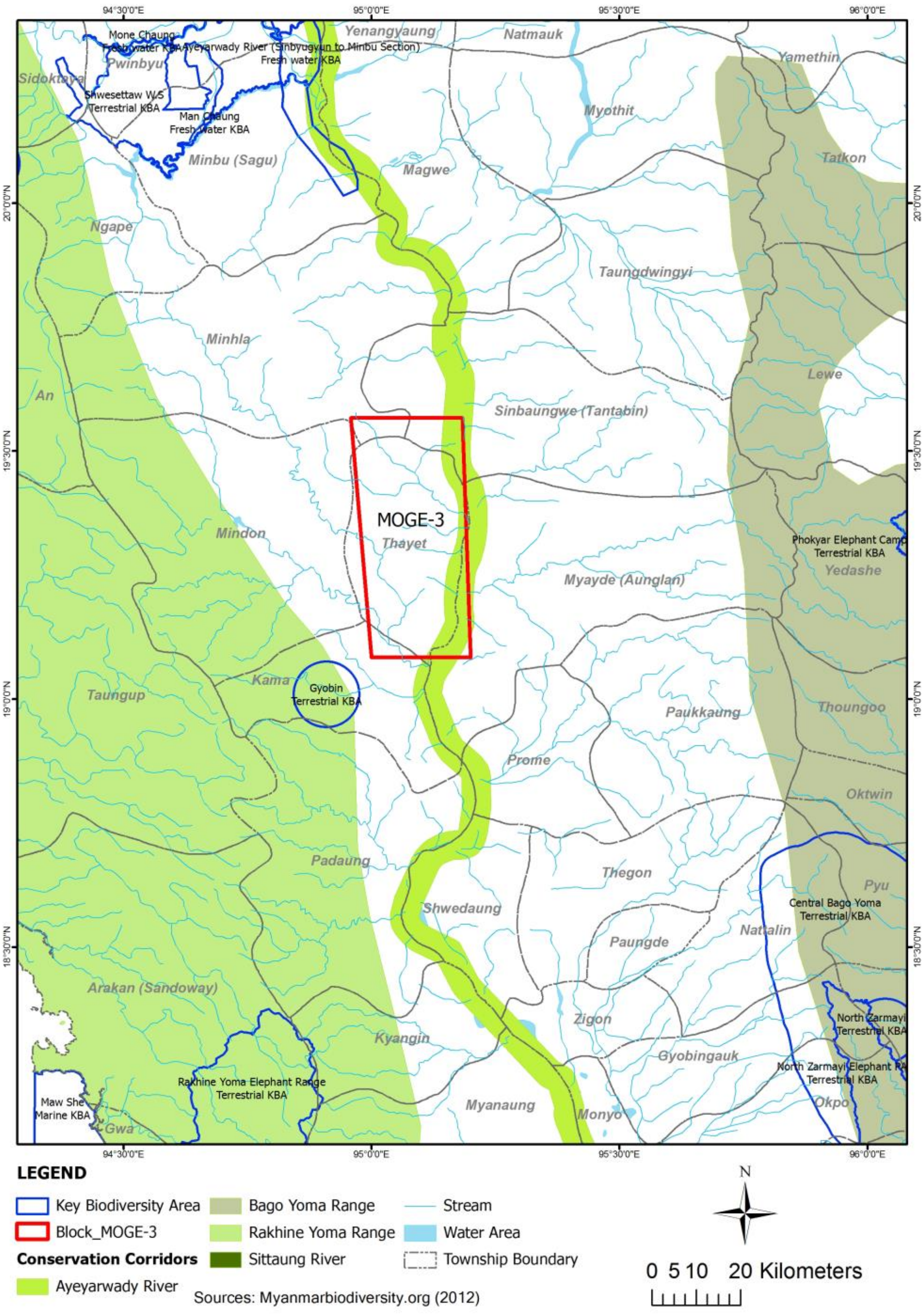


Figure 8-17: Key Biodiversity Areas in Central Myanmar

8.14.4 Biodiversity Training & Awareness

The well sites are not located within sensitvite biodiversity habitats. However, to ensure that works do not negatively disturb wildilife in the area, the following biodiversity training will be provided to works that need to enter natural habitat areas:

- General introduction to ecology and the term biodiversity.
- Presentation of company policy, objectives and targets.
- Information on entirely protected and seasonally protected flora and fauna,
- Requirements under the Forest Law and Biodiversity Law.
- The strict enforcement of a no tolerance policy to hunting / fishing.
- Biodiversity issues in areas near the well sites
- Examples of good and bad practice regarding biodiversity issues, including specific analysis of "success factors."
- Information on designation of international and national protected areas.

8.14.5 Management Actions

The management actions for biodiversity are as follows:

- Drill Rig located in area distant to sensitive receptors.
- Keep night lighting to a minimum, consistent with safety and security.
- Direct lighting to the inside of the well sites.
- Clear vegetation around the flare stack and build earth bermed flare pit.
- High valued habitat to be avoided where practicable in the design process.
- Remove vegetation in project areas only (roads, camp site, well site). Avoid cutting Riparian trees.
- Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
- Mark trees to be cut prior to constructing well pads to prevent the cutting of other trees.
- Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation or wildlife.
- Hunting and trapping will be specifically prohibited and any violations will be grounds for termination of contract and dismissal.

In cases where Critical Habitats are present IFC specifies that:

1. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:
    a. No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
    b. The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
    c. The project does not lead to a net reduction in the global and/or national/ regional population of any Critically endangered or endangered species over a reasonable period of time; and
    d. A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

IFC further specifies that in such cases where a client is able to meet these requirements the project's mitigation strategy will be described in a biodiversity action Plan and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

The following measures are proposed to avoid, minimize or offset impacts to biodiversity in the project area.

Environment Impact Assessment –Drilling Phase			
3. Light	3.1. Functional lighting on vehicles and drill rig, camp site and well site during Drilling Wells.	3.1.1. Lighting on the site at night	3.1.1.1. Drilling Rig located in area distant to sensitive receptors.
			3.1.1.2. Keep night lighting to a minimum, consistent with safety and security.
			3.1.1.3. Direct lighting to the inside of the well sites.
Environment Impact Assessment –Well Testing Phase			
3 Heat and Light	3.1 Flaring during Well testing	3.1.1 Increase in light at night from flaring	3.1.1.1 Position flare away from sensitive receptors.
			3.1.1.2 Direction the light into wellpad as much as possible.
			3.1.1.3 Minimize the duration of flaring process when possible
		3.1.2 Increase heat from flaring	3.1.2.1 Clear vegetation around the flare stack and build earth bermed flare pit.
			3.1.2.2 Minimize flare duration when possible.
			3.1.2.3 Post constant fire watch during flaring operations
			3.1.2.4 Maintain safety distance between flare stack and well site facilities and adjacent crops

Ecological Environment Impact Assessment – Construction and Installation Phase			
7. Flora and Fauna	7.1 Site Clearing for Construction of roads and well / camp sites	7.1.1 Degradation or destruction of natural habitat	7.1.1.1 High valued habitat to be avoided where practicable in the design process.
			7.1.1.2 Remove vegetation in project areas only (roads, camp site, well site).
			7.1.1.3 Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
	7.2 Construction of roads and well / camp sites	7.2.1 Habitat degradation from construction	7.2.1.1 Minimize noisy construction work during daytime hours only.

			7.2.1.2 Limit vegetation removal to a minimum.
			7.2.1.3 Limit to cut the tree only in well site and access road.
			7.2.1.4 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation or wildlife.
			7.2.1.5 Hunting and trapping will be specifically prohibited.
	7.3 Site Runoff and Drainage	7.3.1 Habitat degradation of aquatic biota	7.3.1.1 Avoid the construction of the well pads in areas where such construction obstructs a water route.
			7.3.1.2 Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
			7.3.1.3 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to aquatic biota. In addition, fishing will be specifically prohibited.
			7.3.1.4 Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
			7.3.1.5 Provide drip pans and absorbents at fuel storage area to contain any spillage.
			7.3.1.6 Strictly implement and follow mitigation measures for impacts to soil and surface water hydrology and quality.
Ecological Environment Impact Assessment – Drilling Phase			
7. Terrestrial Flora and Fauna	7.1. Drilling Activities and Labour and Accommodations	7.1.1. Aquatic biota and habitat disturbed from workers' activities	7.1.1.1. Fishing will be prohibited to workers.
			7.1.1.2. Clearly mark signs showing the boundary of the project area.
			7.1.1.3. Prohibit workers from cleaning machines/ equipment in a public water source.
			7.1.1.4. Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.
Ecological Environment Impact Assessment – Well Testing Phase			
5 Terrestrial Flora and Fauna	5.1 Labour and Accommodations	5.1.1 Habitat degradation from workers'	5.1.1.1 Mark well site clearly and prohibit vehicles from moving off site onto surrounding land.

		activities	
			5.1.1.2 Forest incursions will be specifically prohibited.
			5.1.1.3 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation.
	5.2 Flaring during Well Testing	5.2.1 Habitat degradation from light and heat	5.2.1.1 Implement well testing phase mitigation measures 3.1.
Ecological Environment Impact Assessment – Well Abandonment Phase			
6 Terrestrial Flora and Fauna	6.1 Labour and Accomodations	6.1.1 Degradation or destruction of natural habitat and harvesting wild plants / animals	6.1.1.1 Limit abandonment to daytime hours only.
			6.1.1.2 Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to flora and fauna. In addition, fishing will be specifically prohibited.
	6.2 Site-Run off and drainage	6.2.1 Potential degradation or destruction of aquatic biota	6.2.1.1 Implement construction and installation phase mitigation measures in 7.3.

8.14.6 Projected Budgets and Responsibilities

Budget

Budget will be covered as per projects exisiting SSHE requirements.

Responsibilities

Site SSHE

- Ensure construction and drilling contractor implements mitigation measures.

8.15 Public Consultation Plan & Grievance Mechanism

8.15.1 Objectives

Prior to the initiation of drilling activities, as part of the ongoing stakeholder consultation and engagement plan and in response to suggestions voiced at the stakeholder meetings, PTTEP SA will undertake the following objectives prior to and during the proposed operations:

- Appoint a community liaison officer;
- Engagement with communities
- Dissemination of Information;
- Monitor Feedback and Community Attitudes, and
- Implement a Grievance Mechanism

8.15.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- National Environmental Quality (Emission) Guideline (2015);
- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- The Control of Smoking and Consumption of Tobacco Product Law, 2006, Section 9
- The Myanmar Fire Force Law, 2015, Section 25
- Oil Fields (Labour & Welfare) Act, 1951
- Industrial use Explosive Substance, 2018, Section 6(c), 7(c), 12,13,15,16 and 18
- Land Acquisition Act 1894
- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993, Section 15 and 16
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)
- The Underground Water Act, 1930, Section 3 and 6(a)
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013, Section 16,17,23 and 27
- The Protection of Rights of National Race Law, 2015, Section 5

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below.

IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.

Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.

8.15.3 Overview Maps and Site Layout

The study area includes local communities near the basecamp and well sites (for all phases of the project). Please see **Figures 8-1 to 8-15**.

8.15.4 Management Actions

8.15.4.1 Engagement with Communities

Engagement with local communities that may be impacted by PTTEP SA business activities shall be conducted to create awareness on Company's operations, including the associated SSHE controls and recovery measures. Where there are legislative requirements to conduct such engagements, these requirements shall be fully complied with. To facilitate information exchange a community liaison officer will be appointed. The local village leader could possibly fulfill this role. Villages near project activities must be advised 2 weeks in advance of project initiation.

8.15.4.2 Dissemination of Information

The objective of these activities is to distribute information to affected stakeholders and communities within the project area. A combination of communication methods will be used to ensure the target groups within the project area are reminded and aware of the proposed plans. PTTEP SA will periodically inform the local authorities the project plans throughout all phases of the project.

Before project commencement, the Local Authority will be formally notified of the upcoming project. A meeting with the village heads will be conducted at least 2 weeks before project launch. This meeting will be used to inform the community leaders of transportation routes, drilling operations and potential disturbances from these activities. The meeting will also introduce key staff members and ensure contact details are exchanged. The community leaders will be asked to relay the information to their communities.

8.15.4.3 Feedback and Community Attitudes

PTTEP SA understands the importance of listening to stakeholder concerns and addressing any valid issues to maintain good relations and demonstrate respect for the neighbouring communities in which it operates.

The following techniques and mechanisms will be utilized to ensure effective feedback:

Handling a Stakeholder Complaint

All SSHE Complaint shall be processed immediately and according to Stakeholder Complaint Procedure. Access to complaint-handling process shall be free-of-charge to the complainant. All Complainants shall be treated courteously and be kept informed of the progress of their complaint, being addressed in an equitable, objective and unbiased manner through the complaint-handling process.

The flow of activities in the Grievance Handling Process Flow Diagram is shown in **Figure 8-18** below.

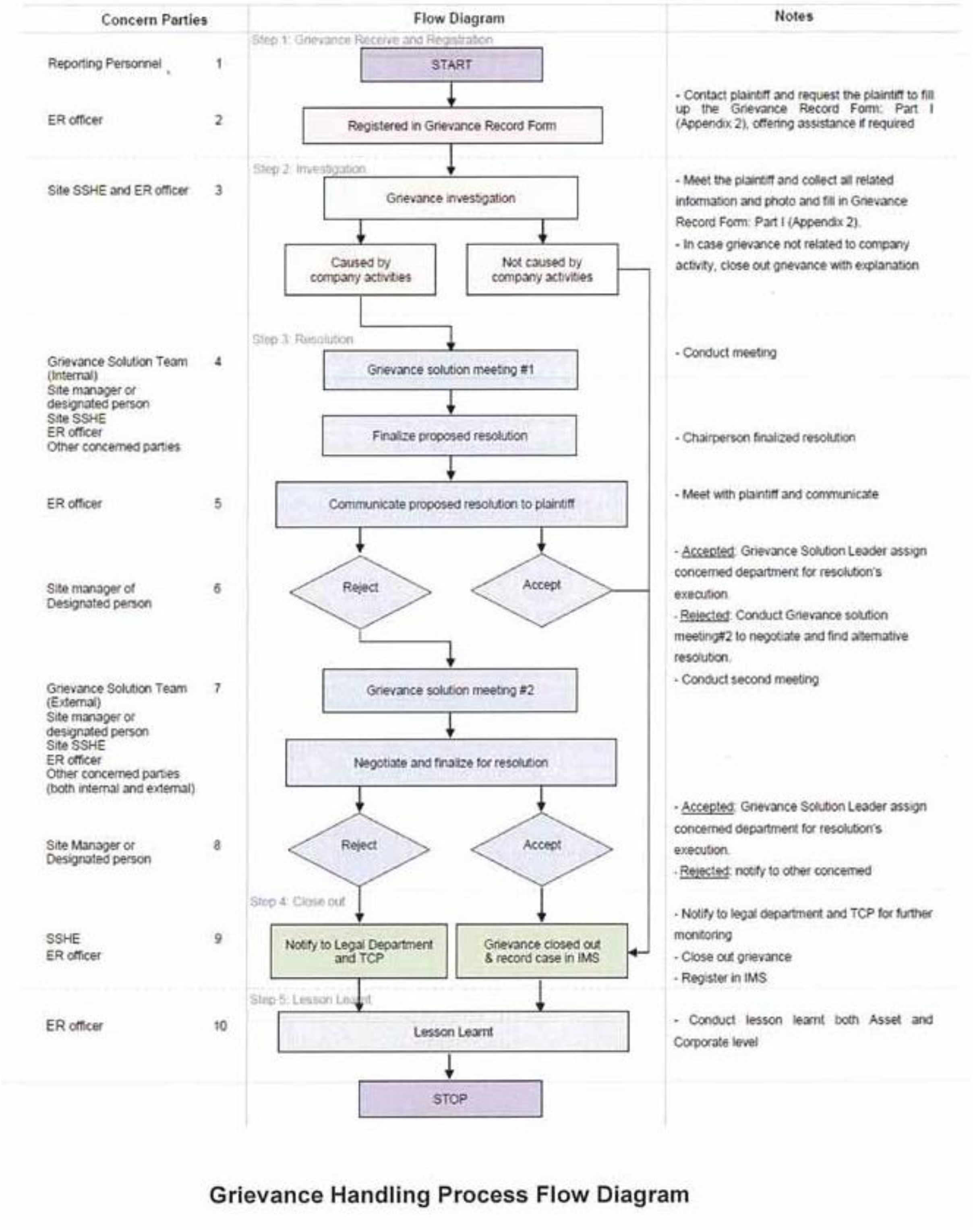


Figure 8-18: Grievance Handling Process Flow Diagram

8.15.4.4 Mitigation Measures

Social Impact Assessment – Construction and Installation Phase			
8. Land Use	8.1 Purchase of land access road/well pad and camp site	8.1.1 Change of traditional use.	8.1.1.1 Transparent and fair compensation to land owners and users according to land acquisition committee decision
			8.1.1.2 Ensure all permissions are obtained from landowners and local authorities.
			8.1.1.3 Notify surrounding landowners before on location and time of project activities.
			8.1.1.4 Hand back the land to concerned parties with agreed condition after project completion.

Social Impact Assessment – Construction and Installation Phase			
9. Transport	9.1 Construction Activites	9.1.1 Damage to roads	9.1.1.1 Check and restore for any damage from project activities to local roads.
Social Impact Assessment – Drilling Phase			
14. Transport	14.1. Vehicle and Equipment Use	14.1.1. Disruption of traffic	14.1.1.1. Ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect performance.
			14.1.1.2. Strictly Follow Speed Limits
			14.1.1.3. Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures.
			14.1.1.4. Safety equipment and emergency equipment must be installed on vehicles such as tool box safety belts and portable fire extinguisher etc. as per company standards.
			14.1.1.5. Provide left hand drive car as priority.
			14.1.1.6. Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
			14.1.1.7. Consult with local authority before major movement.
			14.1.1.8. Restrict/ avoid movement of heavy equipment during rush

			hours.
			14.1.1.9. Provide traffic signs or flags at junction of access roads and main roads.
			14.1.1.10. Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
			14.1.1.11. Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.
			14.1.1.12. Strictly enforce training programs to reduce transport incident cases by its contractors.
			14.1.1.13. Restore any damage to roads that is caused by contractors or Company.
			14.1.1.14. Restrict local traffic in well site area
			14.1.1.15. Road Hazard Assessment will be conducted before transporting any large equipment.
			14.1.1.16. Vehicles will take direct routes where possible and avoid significant habitat areas.
			14.1.1.17. Construction vehicles will follow speed limits.
	14.2. Damage to roads	14.2.1. Check and restore for any damage from project activities to local roads.	14.2.1.1. Check and restore for any damage from project activities to local roads.
Social Impact Assessment – Well Testing Phase			
6 Transport	6.1 Vehicle and Equipment Use	6.1.1 Disruption of traffic	6.1.1.1 Implement construction and installation phase mitigation measures in 9.1.
		6.1.2 Damage to roads.	6.1.2.1 Regularly restore any damaged roads from project activities to good condition.
Social Impact Assessment – Well Abandonment Phase			
7 Transportation	7.1 Vehicle and Equipment Use	7.1.1 Disruption of traffic.	7.1.1.1 Implement construction and installation phase mitigation measures in 9.1.
	7.2 Site restoration	7.2.1 Damage to roads.	7.2.1.1 Restore any damage to roads.

Social Impact Assessment – Construction and Installation Phase			
10. Water Use	10.1 Use of water public utility for construction and domestic use	10.1.1 Compete for water use of communities	10.1.1.1 Inform authority for drilling a ground water well.
			10.1.1.2 PTTEP SA to drill their own ground water wells on site.
			10.1.1.3 Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, must not affect the availability of water to locals.
Social Impact Assessment – Drilling Phase			
9. Water Use	9.1. Use of public utility for water resources	9.1.1. Water usage of project affects the community's water supply.	9.1.1.1. Implement construction and installation phase mitigation measures in 10.1.
			9.1.1.2. Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.

Social Impact Assessment – Drilling Phase			
10. Power Use	10.1. Power for drilling operations and work camp	10.1.1. Increase or decrease of available power for local community	10.1.1.1. Install diesel-powered generators to supply all project power related needs.

Social Impact Assessment – Construction and Installation Phase			
13. Socio-Economy	13.1 Services Supply for Construction Activities	13.1.1 Employment/income and procurement opportunities for people, business and services in surrounding area	13.1.1.1 Employ qualified local workers.
			13.1.1.2 Purchase local supplies and services, whenever possible.
			13.1.1.3 Terms of contract for recruitment of manpower in these project needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.
	13.2 In-migration of labour and social interaction	13.2.1 Potential conflict between workers from other regions and local communities	13.2.1.1 Restrict workers to within project boundaries and do not allow local interaction within the communities.
Social Impact Assessment – Drilling Phase			
12. Socio-Economy	12.1. Employment opportunities and Use of local goods and services	12.1.1. Employment and income	12.1.1.1. Employ qualified local workers if possible.
			12.1.1.2. Purchase local supplies and services, whenever possible.

Social Impact Assessment – Well Abandonment Phase			
8 Socio-Economy	8.1 Labour and Accomidations	8.1.1 Employment and Income	8.1.1.1 Implement drilling phase mitigation measures in 12.1.

Visual Impact Assessment – Construction and Installation Phase			
15. Tourism and Recreational experience	15.1 Well Site, Road and Camp Construction	15.1.1 Disturbance and reduction of tourism and recreational experience	15.1.1.1 Post and enforce speed limit.
			15.1.1.2 Consult with local authority before major movement.
			15.1.1.3 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
			15.1.1.4 Restrict/ avoid movement of heavy equipment during rush hours.
			15.1.1.5 Provide traffic signs or flags at junction of access roads and main roads.
			15.1.1.6 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
			15.1.1.7 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.
			15.1.1.8 Strictly enforce training programs to reduce transport incident cases by its contractors.
			15.1.1.9 Restore any damage to roads if caused by contractor or company.
			15.1.1.10 Restrict local traffic in well site area
			15.1.1.11 When project complete hand back the land with agreed conditions.

8.15.4.5 Study Area, Duration and Responsible Agencies

Study Area

The study area includes local communities within a 5-km radius of the well site (for all phases of the project).

Duration

The Stakeholder Engagements will be conducted during all phases of the project's operations. Four weeks prior to site operations, the stakeholder (village headman, household representatives and community leaders) will be informed about project activities. PTTEP SA will attend monthly meetings at the district office with village headman, household representatives to address any issues regarding PTTEP SA's project if required.

8.15.5 Monitoring Plans

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• All phases • Once after well abandoned and site restored within 3 months.	• Project area, community around project area, and transportation route

8.15.6 Implementation Schedule

The Community Consultation Plan and Grievance Mechanism will be conducted during all phases of the project's operations. Four weeks prior to site operations, the stakeholder (village headman, household representatives and community leaders) will be informed about project activities and Grievance Mechanism. PTTEP SA will attend monthly meetings at the district office with village headman, household representatives to address any issues regarding PTTEP SA's project as required.

8.15.7 Projected Budgets and Responsibilities

Budget

USD $ 30,000

Key Roles and Responsibilities

Asset Manager/Site Manager

- Serve as a chairperson for both internal and external meetings for grievance resolution.
- Ensure his/her asset/department apply the Grievance handling Guideline throughout the lifecycle of the project.
- Ensure staff and reporting personnel report all grievances, excluding requests from communiteis and/or authorities, and grievances raised by staff regarding their employment conditions
- Review and approve corrective actions
- Monitor effectiveness of corrective actions. Introduce additional actions if required.
- Review the implementation of corrective actions for proper close out

Externl Relations Officer/Externa Relations Site Officer

- Perform initial review of grievance and determine the relevance of the grievance.
- Assist plaintiff to fill in the initial grievance record form.
- Serve as the grievance investigation facilitator in the investigation team.
- Investigate and record the complaint in a given form, keep a physical record and answer the plaintiff by acknowledging receipt of the grievance.
- Propose a solution, in case the grievance can be solved by an immediate action.
- Inform supervisor of the ongoing action until the resolution of the issue.
- Participate as an investigation member and act as the secretary to assist the investigation team.
- Act as the secretary for internal and external meetings for grievance resolution.
- External Relations Officer/External Relations Site Officer
- Keep a yearly record on the number of grievances and analyze trends, to compare with previous years, if any.
- Conduct knowledge sharing about the Grievance Handling Guideline with all concerned stakeholders both internal and external.

Site SSHE

- Serve as an investigation team member.
- Participate as a member at internal and external meetings for grievance resolution.
- Provide comment and review necessary information in SSHE aspects and point of view.
- Record all grievances, actions in response to grievances and close outs in the Incident Management System Workflow.

Reporting personnel (i.e. Employees, Contracted staff, Witnesses)

- Report acknowledged grievances to the ER Officer/ER Site Officer immediately

8.16 Cultural Heritage Management Plan

8.16.1 Objectives

The Cultural Heritage Management and Monitoring Plan will have the objective of avoiding potential damage to cultural resources within 5 km of the project area.

8.16.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Environmental Conservation Law, 2012, Section 7(o) 14,15, 24, 29
- Environmental Conservation Rule, 2014, Rule 69
- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- The Petroleum and Petroleum Products Law, 2017, Section 10 (a, d), 15, 16, and 31 (a, d)
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- The Control of Smoking and Consumption of Tobacco Product Law, 2006, Section 9
- The Myanmar Fire Force Law, 2015, Section 25
- Shops and Establishments Law, 2016, Section 13 to 17, 21 and 24
- The Protection and Prevention of Antique Objective Law, 2015, Section 12
- The Protection and Prevention of Ancient Monument Law, 2015, Section 12, 15 and 20
- The Protection and Prevention of Cultural Heritage Area, 2015, Section 20, 23 and 29(b)
- The Protection of Rights of National Race Law, 2015, Section 5

The cultural heritage plan will be implemented based on the required from IFC Performance Standard 8. IFC Performance Standard 8 requires that projects:

- protect cultural heritage by ensuring that internationally recognised practices for the protection, field-based study, and documentation of cultural heritage are implemented. Where relevant this includes the retention of a competent professional to assist in the identification and protection of cultural heritage;
- develop provisions for managing chance finds, requiring any chance find to be undisturbed until an assessment by competent professional is complete and management actions are identified;
- consult with affected communities to identify cultural heritage of importance and to incorporate their views into the decision making process. This shall involve national and local regulatory agencies;
- allow continued access to cultural heritage sites by affected communities within living memory for long-standing cultural purposes;
- avoid impacts to or where not feasible minimise (negative impacts) or restore in situ the functionality of replicable cultural heritage;
- do not remove any non-replicable cultural heritage unless the following criteria are met namely, that – there are no technically or financially feasible alternatives; the overall benefit of the project outweigh the anticipated cultural heritage loss from removal; and the removal of cultural heritage is conducted using the best available techniques;

- shall not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances where impacts are unavoidable, the Project will use a process of Informed Consultation and Participation (ICP);

8.16.3 Overview Maps and Site Layout

During the archeological and historic site assessment for the project area, the Township Administrator from Thayet GAD confirmed that there is no Archaeological or Historic Department in Thayet and no archaeological or historic sites are present in the Thayet Township. The well site is located on agricultural and secondary forest land and no historic or archaeological sites are located near the planned project. Although there is no Heritage area and Archaeological zone approved by government in block MOGE 3, some ancient pagodas which are in good condition and decayed stage could be found in many places within project area.[3] The cultural heritage areas are located near the villages sensitive receptors (see **Figures 8-1 to 8-15**).

8.16.4 Management Actions

Cultural Impact Assessment – Construction and Installation Phase			
14. Historical, Archaeological and Cultural Resources	14.1 Construction of access road/well pad and camp site	14.1.1 Archaeological/ fossil finds within project area.	14.1.1.1 Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.
			14.1.1.2 Report to the Thayet GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed
			14.1.1.3 If artefacts are found during the construction phase, PTTEP SA will inform the responsible local office immediately.
			14.1.1.4 Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact.
			14.1.1.5 Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.
			14.1.1.6 Report to the Thayet GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed

[3] REM, 2015, An Outline Report on Land Use Survey for Seismic Project in Block MOGE 3, Resource & Environment Myanmar Ltd., 2015

8.16.5 Monitoring Plans

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in **Table 8-19**.

Table 8-19: Environmental monitoring

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
CH sites	Monitor appearance of CH resources: survey and recording of the condition and structural integrity of sites with above-ground components.	Area of direct interference (camp site, drill site, access roads)	Presence of CH resources	Continuous
CH sites	Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Area of direct interference (camp site, drill site, access roads)	Completion of required reporting, including: • reporting of ground disturbing activities • Reporting on findings • Completion of induction training • Implementation of all additional measures, such as signage, fencing, structural bracing & conservation • 100% of cultural heritage related grievances and cultural heritage issues raised through community consultation addressed	Weekly

8.16.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the table above. The Plan will be designed to guarantee compliance with Myanmar laws.

8.16.7 Projected Budgets and Responsibilities

Budgets

USD $5,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor SSHE Manager.
- PTTEP SA Manager, Safety, Security, Health and Environment (SSHE)

8.17 Occupational Health/Public Health Plan

8.17.1 Objectives

PTTEP SA has prepared a detailed SSHE Drilling Operations Plan. The Operations Plan is designed to address the Drilling Project Specific Risk Assessment to prevent and eliminate the risk of personal injury, occupational illnesses and damage to properties.

8.17.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- The Petroleum and Petroleum Products Law, 2017, Section 10 (a, d), 15, 16, and 31 (a, d)
- Public Health Law, 1972, Section 3 and 5
- The Prevention and Control of Communicable Disease Law, 1995, Section 3, 4, 9 and 11.
- The Control of Smoking and Consumption of Tobacco Product Law, 2006, Section 9
- The Myanmar Fire Force Law, 2015, Section 25
- Shops and Establishments Law, 2016, Section 13 to 17, 21 and 24
- The Employment and Skill Development Law, 2013, Section 5, 14 and 30 (a and b)
- Oil Fields (Labour & Welfare) Act, 1951
- The Workmen Compensation Act, 1923, Section 10 (a, b) and 11
- The Labour Organization Law, 2011, Section 17 to 22
- The Settlement of Labour Disputes Law, 2012, Section 38, 39, 40 and 51
- Minimums Wages Law, 2013, Section 12, 13 (b, c, d), 43 (e, f, g)
- Payment of Wages Law, 2016, Section 3, 4, 5, 7, 13, and 14
- Social Security Law, 2012, Section 11(a), 15, 18(b), 48(b), 49 and 75
- Leaves and Holidays Act, 1951
- Industrial use Explosive Substance, 2018, Section 6(c), 7(c), 12,13,15,16 and 18
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993, Section 15 and 16
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013, Section 16,17,23 and 27

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below:

- IFC Environmental, Health, and Safety (EHS) Guidelines - GENERAL EHS GUIDELINES: OCCUPATIONAL HEALTH AND SAFETY
- IFC Environmental, Health, 188and Safety (EHS) Guidelines - GENERAL EHS GUIDELINES: COMMUNITY HEALTH AND SAFETY
- IFC Performance Standard 4 Community Health, Safety, and Security

8.17.2.1 Standards and Document Control

Applicable SSHE Procedures, standards, guidelines and documents shall be used for the entire scope of work during the drilling operation in different locations. All the documents shall be revised as and when required. SSHE Officer shall maintain these documents for reference and use.

PTTEP Myanmar Asset is committed to safe Exploration and Production (E&P) Operations in Myanmar with an ultimate goal of "Target Zero – Nobody Gets Hurt in Our Operations" which covers (1) Zero Injury, (2) Zero Major Accident (e.g. zero major hydrocarbon leak, vehicle accident, ship collision), and (3) Zero Spill or External Complaint (e.g. zero complaint by authorities/ communities/ sea users).

8.17.2.2 Occupational Health & Safety Training, Drill and Exercise

OHS Training

- Occupational Health & Safety (OHS) orientation training will be provided to all new employees to ensure they are apprised of the basic site rules of work at the wellsite and of personal protection and preventing injury to fellow employees.
- Training will consist of basic hazard awareness, site- specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use to be thoroughly reviewed as part of orientation training.

Visitor Orientation

- If visitors to the site can gain access to areas where hazardous conditions or substances may be present, a visitor orientation and control program will be established to ensure visitors do not enter hazard areas unescorted.

New Task Employee and Contractor Training

- The workers and contractors, prior to commencement of new assignments, will have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present. The training to all drilling team member will adequately cover:
    - Knowledge of materials, equipment, and tools
    - Known hazards in the operations and how they are controlled
    - Potential risks to health
    - Precautions to prevent exposure
    - Hygiene requirements
    - Wearing and use of protective equipment and clothing o Appropriate response to operation extremes, incidents and accidents

Basic OHS Training

- A basic occupational training program and specialty courses will be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training to be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.

- Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co- workers. Training will include the risks of becoming infected with blood–borne pathogens through contact with bodily fluids and tissue.
- Through appropriate contract specifications and monitoring, the PTTEP SA will ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

Area Signage

- Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. will be marked appropriately.
- Signage will be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

Labeling of Equipment

- All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, must be labeled as to the contents and hazard, or appropriately color coded.
- Similarly, piping systems that contain hazardous substances must be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

Communicate Hazard Codes

- Copies of the hazard coding system must be posted outside the drill pad at emergency entrance doors and fire emergency connection systems where they are likely to come to the attention of emergency services personnel.
- Information regarding the types of hazardous materials stored, handled or used at the facility, including typical maximum inventories and storage locations, must be shared proactively with emergency services and security personnel to expedite emergency response when needed.
- Representatives of local emergency and security services to be invited to participate in periodic (annual) orientation tours and site inspections to ensure familiarity with potential hazards present.
- Incident Investigation: Incidents can provide valuable information about site hazards and the steps needed to prevent accidental releases. The incident investigation mechanism includes procedures for:
  - Initiation of the investigation promptly
  - Summarizing the investigation in a report
  - Addressing the report findings and recommendations o A review of the report with staff and contractors
- Employee Participation: A written plan of action will describe an active employee participation program for the prevention of accidents.
- Contractors: A mechanism in place for contractor control that includes the requirement for them to develop hazard materials management procedures that meet the requirements of the hazardous materials management plan. Their procedures must be consistent with those of the PTTEP and the contractor workforce must undergo the same training once on site. Additionally, procedures require that contractors are:
  - Provided with safety performance procedures and safety and hazard information
  - Observe safety practices

    - Act responsibly
    - Have access to appropriate training for their employees
    - Ensure that their employees know process hazards and applicable emergency actions
    - Prepare and submit training records for their employees to the contracting company
    - Inform their employees about the hazards presented by their work
    - Assess trends of repeated similar incidents
    - Develop and implement procedures to manage repeated similar incidents
- Training: Project employees to be provided training on Hazmat management. The training program at minimum includes:
    - A list of employees to be trained
    - Specific training objectives
    - Mechanisms to achieve the objectives (i.e., hands-on workshops, videos, etc.)
    - The means to determine whether the training program is effective
    - Training procedures for new hires and refresher courses for existing employees

PTTEP SA will require the drilling contactor to contact the labour exchange office in Thayet District to find local qualified labour for appropriate positions on site. PTTEP SA and its contractor will conduct the following HR and safety training, drill and exercise for all workers:

No.	Training Course	Course Provider	Frequency
1.	Site Safety Induction	Contractor In-house	One time
2.	PTTEP SSHE Awareness	PTTEP In-house	One time
3.	Fire Fighting	Certified Training Provider	3 Yr
4.	First Aid	Certified Training Provider	3 Yr
5.	H2S Awareness	PTTEP In-house	1 Yr
6.	Defensive Driving	Certified Training Provider	1 Yr
7.	Well Control (Blow out control)	Certified Training Provider	2 Yr

No.	Emergency Drill and Exercise	Frequency
1.	Fire/Muster Drill	Minimum Once per month but once a week if no other emergency muster drills are held
2.	Man Lost – Search/Rescues	Annually
3.	Man Down (injury) Drill	Once per month
4.	Confined Space Rescue	Once per 3 months
5.	Vertical Rescue Drill	Annually
6.	H2S Release Emergency	Once per week when drilling
7.	H2S Rescue	Once per month
8.	Well Control (Blow out control)	Every 2 week

8.17.2.3 Public Health Public Health Management Plan (PHMP)

Disease Prevention

Increased incidence of communicable and vector-borne diseases attributable to construction and drilling activities represents a potentially serious health threat to project personnel and residents of local communities. Recommendations for the prevention and control of communicable and vector-borne diseases also applicable to construction phase activities are provided below:

Communicable Diseases

Communicable diseases pose a significant public health threat to workers and village populations. Health hazards typically associated with projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

- Providing surveillance and active screening and treatment of workers
- Preventing illness among workers and local communities by:
    - Undertaking health awareness and education
    - Training health workers in disease treatment
    - Conducting immunization programs for workers to improve health and guard against infection
    - Providing onsite health clinic and services
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization

Vector-Borne Diseases

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease including:

- Prevention of larval and adult propagation by the elimination of breeding habitats close to workers accomodations
- Elimination of unusable impounded water
- Design drainage channels to increase in water velocity in natural and artificial channels
- Considering the application of residual insecticide to dormitory walls
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites
- Educating project personnel and area residents on risks, prevention, and available treatment
- Monitoring communities during high-risk seasons to detect and treat cases
- Distributing appropriate education materials
- Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

Water Availability

Groundwater and surface water represent essential sources of drinking and irrigation water in for the local villages in the rural area. Therefore, PTTEP SA will ensure the project activities involving wastewater discharges; water extraction, diversion or impoundment will prevent adverse impacts to the quality and availability of groundwater and surface water resources.

Drinking water sources to be protected at all time so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking-Water Quality.

The potential effect of groundwater or surface water abstraction for project activities will been properly assessed through a combination of field testing and modeling techniques, accounting for seasonal variability during the dry season. The drilling activities will not compromise the availability of water for nearby villages and communities.

Physical Hazards

Community health and safety issues specific to oil exploration includes potential exposure to spills, fires, and explosions. To protect nearby communities from these hazards, the location of the wellsite will have an adequate safety zone around the facilities secured with a safety fence. The emergency preparedness and response plan will consider the role of communities and community infrastructure during unplanned events. To prevent the public contact with dangerous locations and equipment and hazardous materials, access deterrents such as fences and warning signs must be installed around the well site and any temporary structures.

Hydrogen Sulfide

The potential for exposure of members of the community to facility air emissions will be carefully considered during the well site planning. A security fence and buffer zone will be established around each wells ite. All necessary precautions in the design, well site siting and procedures will be be implemented to ensure no health impacts to human populations and the workforce will result from activities.

When there is a risk of community exposure to hydrogen sulfide from activities, the following measures are to be implemented:

- Installation of a hydrogen sulfide gas monitoring network with the number and location of monitoring stations determined through air dispersion modeling, taking into account the location of emissions sources and areas of community use and habitation;
- Continuous operation of the hydrogen sulfide gas monitoring systems to facilitate early detection and warning;
- Emergency planning involving community input to allow for effective response to monitoring system warnings.

Security

- Unauthorized access to facilities will be avoided by perimeter fencing surrounding the facility and controlled access points (guarded gates).
- Adequate signs and closed areas will be established for the areas where security controls begin at the property boundaries.

- Vehicular traffic signs will clearly designate the separate entrances for trucks / deliveries and visitor / employee vehicles.
- To maximize opportunities for surveillance and minimize possibilities for trespassers, the facility will have adequate lighting and security systems.

Worker notification and communication

Alarm bells, visual alarms, or other forms of communication are required to reliably alert workers to an emergency. Related measures include:

- Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations
- Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency

Community Notification

If a local community may be at risk from a potential emergency arising at the facility, the company must implement communication measures to alert the community:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advise on selecting an appropriate protection option

8.17.3 Overview Maps and Site Layout

The area includes local communities within a 5-km radius of the well site and the basecamp / well site area (for all phases of the project). Please see **Figures 8-1 to 8-15**.

8.17.4 Management Actions

Health Impact Assessment – Construction and Installation Phase			
16. Public and Occupational Health	16.1 Well Site, Road and Camp Construction	16.1.1 Respiratory irritation and Exacerbation of asthma impact from dust	16.1.1.1 Implement construction and installation phase mitigation measures in 2.1.
	16.2 Vehicle and Equipment Use during construction	16.2.1 Hearing impairment for workers and annoyance for public.	16.2.1.1 Implement construction and installation phase mitigation measures in 3.1.
			16.2.1.2 Provide PPE to workers on site.
			16.2.1.3 Should complaints over noise be received, consideration will

			be given to the provision of noise barriers.
	16.3 Non-Hazardous Waste Management	16.3.1 Food safety, Increase in vector-borne diseases: malaria, typhus and dengue and others.	16.3.1.1 Implement construction and installation phase mitigation measures in 12.1.
Health Impact Assessment – Drilling Phase			
13. Occupational and Public Health	13.1. Rig, Generators and Equipment	13.1.1. Health impact from noise	13.1.1.1. Implement drilling phase mitigation measures in 2.1.
			13.1.1.2. Provide PPE to workers on site
	13.2. Non Hazardous waste management	13.2.1. Health impact from Non-Hazardous Waste	13.2.1.1. Implement construction and installation phase mitigation measures in 12.1.
	13.3. Handling and Disposal of Hazardous Waste	13.3.1. Health impact from hazardous Waste	13.3.1.1. Implement drilling phase mitigation measures in 11.2.
	13.4. Hazardous waste management and chemical handling	13.4.1. Health impact from Mud, Chemicals and Drilling Waste	13.4.1.1. Implement drilling phase mitigation measures in 11.3.
	13.5. Labour and Accomodations	13.5.1. Health impact from Communicable Diseases	13.5.1.1. Implement construction and installation phase mitigation measures in 12.1.
			13.5.1.2. Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.
			13.5.1.3. Drainage and removal of waste from waste pit upon completion of drilling.
			13.5.1.4. Health screening of workers before employment.
			13.5.1.5. On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.

			13.5.1.6. Considering on hiring of qualified local workers to reduce reliance on outside labour and increase local employment.
			13.5.1.7. Do not allow workers to enter communities near the drill site.
			13.5.1.8. Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.
Health Impact Assessment – Well Testing Phase			
9 Occupational and Public Health	9.1 Flaring	9.1.1 Heat exposure and Nuisance light from Light and heat	9.1.1.1 Implement well testing phase mitigation measures 3.1.
			9.1.1.2 Implement PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.
			9.1.1.3 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
			9.1.1.4 Heat impacts from the flare stack will be minimised by having a protected flare pit.
			9.1.1.5 Maintain a safe distance from nearest sensitive receptor.
	9.2 Flaring	9.2.1 Increase in respiratory illnesses/diseases, asthma, Disturbance psychological wellbeing from flaring emissions	9.2.1.1 Ensure flare system has efficient combustion.
			9.2.1.2 Clear vegetation around the flare stack and build earth bermed flare pit.
			9.2.1.3 Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			9.2.1.4 H2S detection and safety equipment is standard issue. PTTEP SA's develop emergency response plan (ERP) and H2S Contingency Plan.
			○ Monitor H2S during well testing.

			9.2.1.5 Staff trained in H2S procedures.
	9.3 Non-hazardous waste management	9.3.1 Waste can be a contaminate surface and groundwater, and be a vector for disease.	9.3.1.1 Implement construction and installation phase mitigation measures in 12.1.
	9.4 Hazardous waste management	9.4.1 Health impacts from Hazardous Waste	9.4.1.1 Implement drilling phase mitigation measures in 11.2.
Health Impact Assessment – Well Abandonment Phase			
9 Public and Occupational Health	9.1 Non-hazardous waste management	9.1.1 Exposure to contamination from non-hazardous wastes,	9.1.1.1 Implement construction and installation phase mitigation measures in 12.1.

8.17.5 Monitoring Plans

Occupational & Public Health and Safety Monitoring programs must verify the effectiveness of prevention and control strategies. The selected indicators are representative of the most significant health and safety hazards, and the implementation of prevention and control strategies. The monitoring program will include:

- Safety inspection, testing and calibration: This includes the regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection must verify that issued PPE continues to provide adequate protection and is being worn as required.
- Surveillance of the working environment: This must document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses to be conducted according to internationally recognized methods and standards.
- Surveillance of workers health: The periodic medical examination for the workers onsite will be reuied. All workers will be provided appropriate and relevant health surveillance prior to arriving to site and receive regularly annual health check ups. If occupational diseases are found while doing the periodic medical examination, the works will be treated on site as appropriate or medicated to an approporate medical hospital dending on the type of disease found.
- Training: Training activities for employees and visitors must be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, must be documented adequately. Service providers and contractors must be contractually required to submit to the employer adequate training documentation before start of their assignment.

Accidents and Diseases monitoring:

- A on-site health clinic (with a doctor who have Medical Practitioner License) will be established through the project duration.
- The site will establish procedures and systems for reporting and recording:
  - Occupational accidents and diseases outbreak within workers.
  - Dangerous occurrences and incidents
- These systems enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health.
- The systems and the employer will further enable and encourage workers to report to management all:
  - Occupational injuries and near misses
  - Suspected cases of occupational disease outbreak
  - Dangerous occurrences and incidents
- All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses must be investigated with the assistance of a person knowledgeable/competent in occupational safety. The investigation will require at minimum:
  - Establish what happened
  - Determine the cause of what happened
  - Identify measures necessary to prevent a recurrence
  - Report and cooperate with relevant Public Health Department, if a disease outbreak is detected on site

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Occupational health and safety	• Accident statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• All phases	• Project area, community around project area, and transportation route

8.17.5.1 Methods and Procedures for Hazards and Effects Management

Hazards have been identified and assessed for all activities including sub-contractors activities in the contract and documented on the **Project Risk Assessment Register**. Copies of the Hazard and Control Sheets will be distributed to Party Chief and sub-contractors for reference in their respective activities.

The Party Chief and Crew Supervisors will ensure that control measures mentioned on the **Project Risk Assessment Register** are implemented. The SSHE Officer will carry out periodic check on awareness among site personnel of the hazards and report any non-compliance for corrective action. The **Project Risk Assessment Register** will be reviewed for the changes required and will be updated accordingly.

8.17.6 Monitoring Plans

Audits: Organised and led by SSHE Team

Audit	Responsible Person (Leader)
1. Carry out SSHE Compliance audit in the locations.	SSHE Officer/Party Chief
2. Conduct Health and Hygiene audit	SSHE Officer/Crew Doctor
3. Conduct Medical Facilities audit	SSHE Officer/Crew Doctor
4. Conduct audit on head office journey management system.	Vehicle Controller/SSHE Officer

Inspections

No	Action	Action Party
1	Carry out inspection in location during site visit.	Party Chief/SSHE Officer
2	Conduct inspection in sub-contractors worksite, maintenance workshop, sludge farm, waste yard, STOP and call of work.	Party Chief/SSHE Officer
3	Conduct inspections on Field Survey Team	HH Survey Manager/PTTEP SA Site Representative
4	Conduct Health and Hygiene inspections	SSHE Officer/Crew Doctor
5	Conduct Medical Facilities inspections	SSHE Officer/Crew Doctor

8.17.7 Implementation Schedule

The Occupational Health/Community Health Plan will be conducted during all phases of the project's operations. The personnel and infrastructure necessary for implementing the occupational health/community health plan will be established 2 weeks prior to project initiation and will be maintained until one month after project completion.

8.17.7.1 Audit's & Inspections

Audits: Organised and led by SSHE Team

Audit	Responsible Person (Leader)	Schedule	Reporting
1. Carry out SSHE Compliance audit in the locations.	SSHE Officer/Party Chief	Monthly	

2. Conduct Health and Hygiene audit	SSHE Officer/Crew Doctor	Monthly	Monthly occupational health and safety statistics have to be informed to "Factories and General Labour Laws Inspection Department".
3. Conduct Medical Facilities audit	SSHE Officer/Crew Doctor	Monthly	
4. Conduct audit on head office journey management system.	Vehicle Controller/SSHE Officer	Monthly	

Inspections

No	Action	Action Party	Schedule
1	Carry out inspection in location during site visit.	Party Chief/SSHE Officer	Monthly
2	Conduct inspection in sub-contractors worksite, maintenance workshop, sludge farm, waste yard, STOP and call of work.	Party Chief/SSHE Officer	Monthly
4	Conduct Health and Hygiene inspections	SSHE Officer/Crew Doctor	Monthly
5	Conduct Medical Facilities inspections	SSHE Officer/Crew Doctor	Monthly

8.17.8 Projected Budgets and Responsibilities

Budget

The budget for this program is USD 100,000

Responsibilities

Responsibilities for Audits and Actions is provided above.

8.18 Corporate Social Responsibility (CSR) Plan

8.18.1 Objectives

PTTEP SA recognises the fact that Corporate Social Responsibility (CSR) has emerged as an important approach for addressing the social and environmental impacts on its activities.

It is also committed to the wellbeing of the people and nation in countries where it operates which are relevant to its business and stakeholders.

8.18.2 Legal Requirements

PTTEP SA's commitment towards Corporate Social Responsibility (CSR), sponsorships and donations would aim to improve the overall socio- economic status in its areas of operation. This may include the following initiatives:

1. Encouraging and Promoting Education
2. Social Engagement & Community Development
3. Environmental Sustainability
4. Event/Program organized by relevant authorities
5. Promoting healthcare

8.18.3 Management Actions

PTTEP SA primary focus areas for CSR in MOGE-3 are as below:

1. Block MOGE 3 is located within Kanma Township and Thayet Township. During seismic survey, CSR was conducted in Kanma Township.
2. In 2015, public health care support was conducted in Taung bok kyi village and Ywa ma village.
3. Khahtein ceremony supported in Bawana Monastery.
4. Constructed religious hostel for Bawana Monastery.
5. Donated medical machines that were needed by the Thatyet Township Hospital. Cost 128 lakhs.
6. In 2016, public health care was conducted in 9 villages in Thayet Township.
7. During floods, donation provided for flood refugees.
8. Khahtein ceremony supported in Lay Htat Kyaung Monastery.
9. Donated 10 lakhs for four Buddha teaching centres.
10. Sanmagyi-oak pone village road was repaired.
11. Donations provided for sport matches held in Thayet township.
12. Donations provided for the football matches in the primary schools.
13. In 2017, public health care was conducted in 4 villages of Thayet Township.
14. The remaining villages from Kanma Township.
15. Khahtein ceremony supported in Sa lote Kyaung.
16. Khahtein ceremony supported in Ka Thet Pin Monastery.
17. Donation provided for the 130 year anniversary of Thayet Golf-course which is the first golf-course in Myanmar.
18. Donated a generator for the Baw village High School.

19. In 2018, plans to conduct public health care in 13 villages; finished Moe Nant Kone and Nga Bat Kya village. Now, planning with Thayet Township Hospital to conduct public health care once per village. One specialist from Thayet Hospital accompanied with public health care team in every village.
20. Khahtein ceremony planned in villages for 2018.
21. Donated for Myanmar New Year Festival (Thingyan) in Thayet.
22. Donated for the building of township's religious shrine.

8.18.4 Projected Budgets and Responsibilities

CSR activities will be completed for the entire the duration of the project into 2019. However, the CSR Budget is up to the approval from MOGE and the Regional Government for each year of CSR activities. Therefore, PTTEP SA will implement similar CSR activities in 2019 under the guidance and approval from MOGE and the Regional Government.

The PTTEP SA (MOGE-3) CSR plan and budget for 2018 is outlined below:

2018 Approved CSR Budget

Block	Area	Work Program	Budget
MOGE3	Operating Area & Vicinity	• Construction of public infrastructure or utility • Mobile Health Check Program • Community support and Emergency relief	140,000
	Other area	• Technical Capability building and Development Program	10,000
		Total Budget for MOGE3	150,000

PTTEP SA's core mission is to ensure that the CSR Plan of the organization is in line with the host government initiatives, vision and mission. Hence, it is highly likely that the CSR Plan and action items will be further revised subject to gradual engagement with the governing authorities to ensure that PTTEP SA's CSR plan is in line with the requirements of the Government of the Republic of the Union of Myanmar.

8.19 Land Lease/Acquisition Compensation Plan

8.19.1 Objectives

The objective of this plan is to provide the mechanism and approach for PTTEP SA to enter into land purchase or rental agreements for access roads, campsite and drill site. In cases where damage is caused, crop compensation will be provided.

The land on which the well sites and access roads will be constructed is privately owned. The land for the project sites and access roads will be leased from the owners as per mutual agreement between PTTEP SA, MOGE and the owners.

8.19.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- Myanmar Investment Law, 2016, Section 50 (d), 51 (a to f), 65 (e, f, g, i, j, k, l, m, o, p, q) and 73
- The Petroleum and Petroleum Products Law, 2017, Section 10 (a, d), 15, 16, and 31 (a, d)
- The Protection and Prevention of Antique Objective Law, 2015, Section 12
- The Protection and Prevention of Ancient Monument Law, 2015, Section 12, 15 and 20
- The Protection and Prevention of Cultural Heritage Area, 2015, Section 20, 23 and 29(b)
- Land Acquisition Act 1894
- The Vacant, Fallow and Virgin Lands Management Law, 2012, Section 16 and 19
- The Conservation of Water Resources and Rivers Law, 2006, Section 8, 11, 19 and 24
- Forest Law, 2018, Section 12(a)
- The Protection of Biodiversity and Conservation Areas Law, 2018, Section 39 (d, e) and 41 (a, b)

Land Acquisition or Lease will be carried out in a clear and transparent manner in accordance with national regulations through an MOGE approved land acquisition team. The Ministry of Electric and Energy will approve the acquisition/lease of the land and compensation to be paid to all landowners.

A land acquisition / lease team will be established to:

- evaluate the market price diligently for the acquisition and give away payment directly to the owners of the land acquired for the drilling operation under the permission of the local authority with a view to pay the reasonable price that is fully satisfied and agreed by the farmland owners.
- To achieve understanding and cooperation from the local community through engagements where the drilling programs and activities are clearly explained as well as the acquisition process.
- to carry out the acquisition exercise in accordance with the authorities' procedure and process.
- to ensure the payment is fair, reasonable and timely.
- to ensure the payment is paid directly to the affected parties.

8.19.3 Overview Maps and Site Layout

The land / lease compensation plan are the basecamp and wellsite areas. This also includes the proposed access roads. Please see **Figures 8-1 to 8-15**.

8.19.4 Management Actions

- ***Engagement Sessions with owners of proposed drilling sites*****:** To engage and explain to the local owners of proposed well sites from the affected villages by the team comprising of staff from Stakeholder Management Department in collaboration with MOGE officials. Agreement with farmland owner by signing MOU in front of officials.
- ***Survey and Recording for the proposed lands*****:** Before the staking the compensation team is to survey the affected land and crop, take record in the Form that PTTEP SA will use for recording the damage of land and/or crops and take photograph the well location and access road upon the consent and presence of the respective individual owner as well as the official from Township Agriculture Land Management and Statistics Department and the village administrative officials. And also Compensation team has to evaluate the fair market price for Land and Crop according to the proposed well locations.
- ***Acceptance and acknowledgement of the land owne*****r:** The team has to get all detail information about the land and crop in that land in the Primary Record book and later on will transfer these collected data into the form that "record the land and type of crops" and obtain agreement with signature and thumbprint of the owner on area of the land and crops in that land at the presence of the compensation team, village administrator and relevant Township Agriculture Land Management and Statistics Department officers. This data/record will be used in calculating the land acquisition / lease.
- ***Liaising with local Authorities and government departments*****:** The compensation team members seek confirmation on the price of the land and crops in proposed land area yield of the crops in that area from authorities of relevant townships, district and regional government. They are to liaise with the different levels of authorities to expedite the process by facilitating the efficient correspondence and engagement.

The Standing points for Clarification in Engagement Sessions

Understanding Farm Land Rule (2012): In order not to confuse the villagers the followings are to be clarified to the villagers;

- According to the farm land rule Chapter 8 , Para 67 (a)(b) , the affected farm land owner must be compensated not only for the price of farm but also for the price of crop . And also a farmland owner whose farm has unmovable things such as buildings , trees , water well etc… must be compensated as mentioned above.
- The compensation rate for farmland is decided by the Land and Crop Compensation Team .
- The Compensation rate for Crop of that farm is 3 times of appropriate and market prices decided by the Land and Crop Compensation Team.
- The Compensation rate for unmovable things such as buildings, water-well etc., is 2 times of market prices decided by the Land and Crop Compensation Team .
- The Compensation rate for perennial trees such as palm, toddy etc., is 3 times of market price decided by the Land and Crop Compensation Team.

Explaining to the villagers

The affected landowners are to be explained how the land will be measured and acquisition will be calculated and paid together with the samples of the forms. They also need to be explained the legal binding of the contract and they have no right to complaint after getting compensation.

Arrangement for Land Acquisition / Lease

- Report to Township Administrators on the mobilization and arrival of the team at site
- At the same time the team also has to seek information on the local market price and the yield of the crops produced in the area and price of the farm land, crops and trees from the respective township authorities
- Once the Township authorities has come up with the price of the farm land and market price of yield of the crops grown in the proposed land area, the team comprising the Township officials have to forward it to get the approval of the District Administrator on the said data.
- Afterwards, the counter approval from the District level has to be submitted to the relevant Regional Governments. The approved price of farmland and price of crops, trees by the Regional Government will be officially referred as final.
- Once the calculations are done based on the approved land and crop price and yield of the crop, the acquisition as listed in farm by farm are to be compiled and submitted to the Township Administrator (Chairman of Crop and Land Compensation Team) to proceed to give away the payment to the individual farm land owners.
- The completion of the compensation also has to report officially after of all payments are paid in hand to the owners of the land together with the signed receipts.
- *Although it is not a requirement of the Government, the compensation team introduces "Acceptance Deed" as per herewith attached with each and every villager upon their consent on the damage and satisfaction on the compensation clearly stating that the settlement is final.*

IMPLEMENTATION

Recording

The ownership of the proposed lands and crops are to be checked with the record of the Township Agriculture Land Management and Statistics Department official and verified by the village administrator. The type of crops really grown in the particular proposed land field is also to be recorded for calculation of the compensation.

Condition of the lands before Land acquisition are to be recorded by the Camera

- Following data are also to be recorded by the crop and land compensation team.
  - Name of the owner
  - NRC No
  - Father's name
  - Plot number
  - Field No
  - Ownership number

- Date

Setting payment the owners of acquired land

The primary data record Form, that recorded the affected persons personal data and his/her land and crops acquired, signed and thumb-printed and countersigned accordingly by the relevant representatives, are to be compiled into (3) original copies for each and every township and distributed to the followings;

- Township Administrator (Chairman of Compensation Team in his townships)
- Township Agriculture Land Management and Statistics Department
- PTTEP SA Copy

Once the payment is ready, after completing calculation and getting cash ready in hand, it is to notify to and request permission from the Township Administrator for official cash distribution.

Once the Township Administrator, who is also the Chairman of the compensation team, approves, together with one of his representative, the team has to go village by village and give away the payment directly in hand to the respective farm land owners as individuals.

The payment (money) will be put into individual envelopes with the name of respective farm land owners, then finally give away by the PTTEP SA Finance team.

Use of farmland by other means

After all the above procedures have been implemented, it is necessary to convert land use by other means according to Farm Land law Chapter 10, article 29 and article 30.

And also the need to comply with Farm Land rules Chapter 9, article 78. The Union Ministry or Nay Pyi Taw Council or region / state government which will implement the plan to use farm land by other means for planning work, for the sake of land term national interest.

(a) It shall be submitted to the Union Government with the approval of central farmland management committee.

(b) When getting the approval of Union Government, the planting may be implemented.

The need to get approval from central farmland management committee.

8.19.5 Monitoring Plans

The dispute resolution process will track claims and settlements. In addition a post audit of the land purchase/lease and compensation program will be conducted. This audit must be completed within one month of project completion.

8.19.6 Implementation Schedule

The land purchase/lease and compensation program must be implemented 6 months prior to the planned start of the exploration drilling program.

8.19.7 Projected Budgets and Responsibilities

Budget

USD 200,000

Responsibilities

1. According to the Production Sharing Contract of Onshore Block MOGE-3 in Thatyet Township, Thatyet District, Myanma Oil and Gas Enterprise (MOGE) and PTTEP South Asia Company submitted the letter for the approval of "the constituting of Land and Crop Compensation Committee" for exploration drilling as the agreement of Ministry of Electricity and Energy (MOEE). In Thatyet District Management Committee meeting No. (7/2018), decision section (11), sub-section (a) which was held on (16.3.2018), "the Land and Crop Compensation Committee" was permitted to constitute, and it include that_ the committee members that are assigned for compensation are to be systematic, no issues for the compensation process, no issue by becoming lass of administrative activities, to include village tract administrative and village's elders who are relative with the exploration wells and to stipulate the duties of the committee members. The person included in "Land and Crop Compensation Committee" are_

"Permit for the constitution of Land and Crop Compensation Committee (township)"

a)	U Tun Shwe	Township Administrative Officer Township General Administrative Department	Chairman
b)	Daw Aye Yu Maw	Regional (1)Parliament Member	Member
c)	U Zaw Moe Aung	Regional (2) Parliament Member	Member
d)	U Myint San	Township Officer Department of Agricultural Land Management And Statistics	Member
e)	U Tin Naing Oo	Staff Officer Department of Agriculture	Member
f)	U Win Khaing Phyoe	Staff Officer Forest Department	Member
g)	U Myint Hlaing	Village Tract Leader Padauk Pin Village Tract	Member
h)	U Pauk Hla	Local elder person Padauk Pin Village Tract	Member
i)	U Naing Oo	Village Tract Leader Innma Ngal Village Tract	Member
j)	U Maung Htoo	Local elder person Innma Ngal Village Tract	Member
k)	U San Kyaw	Village Tract Leader Yay Phyu Village Tract	Member
l)	U Khin Soe	Village Tract Leader Moe Nat Kone Village Tract	Member

m)	U Kyant Ngwe	Local Elder Person Moe Nat Kone Village Tract	Member
n)	U Phyoe Linn Aung	Village Tract Leader Ohn Mon Daw Village Tract	Member
o)	U Win Myint	Local Elder Person Ohn Mon Daw Village Tract	Member
p)	U Aung Htwe	Village Tract Leader Baww Village Tract	Member
q)	U Thein Win	Local Elder Person Baww Village Tract	Member
r)	Mr. Kanchit Jantarangsi (Exploration Project Manager, PTTEP SA)		Member
s)	U Kun Hlaing Myint	Geological Expert, PTTEP SA	Member
t)	U Phone Thet Khaing	Representative Officer, PTTEP SA	Member
u)	U Myo Min Soe	Representative Officer Myanma Oil and Gas Enterprise	Secretary

2. Therefore, committee members who are assigned for “Land and Crop Compensation Committee” have to be systematic for the performance of the activities, no issue for the process of compensation, no issue by becoming lass of administrative activities, no problem with farmers, measuring the affected land systematically and manage by complying the land laws.

9. PUBLIC CONSULTATION AND DISCLOSURE

9.1 Methodology and Approach

9.1.1 Purpose and Objectives

The primary objective of public consultation and disclosure is to maximize public understanding of the project through information distribution and exchange between the project proponent and the communities that might be affected directly or indirectly by the proposed project activities.

Stakeholder consultation is a process, which involves the two-way sharing of information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration. It allows stakeholders to understand the potential risks, impacts and opportunities of the project in order to achieve positive outcomes.

The main objectives of stakeholder consultation are:

- to ensure that adequate information is provided to those affected by a project;
- to provide these groups with sufficient opportunity to voice their opinions and concerns;
- to ensure that comments are received in a timely manner so that they can be taken into account in project decisions.

9.1.2 Approach

The main steps in a successful stakeholder consultation are the following:

- stakeholder identification and analysis, which consists of identification of the various individuals or groups who (i) are affected or likely to be affected (directly or indirectly) by the project, or (ii) may have a relevant interest in the project;
- stakeholder consultation plan, which defines how communication with the identified stakeholders will be handled throughout project preparation and implementation, including the type of grievance procedure envisaged;
- information disclosure, provides awareness and helps stakeholders understand the planned project and possible risks, impacts and opportunities of the project.

The comments and concerns of the stakeholders consulted during this EIA have been considered and incorporated into the project design and mitigation measures. This chapter presents the key findings from public consultation and disclosure. It also provides recommendations for future consultation to be implemented throughout the execution of the project.

Within the project area, 34 villages were identified for participation in the public involvement meetings in the potentially affected exploration drilling area located in Thayet Township, Thayet District under Magway Region.

9.1.3 Determining the Sample Sizes

The sample size for the socio-economic and opinion questionnaire survey was collected as follows:

(1) Within 1 km – no households present

(2) Nearby Villages – nearby potentially affected villages determined according to Yamane (1973) with the confidence level at 90% as following formula;

$n = \frac{N}{\left(1 + Ne^2\right)}$	where	n = Sample size N= Number of population – households in this study e = Level of precision at 0.1 in this study

Equation 1

From the above instructions the sample size was calculated as follows:

The project area consists of 34 villages with 4545 households (HH) total. Using **Equation 1** the minimum sample size in the area is:

$$n = \frac{4545}{1 + 4545\ (0.05)^2} \quad = \quad 368 \text{ samples}$$

The total number of samples obtained was 412. The number of samples collected exceeded the minimum for 95% confidence level.

9.1.4 Stakeholder Identification and Analysis

Stakeholder is 'any individual or group who may be directly or indirectly affected by the Project, as well as those who may have an interest in or influence over the project'. The objective of stakeholder identification is therefore to establish which organisations and individuals may be directly or indirectly affected (positively and negatively) by the Project ("affected parties") and those that may have an interest in the project ("other interested parties").

When identified, stakeholders are classified according to their importance to the success of the Project and their influence or potential impact over its implementation and outcome. Different issues are likely to concern different stakeholders, therefore stakeholders are grouped based on their connections to the project; having an understanding of the connections of a stakeholder group to the project helps identify the key objectives of consultation. The process of stakeholder mapping also aims to identify which stakeholder may have a positive or negative impact or influence on the project.

Mapping of stakeholders in the PTTEP SA Block MOGE-3 project area include:

Stakeholders	Likely interest/ Responsibilities
Farmers/Local Business	• Possible impact/benefit
Hand-Dug Well Operators	• Possible impact/benefit
Vulnerable Groups including landless farm labourers	• Possible impact/benefit
Government (Local - State and Regional)	
Chief Minister of Magway Region	• Administration
Member Ministers of Magway Region	
Ministry of Home Affairs	
General Administration Department	
District Commissioner/Administrator	

Stakeholders	Likely interest/ Responsibilities
Township Commissioner/Administrator	
Village Head	
Regional Police Force	
Township and District Police Officer	• Security and Civil jurisdictions
Government (Departments under concerned Ministry)	
Representative of Forestry Department under Ministry of Natural Resources and Environmental Conservation	• Protection, and conservation of the wildlife and sustainable management of the forest resources
Representative of Environmental Conservation Department under Ministry of Natural Resources and Environmental Conservation	• Responsible for implementing National Environmental Policy, strategy, framework, planning in the national sustainable development process. • Manage natural resources conservation and sustainable utilisation, and pollution control • Co-operate with other government organisations, civil society, private sectors and international organisations with environmental management.
Representative of Water Resources Utilization Department, Ministry Of Agriculture and Irrigation	• Provision of irrigation water by pumping water from rivers and streams and also utilization of groundwater to boosting crop production.
Representative of Township Agriculture Land Management and Statistics Department, Ministry of Agriculture and Irrigation	• The only government agency with the mandate to collect and disseminate agricultural statistics. SLRD's statistical activities include; • Monitoring the progress of land preparation and cropping; condition of weather and crops and crop forecasts, • Carrying out periodic crop surveys to compile data on farmers and farm size distribution • Taking annual inventory of agricultural machinery and implements • Compiling the annual Season and Crop Report which provides statistics on rainfall; land use; irrigation and flood protection; crop acreage, yield per acre and production; multiple cropping; inventory of agricultural machinery and implements.
Township Medical officer (TMO) Township Health Department or Township Hospital, Ministry of Health	• Provision of all health care services. • Collaboration with organizations such as WHO, UN and NGO etc.
Departmental Head of Labour Relations /Ministry of Labour	• Maintains peaceful workplace between the employer or employer organizations and the worker or the labour organizations
Fire Services Department, Ministry Of Social Welfare, Relief And Resettlement	• Protection and prevention of fire disaster and natural disaster
NGO / CSOs from Thayet Township	• Regional development and public services

9.2 Summary of Consultations and Activities Undertaken

9.2.1 Overview

Based on stakeholder mapping and information collected during EHS baseline discussions, this EIA has engaged the following stakeholder groups:

1. Directly affected Stakeholders including Village heads and villagers;
2. Hand-Dug Well Operators;
3. Non-Government Organizations; and
4. Authorities at the Thayet District and Township Level.

Public consultation allows for scoping of issues that are of significance to the communities. Their concerns can assist in identification of potential project impacts that are unique and specific to the communities where the project is situated. Similarly, recommendations from the affected communities on how to manage the potential impacts are essential in developing mitigation measures and management practices for eliminating/reducing negative impacts and enhancing positive impacts.

Consultations also maximize stakeholder understanding of the proposed project through information exchange between the project proponent and the communities that might be affected directly or indirectly by the proposed project activities.

9.2.2 Scoping Stage Public Consultation

PTTEP SA conducted a Courtesy Visit with Magway Regional Chief Minister on 12th January 2018 and Thayet District and Township Administrators on 15th January 2018 to ensure higher level aware of the proposed project and to get approval of project activities, EIA study and Public Consultation plan.

PTTEP SA together with IEM conducted the 1st stakeholder consultation from 5th to 8th February with local officials for Thayet Township and District, and conducted focus group meetings and surveys of with 34 villages at 4 village venue locations including Paput Village, Ohn Mun Daw Village, Baw Village, and Padauk Pin Village within the Thayet Township that are located closest to the potentially affected area. The detail schedule of public consultation schedules are shown in **Table 9-1**. Representatives from each of the 34 villages were invited to attend the meetings. Minutes of community meetings are provided in **Appendix 4**.

The villages selected are the closest sensitive receptors to the potentially affected well site areas. IEM's survey team consisted of the Senior Socio-Economic expert, two supervisors, and Myanmar local technicians who were trained by IEM.

The 1st Public Stakeholder consultation was conducted with local authorities and communities within the project area. Totally 814 people from 34 villages attended and involved in this Public Consultation. The stakeholder consultation included:

- Stakeholders Meeting/Focus Group Discussions with communities, non-governmental organizations (NGOs), international NGOs, and community interest groups in urban and rural areas;
- Key Informant Interviews with Thayet General Administrative Department (GAD), Forestry Department and City Development Committee (CDC) officials on environmental, social and historic & archaeological information.
- 412 opinion & attitude surveys were collected from 34 villages

From those interviewed, 88% agreed with the proposed project development, 7 % were unsure and 5% disagreed with the project development at this stage.

Table 9-1: 1st Public Consultation Schedule and Stakeholders

Date	Time	Meeting Venue	Stakeholders Covered/Villages	Attendance
5th February	09:30 – 11:30	Thayet Township Town Hall	1. Township & District Level Authorities 2. Forestry & ECD 3. NGOs 4. CSOs 5. Media	102
5th February	14:00 – 16:00	Padauk Pin village	1. Kyauk-O 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay	167
6th February	14:00 – 16:00	Baw village	1. Tazigauk (East) 2. Tazigauk (West) 3. Talokpin 4. Monatkon 5. Tat 6. Baw (North) 7. Baw (South) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon	214
7th February	14:00 – 16:00	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Ok Mun Daw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi	272
8th February	14:00 – 16:00	Paput Village	1. Ton 2. Paput 3. Paukuga	59

9.2.3 EIA Stage Public Consultation

PTTEP SA together with IEM conducted the 2nd stakeholder consultation from 24th to 26th April 2018 with local officials for Thayet Township and District, and conducted focus group meetings with 34 villages at 4 village locations including Paput Village, Ohn Mun Daw Village, Baw Village, and Padauk Pin Village within the Thayet Township as shown in **Table 9-2**. Representatives from each of the 34 villages were invited to attend the meetings similarly as 1st Public Consultation meetings. Totally 852 people from 34 villages attended the Public Consultation meetings. The minutes of meetings are provided in **Appendix 5**.

MOGE, PTTEP SA and IEM/EQM engaged with relevant Township Administrative Officers to discuss the public consultation plan and support needs. Once the public consultation schedule was agreed and assigned by Township Administrative Officers, IEM/EQM completed the Public Consultation Meetings to present the **draft preliminary EIA Report**, gather the suggestions/concerns from stakeholders for developing the appropriate Environmental Management Plan.

The stakeholder consultation included:

- Stakeholders Meeting/Focus Group Discussions with communities, non-governmental organizations (NGOs), international NGOs, and community interest groups in urban and rural areas.

Table 9-2: 2nd Public Consultation Schedule and Stakeholders

Date	Time	Meeting Venue	Stakeholders Covered/Villages	Attendance
24th April	09:00 – 11:00	Thayet Township Town Hall	1. Township & District Level Authorities 2. Forestry & ECD 3. NGOs 4. CSOs 5. Media	119
24th April	14:00 – 16:00	Baw village	1. Tazigauk (East) 2. Tazigauk (West) 3. Talokpin 4. Monatkon 5. Tat 6. Baw (North) 7. Baw (South) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon	229
25th April	09:00 – 11:00	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Ok Mun Daw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi	232
26th April	09:00 – 11:00	Padauk Pin village	1. Kyauk-O 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay	212
26th April	14:00 – 16:00	Paput Village	1. Ton 2. Paput 3. Paukuga	60

9.3 Results of Consultations

9.3.1 Scoping Stage Public Consultation

At the focus group meetings prior to conducting the opinion questionnaires, the villagers were informed that PTTEP SA was planning to conduct an exploration drilling program including drilling of four exploration wells in the area.

The exploration drilling program is to determine if any oil or gas is present. If no oil or gas is found the wells will be abandoned and the area returned the land to MOGE or land owner with agreeable conditions. When oil and gas is found from four exploration wells, then the development phase of oil and gas production will be commenced.

The villagers were informed that the focus group meetings and questionnaires were being conducted as part of an environmental, social and health impact assessment that is required to obtain approval for the project to proceed and to help guide PTTEP SA to reduce any potential impacts from the project.

The focus group meetings included the following agenda:

1. Opening of Public Consultation meeting
2. Introduction to PTTEP SA personnel
3. Introductory speech by MOGE representative U Myo Min Soe
4. Showing PTTEP Myanmar Asset Video
5. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA
6. Presentation about Drilling operation by U Wunna Win, Drilling Engineer
7. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins
8. Question and Answer

The presentation/discussion topics for public involvement and disclosure included, but not limited to:

- Objective of Public Consultation
- Overview of project description/information
- Methodology of drilling activities
- Sensitive existing environmental conditions.
- Key impact aspects
- Proposed project mitigation measures and monitoring program
- Compensation

MOGE assisted IEM/PTTEP SA by contacting local officials in each Township and village and made arrangements for our team to meet with them. MOGE too, participated in each focus group meeting and addressed those questions appropriate for the government to answer. The stakeholders at the township meeting and at the villages raised two main concerns as detailed in **Table 9-3**.

Table 9-3: Key Points from 1st Public Consultation Meetings

Question / Comment	Response	Mitigation Measures
The existing hand-dug operators requested if they could receive permission from PTTEP SA to continue their hand-dug operations within the block.	PTTEP SA and MOGE informed the stakeholders that most of the hand dug wells are producing from about 300 – 1200 ft and the prospect of PTTEP SA is at about 9000 – 15000 ft. Due to the different prospects, PTTEP SA will not disturb hand dug wells operations. PTTEP SA is also an operator company and operating under permission of Myanmar Investment Committee and Myanma Oil and Gas Enterprise. So, PTTEP SA has no authority for endorsement of hand dug wells within the block.	• PTTEP SA will not disturb hand dug wells operations. • PTTEP SA to design well site areas to avoid hand dug well sites areas.

Compensation was a concern regarding landowner having no evidence form such as Land Registration Form No (7).	Regarding compensation, villagers were informed that according to the decision and recommendation of village administer and village elders, the land compensation committee will be mechanism to address any compensation issues.	• Transparent and fair compensation to land owners and users • Ensure all permissions are obtained from landowners and local authorities. Notify surrounding landowners in advance before on location and time of project activities.

The photographs of the 1st public consultation are detailed in **Figure 9-1**.

Public Consultation at Administrative office, Thayet Township

Presentation at Administrative office Meeting, Thayet Township

Focus Group Meeting and Questions in Padauk Pin Village

Presentation during Focus Group Meeting in Baw Village

Meeting / Questions in Ohn Mun Taw Village

Presentation in Parput Village

Figure 9-1: Photographs of First Public Consultation Meetings

9.3.2 EIA Phase Public Consultation

The second public consultation meetings were completed in April 2018. The second public consultation meetings purpose is to present the draft preliminary EIA report including potential impact and mitigation measure to the stakeholders.

The second public consultation meetings were arranged in the same Township and Villages locations as the first Public Consultation. MOGE, PTTEP SA and IEM/EQM engaged with relevant Township Administrative Officers to discuss the public consultation plan and support needs. Once the public consultation schedule is agreed and assigned by Township Administrative Officers, IEM/EQM completed the Public Consultation Meetings to present the **draft preliminary EIA Report**, gather the suggestions/concerns from stakeholders for developing the appropriate Environmental Management Plan.

The stakeholders at the EIA phase public consultation at the township meeting and at the villages raised similar concerns as the 1st public consultation. They key issues, concerns and recommendations are as follows:

Table 9-4: Key Points from 2nd Public Consultation Meetings

Question / Comment	Response	Mitigation Measures
Monitoring - Who will monitor and check the PTTEP SA environmental performance activities as the third parties?	For monitoring, the villagers were informed that PTTEP SA have to report these activities to the ECD every six month. Magway Regional ECD and other government organization will come and check our operation if necessary as the third party.	• Regular Monitoring Reports will be submitted to ECD as per the requirements of the Environmental Conservation Law and EIA procedure.
Employment – Job opportunities for local people.	Technical skilled workers especially for drilling will be foreigners or from other places will be employed in the project implementation. PTTEP SA will note the suggestions and plan to employ local workers as a first priority.	• Consult with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons. • Employ qualified local workers for some position. • Encourage contractor to recruit local unskilled and semi skilled workforce.
Land Compensation – How will PTTEP SA pay compensation for lands? Please pay reasonable prices.	Land acquisition committee (local authority, MOGE and PTTEP personnel including land record department) will handle land compensation issue.	• Transparent and fair compensation to land owners and users • Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE.
Road construction – What is the road construction plans?	PTTEP SA indicated that the width of the road is about 8 meters (including shoulders and channel for rain water flow). PTTEP SA can only build roads with the permission of the Village Road and Bridge Association and Land Compensation Committee.	• PTTEP SA will obtain the permission of the Village Road and Bridge Association and Land Compensation Committe. • The Township Administration Office will be conducted a field survey for requested lands and roads.
Hand-dug operations - How PTTEP SA will manage if PTTEP SA drilling area is overlap with hand dug wells operations?	PTTEP SA noted that their drilling will not affect local self-employed drilling because the depth that we will drill is over 10,000 ft. PTTEP SA will not disturb hand dug wells operations.	• PTTEP SA will not disturb hand dug wells operations. • PTTEP SA to design well site areas to avoid hand dug well sites areas.
CSR - What is the CSR Plan?	PTTEP will implement a CSR program for the next drilling activities.	• PTTEP SA to implement their planned CSR program
Road Safety – The increase in traffic will cause a road hazard to local areas.	PTTEP SA has a SSHE Policy and Procedure. The villagers can inform PTTEP SA representative on site if drivers don't follow requirements.	• Provide traffic signs or flags at junction of access roads and main roads. • Strictly enforce training programs to reduce transport incident cases by its contractors. • PTTEP SA will conduct Road Hazard Assessment before transporting any large equipment.

The photographs of the 2nd public consultation are detailed in **Figure 9-2.**

Consultation at Administrative Hall, Thayet Township	Presentation at Administrative Hall, Thayet Township
Meeting / Presentation in Padauk Pin Village	Presentation in Baw Village
Questions / Answer in Ohn Mun Taw Village	Questions / Answer in Parput Village

Figure 9-2: Photographs of 2nd Public Consultation Meetings

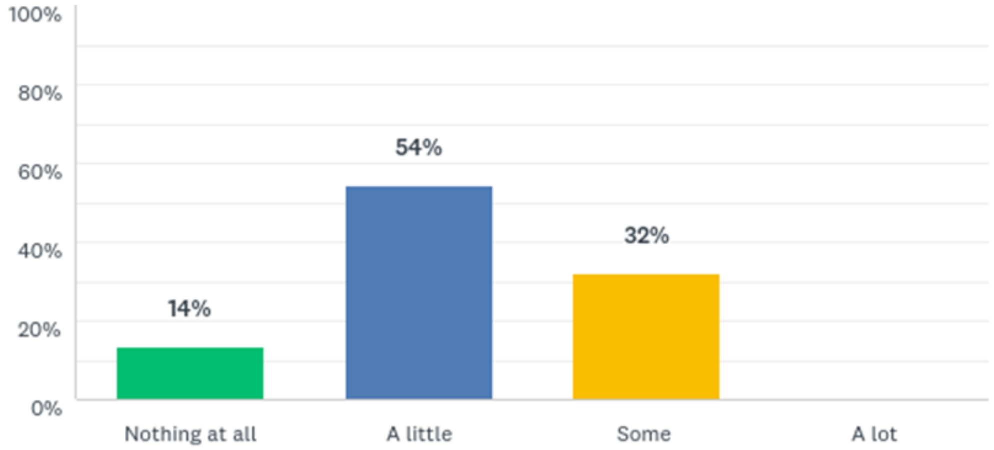
9.3.3 Public Opinions about the Project in the Development Area

9.3.3.1 The Project

Obtaining opinions was designed to collect information and opinions on the prospective impacts before the project commencement.

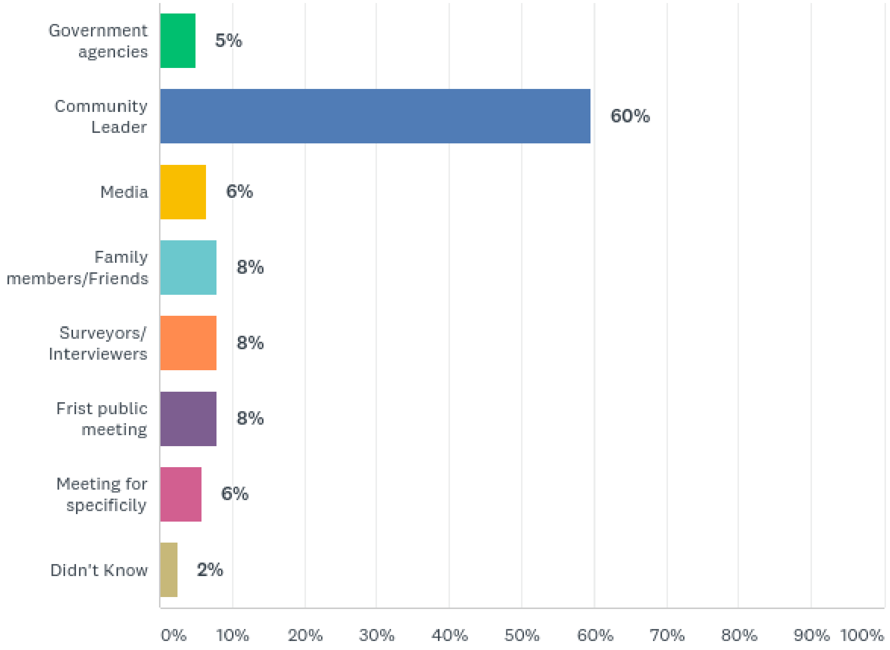
From the villagers interviewed, 32% had some previous knowledge of the project, while 54% had a little knowledge of the project and 14% had no previous knowledge about the project.

Chart 9-1: How much do you know about this project?



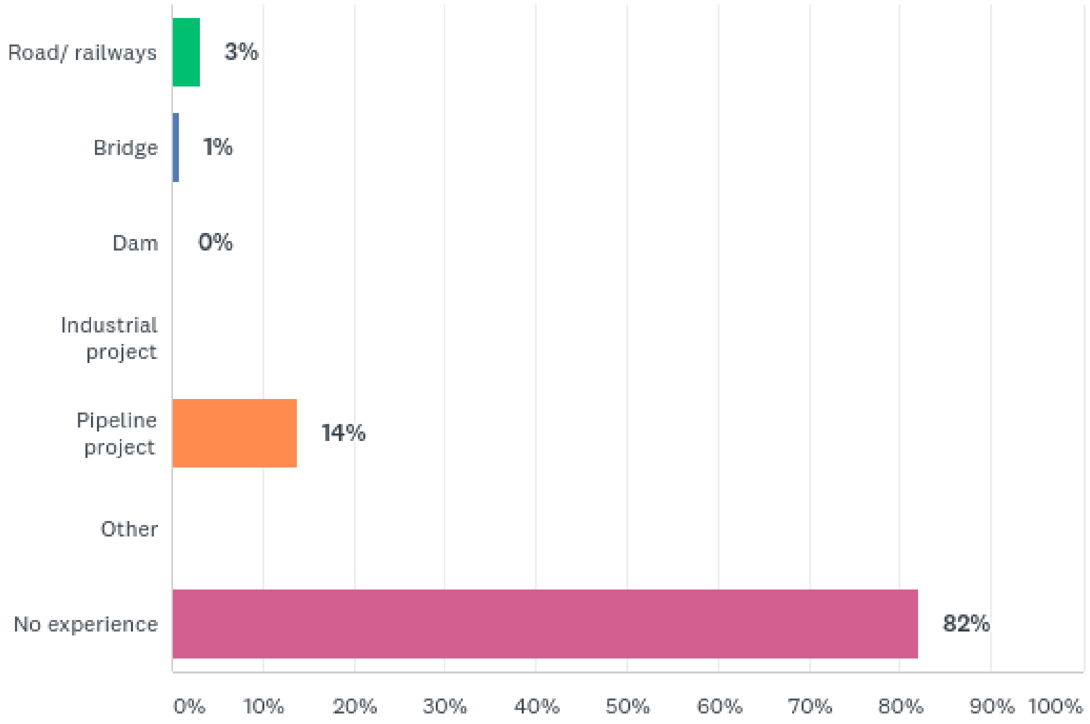
The majority of villagers learned of the project from community leaders (60%).

Chart 9-2: How did you know about this project?



The majority (82%) of villagers indicated that they had no experience with other project development before, while 14% had experience with the pipeline projects, 3% had experience with road / railways and 1% with bridge development.

Chart 9-3: What kinds of other projects did you experience before?



Villagers indicated that project developments had no effect (47%), and positive effect (49%) and a negative effect (3%).

Chart 9-4: How did it affect your community?

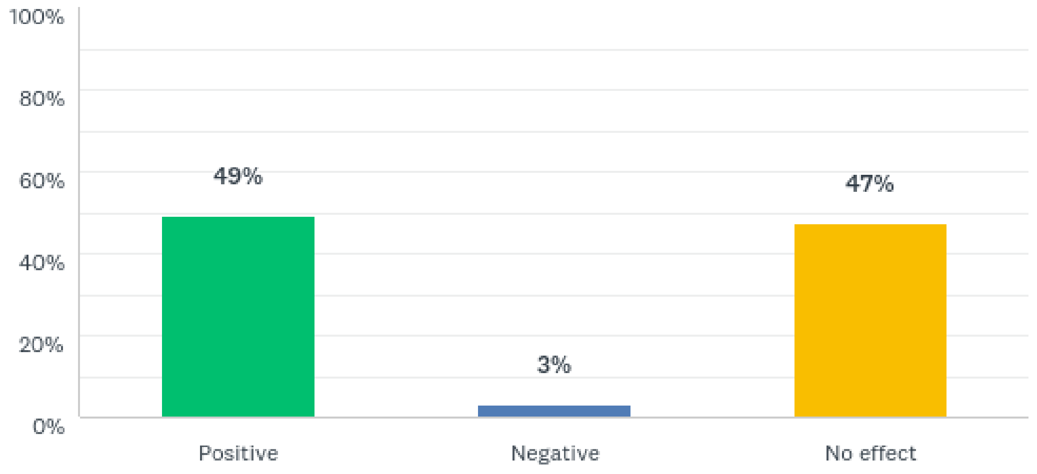


Chart 9-5: If a project negatively affected your community, were you able to lodge complaints?

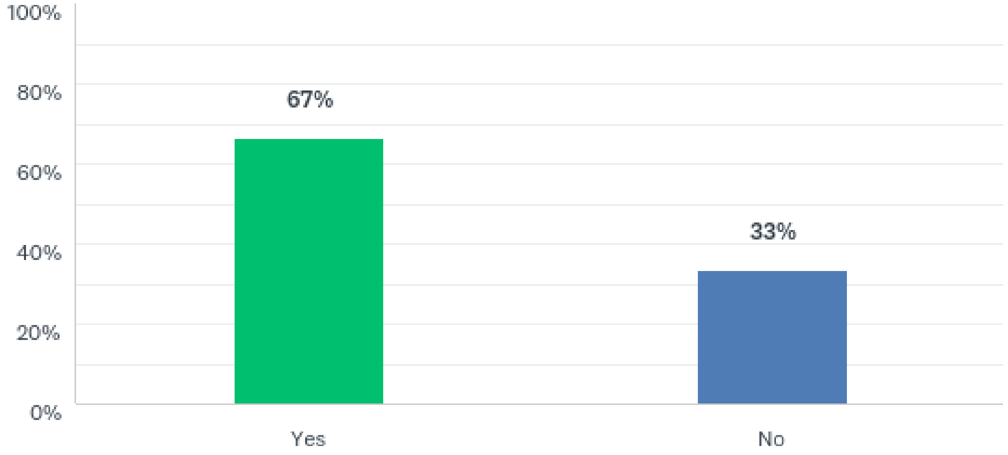
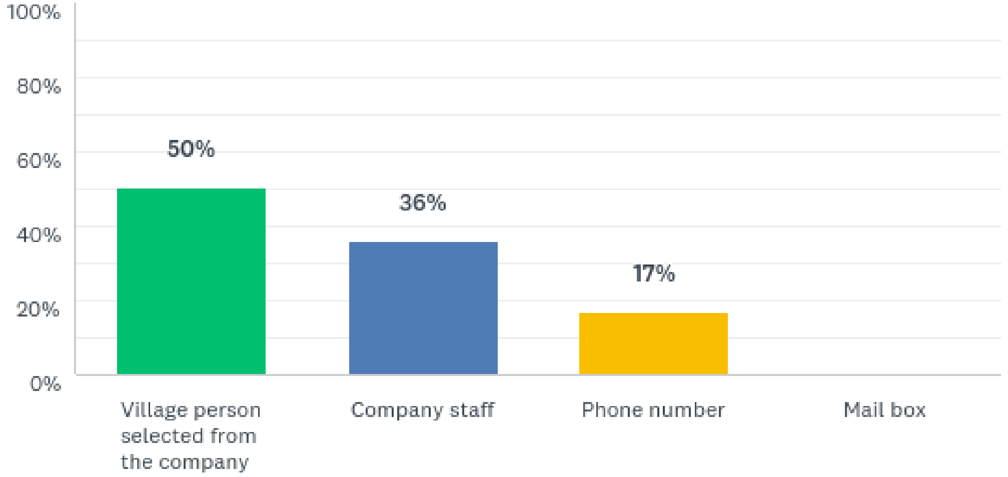


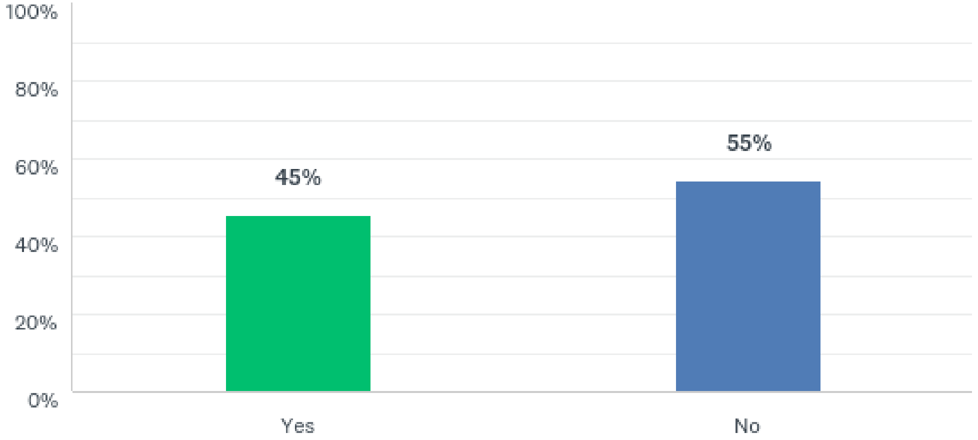
Chart 9-6: What would be the channel through which you would prefer to lodge a complaint?



9.3.3.2 *Compensation*

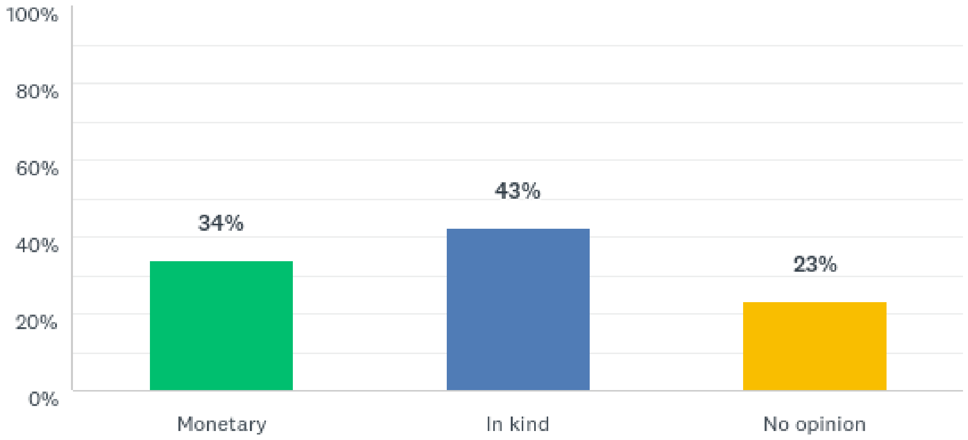
Most villagers (55%) had not received compensation from project developments.

Chart 9-7: Have you received compensation related to impacts from a development project?



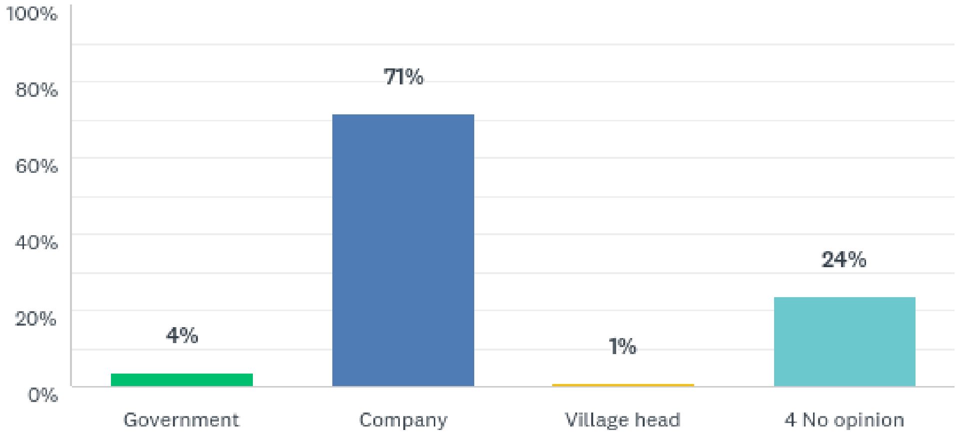
Of those that received compensation, 43% had received monetary compensation, 34% had received monetary compensation and 23% had no opinion.

Chart 9-8: What was the type of compensation?



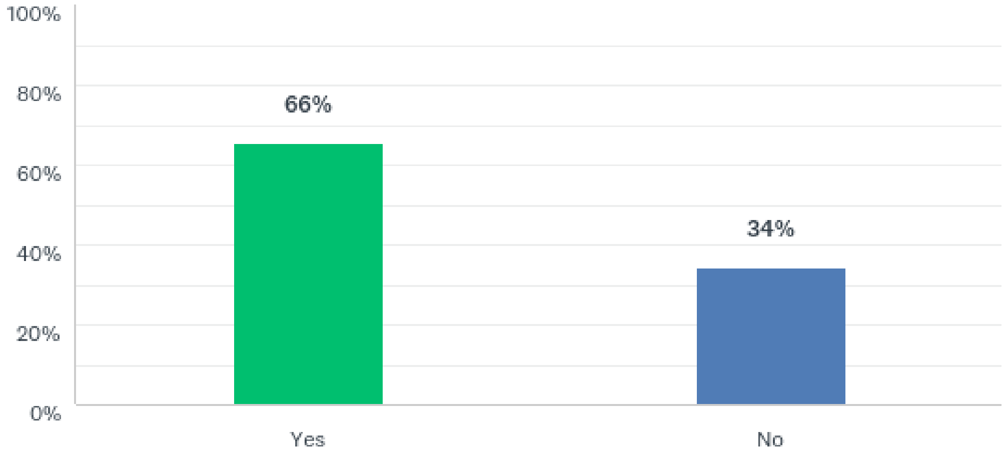
Of those that received compensation, 71% had received the compensation directly from the company, 24% had no opinion, 4% from government and 1% from village head.

Chart 9-9: From whom did you receive compensation?



The majority of those who received compensation (66%) were satisfied with the compensation received and 34% were not satisfied.

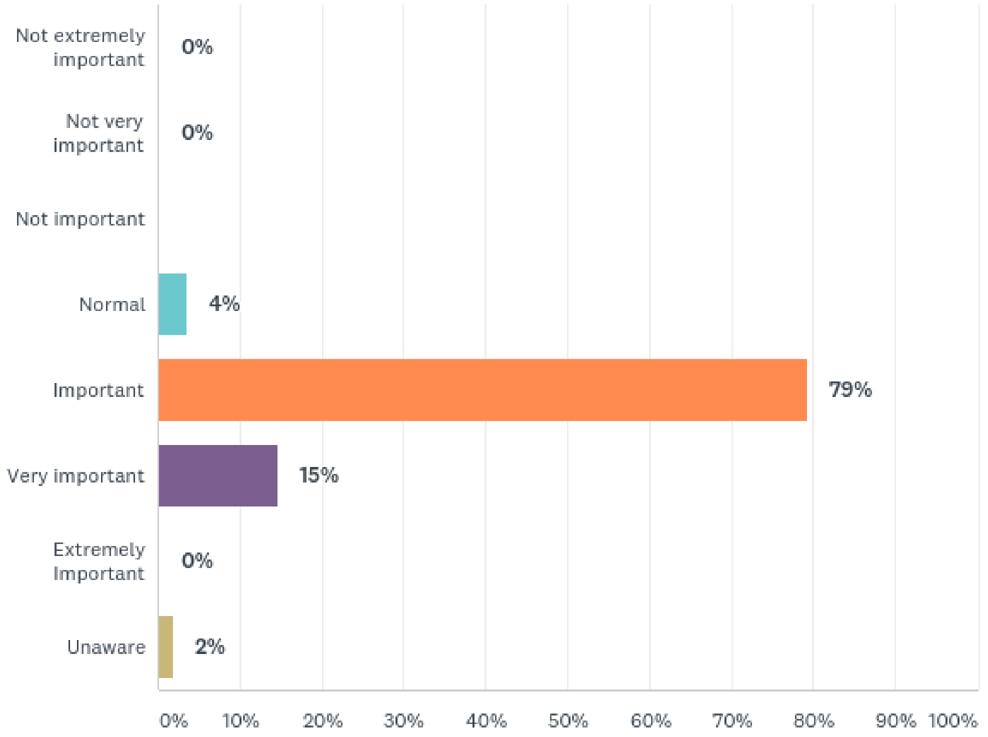
Chart 9-10: Were you satisfied with the compensation?



9.3.3.3 Development Interests

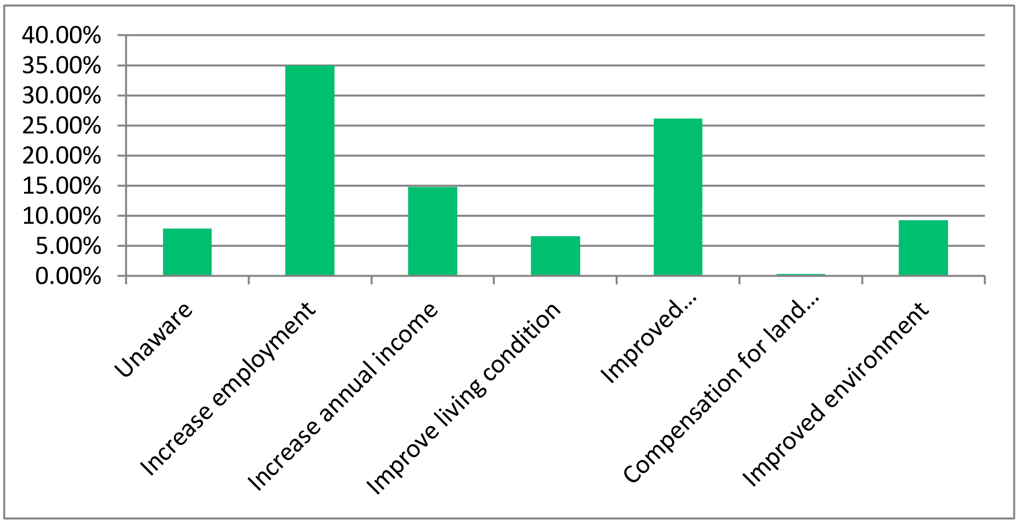
Of those interviewed, 79% considered oil and gas drilling to be important to the community.

Chart 9-11: How important will oil and gas drilling be to this community?



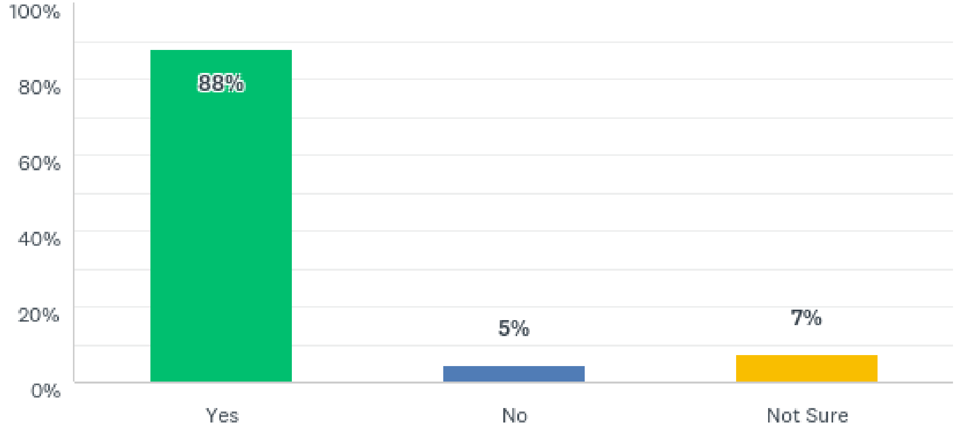
Villagers anticipated increased employment (35%), improved transport / infrastructure (26%), and increase annual income (15%) as the three main positive impacts from the project.

Chart 9-12: What positive impacts of the project do you anticipate?



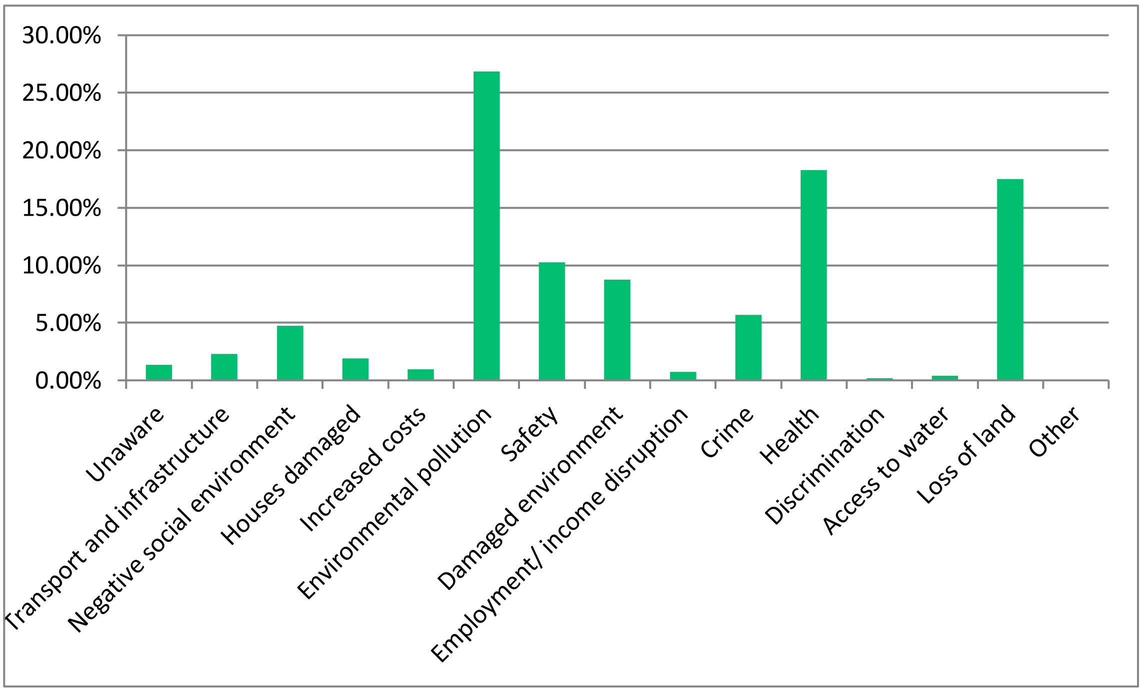
Of those interviewed, 88% agree with the proposed project development, 7 % were unsure and 5% disagreed with the project development.

Chart 9-13: Do you agree with the project development?



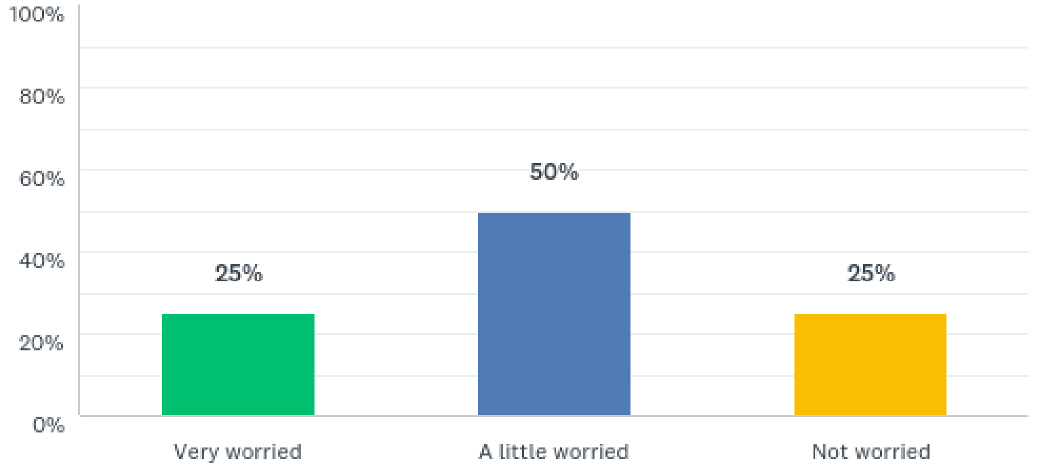
Most of the villagers (27%) concerned about possible environmental pollution, while 18% are concerned about health, and 17% are concerned about loss of the land as the three main negative impacts from the project.

Chart 9-14: What are the three most negative impact of the project that you are concerned about?



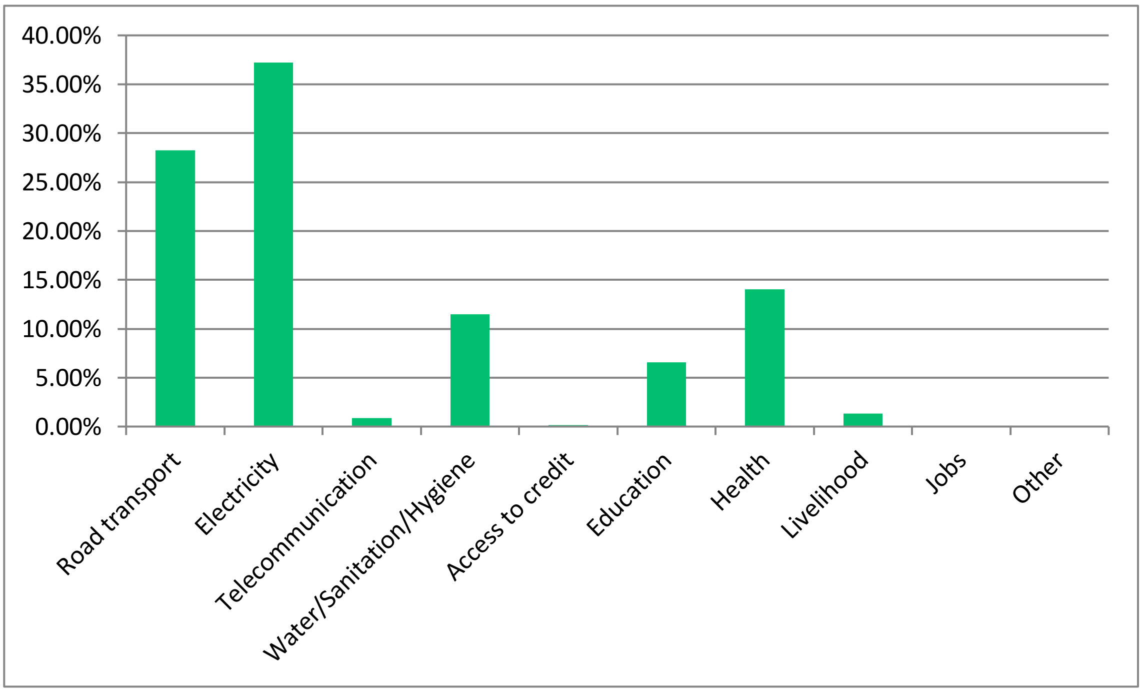
Half of the participants (50%) are a little worried about labour in-migration, while 25% are very worried and 25% are not worried about worker during the construction and maintenance of the project.

Chart 9-15: Are you concerned about outside people coming to your village/community to work on construction and maintenance of the project?



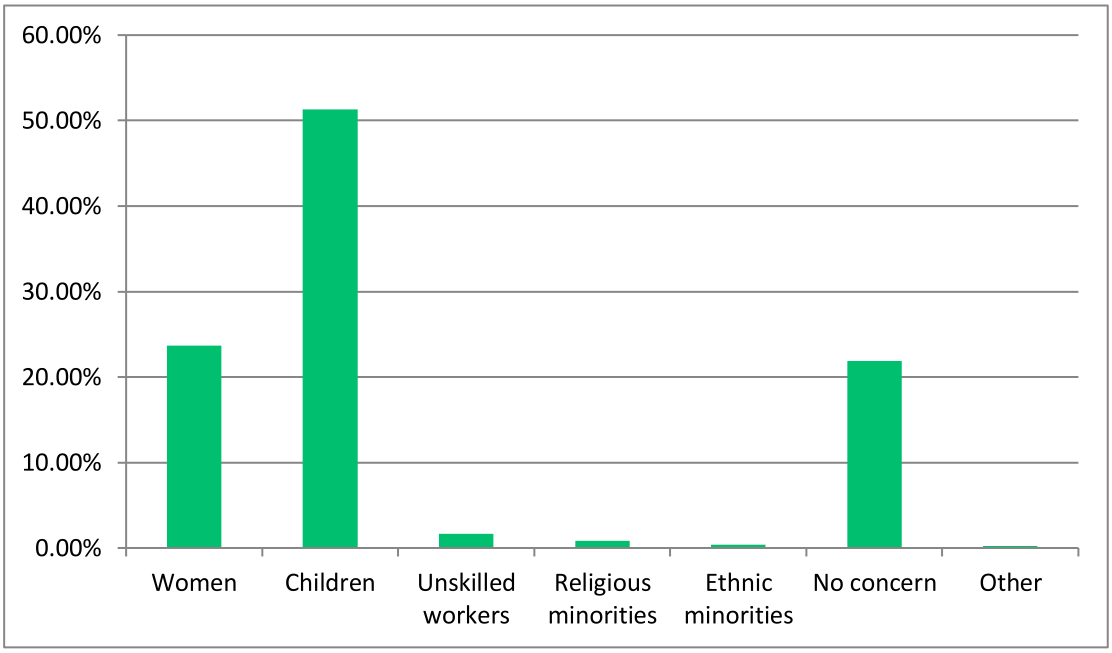
Villagers (37%) consider electricity as a priority development initiative, while 28% consider road transport and health (14%) as their second and third priorities.

Chart 9-16: What is the development priority for your community?



Groups of possible concern are children (51%), women affected from the project (24%) and No concern (22%), unskilled workers, religious and ethnic minorities accounted for the remaining 3% of responses

Chart 9-17: Which three groups or categories are likely to be most negatively affected from the project?



9.3.4 Perceptions of the potential Impacts of the project.

To allow subjective data to be quantified, the stakeholders' perceptions about the project and its impacts are quantified using a ranking system. The interviewees are asked to score their perceptions as to whether they felt that the proposed activities would have a positive or negative impact on 34 issues.

The answer ranks attitude in 7 levels from extremely negative to extremely positive (of scale -3 to +3). Minus scales imply negative attitude, while plus scales indicate the opposite. Zero indicates a neutral perception regarding impacts from the project. The ranking system is outlined in **Table 9-5**.

Table 9-5: Ranking System

Negative Attitude	Neutral Attitude	Positive Attitude
-1 Slightly Negative	0 No Effect	+1 Slightly Positive
-2 Negative	-	+2 Positive
-3 Very Negative	-	+3 Very Positive

Attitude responses, both positive and negative, were deemed significant based on the criteria outlined in **Table 9-6**.

Table 9-6: Significant Criteria

Significant scores are highlighted in red in Table 1 if response greater than:	
Criteria	**Response (%)**
-3, +3	5%
-2, +2	10%
-1, +1	15%
0	20%

The attitude survey results identify the perceptions of the level of impact potentially caused by the planned development activities. This assists the company to understand how the stakeholders view the project. If responses to certain issues are determined to be significant, then they should be further addressed to ensure that the public have factual information about the project and clearly understand the likely effect of the project.

When read a statement describing the planned project, the interviewees were asked their perceptions about the positive and negative impacts of the project. Those perceptions determined to be significant perceived to be negative or positive impacts are highlighted in the **Table 9-7** below.

Table 9-7: Perceptions of Potential Impacts of the Project in Block MOGE-3

Those highlighted below are considered significant values.

	Very negative	Negative	Slightly negative	No effect	Slightly positive	Positive	Very positive
Soil quality	11.4%	13.1%	14.8%	60.8%	0.0%	0.0%	0.0%
Surface water quality	1.0%	24.8%	14.3%	60.0%	0.0%	0.0%	0.0%
Ground water quality	0.2%	24.2%	13.8%	61.7%	0.0%	0.0%	0.0%
Air quality	0.0%	2.4%	34.6%	62.7%	0.2%	0.0%	0.0%
Noise	0.2%	1.9%	32.7%	64.9%	0.2%	0.0%	0.0%
Forestry and conservation areas	20.1%	3.2%	5.6%	71.2%	0.0%	0.0%	0.0%
Agriculture / Farming areas	4.4%	21.1%	9.5%	64.6%	0.5%	0.0%	0.0%
Local animals	0.7%	2.7%	24.0%	72.4%	0.2%	0.0%	0.0%
Pasture	0.0%	8.2%	20.3%	71.4%	0.0%	0.0%	0.0%
Aquatic animals	0.0%	0.5%	4.4%	94.9%	0.2%	0.0%	0.0%
Local Fisheries	0.0%	0.0%	1.0%	98.8%	0.2%	0.0%	0.0%
Local Livestock	0.0%	0.0%	17.4%	77.0%	5.3%	0.2%	0.0%
Local Vegetation	0.2%	6.8%	19.4%	72.9%	0.7%	0.0%	0.0%
Local Industry	0.0%	0.5%	5.3%	85.2%	7.3%	1.7%	0.0%
Local Transportation	0.0%	0.2%	1.0%	61.2%	8.7%	28.4%	0.5%
Local Price	0.0%	0.0%	1.2%	85.5%	10.2%	2.9%	0.2%
Recreation	0.0%	0.0%	0.5%	74.6%	8.0%	17.0%	0.0%
Local Economy	0.0%	0.0%	0.7%	70.7%	8.5%	19.9%	0.2%
Housing	0.0%	0.5%	1.2%	65.1%	31.5%	1.7%	0.0%
Health	0.2%	2.4%	3.4%	62.2%	28.6%	2.9%	0.2%
Education	0.0%	1.0%	1.2%	65.1%	29.1%	3.6%	0.0%
Spiritual	0.0%	0.5%	2.9%	93.0%	2.7%	1.0%	0.0%
Safety	0.7%	15.5%	13.8%	67.6%	2.4%	0.0%	0.0%
Crime	0.2%	18.9%	9.2%	68.8%	2.7%	0.2%	0.0%
Family Structure	0.0%	1.0%	7.5%	87.1%	2.9%	1.5%	0.0%
Job opportunities	0.0%	0.2%	1.7%	62.7%	10.5%	24.4%	0.5%
Income	0.0%	0.7%	2.2%	62.7%	8.5%	25.7%	0.2%
Scenery	0.0%	12.8%	5.3%	70.9%	8.0%	2.9%	0.0%
Access to land	0.2%	15.0%	12.8%	70.0%	1.2%	0.7%	0.0%
Corruption	0.0%	3.9%	19.9%	75.2%	0.7%	0.2%	0.0%
Local Culture	0.2%	0.7%	21.8%	75.1%	1.9%	0.2%	0.0%
Religious Building	0.0%	3.4%	19.7%	73.5%	2.7%	0.7%	0.0%
Cemetery	0.0%	0.0%	18.5%	79.9%	1.5%	0.2%	0.0%
Historic buildings / sites	0.0%	2.7%	21.1%	73.3%	1.9%	1.0%	0.0%

The villagers surveyed perceive that the project may have a very negative impact on soil quality and forestry and conservation areas. Other significant issues that were perceived as receiving a negative impact are soil quality, surface water quality, ground water quality and agriculture / farming areas. Significant issues that were perceived as receiving a positive impact from the project are local transportation, recreation, local economy, job opportunities and income.

The company should address these issues and provide accurate information to the public prior to project initiation. If stakeholders understand the likely effects and have realistic expectations, it will reduce the risk of negative perceptions, and/or high expectations from project benefits and therefore increase project manageability.

9.4 Further Ongoing Consultation

Before operations begin, additional public consultations and disclosure prior to project implementation are required. This will be initiated in advance before the exploration drilling program is started. Once the project is initiated and throughout project execution a communication process and schedule must be defined. Consultations conducted early on prior to project commencement will assist to ensure that the concerns of the stakeholders are considered, and that mitigation measures are developed to address them.

Similarly, ongoing stakeholder consultations throughout project execution are essential in order to identify and address new impacts, as well as assess the effectiveness of mitigation measures through stakeholder comments and complaints. Overall, stakeholder consultations promote increased understanding between the project owner and affected communities, resulting in stakeholder acceptance of the project.

A Grievance Mechanism has been established in the form of Complaint Process that is provided in the EIA / SIA Management Plan. A Stakeholder Consultation Log will be kept to document all consultation carried out throughout the entire life cycle of the project. An External Relation Officer will be appointed to facilitate the grievance process and also to provide information/clarification to the local community.

Stakeholder consultations throughout project implementation (construction, operation, and decommissioning) will be handled through the Stakeholder Involvement Program as provided in **Chapter 8: Environmental Management Plan**.

9.5 Disclosure

The project disclosure required for the EIA was conducted in compliance with EIA Procedure. PTTEP SA Myanmar will disclose the planned project via PTTEP SA website and at PTTEP SA Yangon Office. In addition copies of the submitted EIA will be provided to the Township Administrative Office.

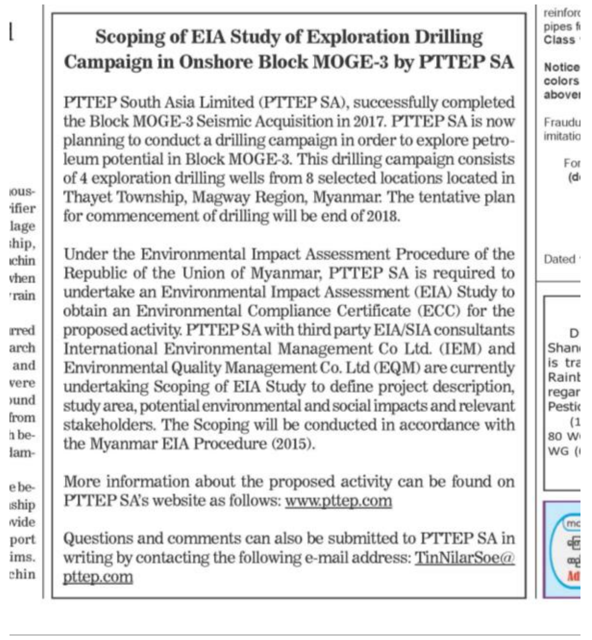
Project disclosure was undertaken during the EIA at various stages. The 1st disclosure was completed during the Scoping of EIA Study for Onshore Block MOGE-3 Exploration Drilling Campaign via the PTTEP SA website (https://www.pttep.com/en/Sustainabledevelopment/Business/Capitalproject management.aspx) and with a public notice of Myanmar and English Languages through a Myanmar Government Newspaper. (**Figure 9-3**)

The 2nd PC Disclosure at the EIA Phase via the PTTEP SA website and with a public notice of Myanmar and English Languages through a Myanmar Government Newspaper. (**Figure 9-4**)

The 3rd project disclosure will be announced after the Submission of EIA Study of Onshore Block MOGE-3 Exploration Drilling Campaign via the PTTEP SA website and with a public notice of Myanmar and English Languages through a Myanmar Government Newspaper.

In addition copies of the submitted EIA will be provided for public viewing at the following locations:

- PTTEP SA's office in Yangon: 3rd Floor, Vantage Tower, 623 Pyay Road, Kamayut Township 11041, Yangon, Myanmar.
- Environmental Conservation Department, Magway Region
- Thayet District General Administrative Department Office, Magway Region
- On PTTEP SA's website as follows: www.pttep.com



Scoping of EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3 by PTTEP SA

PTTEP South Asia Limited (PTTEP SA), successfully completed the Block MOGE-3 Seismic Acquisition in 2017. PTTEP SA is now planning to conduct a drilling campaign in order to explore petroleum potential in Block MOGE-3. This drilling campaign consists of 4 exploration drilling wells from 8 selected locations located in Thayet Township, Magway Region, Myanmar. The tentative plan for commencement of drilling will be end of 2018.

Under the Environmental Impact Assessment Procedure of the Republic of the Union of Myanmar, PTTEP SA is required to undertake an Environmental Impact Assessment (EIA) Study to obtain an Environmental Compliance Certificate (ECC) for the proposed activity. PTTEP SA with third party EIA/SIA consultants International Environmental Management Co Ltd. (IEM) and Environmental Quality Management Co. Ltd (EQM) are currently undertaking Scoping of EIA Study to define project description, study area, potential environmental and social impacts and relevant stakeholders. The Scoping will be conducted in accordance with the Myanmar EIA Procedure (2015).

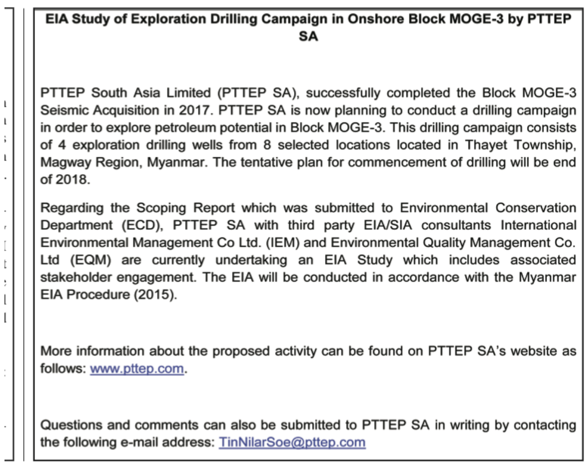
More information about the proposed activity can be found on PTTEP SA's website as follows: www.pttep.com

Questions and comments can also be submitted to PTTEP SA in writing by contacting the following e-mail address: TinNilarSoe@pttep.com

PTTEP SA ကုမ္ပဏီမှဆောင်ရွက်လျက်ရှိသည့်
ကုန်းတွင်းလုပ်ကွက် အမှတ် MOGE-3 ရှိ
တူးဖော်ရေးလုပ်ငန်းစဉ်များအတွက်
ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း၏
နယ်ပယ်အတိုင်းအတာ သတ်မှတ်ခြင်း

English Language Disclosure Statement at Scoping Phase	Myanmar Language Disclosure Statement at Scoping Phase

Figure 9-3: Scoping Phase Disclosure Statements



EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3 by PTTEP SA

PTTEP South Asia Limited (PTTEP SA), successfully completed the Block MOGE-3 Seismic Acquisition in 2017. PTTEP SA is now planning to conduct a drilling campaign in order to explore petroleum potential in Block MOGE-3. This drilling campaign consists of 4 exploration drilling wells from 8 selected locations located in Thayet Township, Magway Region, Myanmar. The tentative plan for commencement of drilling will be end of 2018.

Regarding the Scoping Report which was submitted to Environmental Conservation Department (ECD), PTTEP SA with third party EIA/SIA consultants International Environmental Management Co Ltd. (IEM) and Environmental Quality Management Co. Ltd (EQM) are currently undertaking an EIA Study which includes associated stakeholder engagement. The EIA will be conducted in accordance with the Myanmar EIA Procedure (2015).

More information about the proposed activity can be found on PTTEP SA's website as follows: www.pttep.com.

Questions and comments can also be submitted to PTTEP SA in writing by contacting the following e-mail address: TinNilarSoe@pttep.com

English Language Disclosure Statement at EIA Phase

EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3 by PTTEP SA

Myanmar Language Disclosure Statement at EIA Phase

Figure 9-4: EIA Phase Disclosure Statements

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Appendix 1

IEM & EQM Registrations

REPUBLIC OF THE UNION OF MYANMAR

Ministry of Natural Resources and Environmental Conservation

CERTIFICATE FOR TRANSITIONAL CONSULTANT REGISTRATION

(ကြားကာလအကြံပေးလုပ်ကိုင်သူမှတ်ပုံတင်ခြင်းအထောက်အထားလက်မှတ်)

No. 0011 Date 01 JUL 2017

The Ministry of Natural Resources and Environmental Conservation, hereby, issues this certificate to the organization under Environmental Impact Assessment Procedure, Notification No. 616/2015.

(ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမိန့်ကြော်ငြာစာအမှတ်၊ ၆၁၆/၂၀၁၅ အရ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသည် ဤအထောက်အထားလက်မှတ်ကို အဖွဲ့အစည်းအား ထုတ်ပေးလိုက်သည်။)

(a)	Name of Organization (အဖွဲ့အစည်းအမည်)	International Environmental Management Co. Ltd.
(b)	Name of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ အမည်)	Mr. Ronald David Livingstone
(c)	Citizenship of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ နိုင်ငံသား)	Canadian
(d)	Identity Card /Passport Numberof the representative person in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ မှတ်ပုံတင်/နိုင်ငံကူးလက်မှတ်အမှတ်)	HG068880
(e)	Address of organization (ဆက်သွယ်ရန်လိပ်စာ)	No. 148/B, Dhamma Zedi Road, Bahan Township, Yangon ron@iem-global.com , www.iem-global.com
(f)	Type of Consultancy (အကြံပေးလုပ်ကိုင်မှုအမျိုးအစား)	Organization
(g)	Duration of validity (သက်တမ်းကုန်ဆုံးရက်)	31 March 2018

Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Areas of Expertise Permitted
(ခွင့်ပြုသည့် ကျွမ်းကျင်မှုနယ်ပယ်များ)

1. Ecology and Biodiversity
2. Socio-Economy
3. Biology and Environmental management,
   Risk Assessment
4. Geotechnical and Environmental Engineering
5. GIS
6. Marine Science

REPUBLIC OF THE UNION OF MYANMAR

Ministry of Natural Resources and Environmental Conservation

CERTIFICATE FOR TRANSITIONAL CONSULTANT REGISTRATION

(ကြားကာလအကြံပေးလုပ်ကိုင်သူမှတ်ပုံတင်ခြင်းအထောက်အထားလက်မှတ်)

No. 0009 Date 04 JUL 2017

The Ministry of Natural Resources and Environmental Conservation, hereby, issues this certificate to the organization under Environmental Impact Assessment Procedure, Notification No. 616/2015.

(ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမိန့်ကြော်ငြာစာအမှတ်၊ ၆၁၆/၂၀၁၅ အရ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသည် ဤအထောက်အထားလက်မှတ်ကို အဖွဲ့အစည်းအား ထုတ်ပေးလိုက်သည်။)

(a)	Name of Organization (အဖွဲ့အစည်းအမည်)	Environmental Quality Management Co., Ltd. (EQM)
(b)	Name of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ အမည်)	Dr. Ohnmar May Tin Hlaing
(c)	Citizenship of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ နိုင်ငံသား)	Myanmar
(d)	Identity Card /Passport Numberof the representative person in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ မှတ်ပုံတင်/ နိုင်ငံကူးလက်မှတ် အမှတ်)	12/Da Ga Ta (N) 024452
(e)	Address of organization (ဆက်သွယ်ရန်လိပ်စာ)	No 233, Block 23, Sayeepin Lane, Thuwunna, Thingungyun Township, Yangon contact@eqmmyanmar.com , 012330291
(f)	Type of Consultancy (အကြံပေးလုပ်ကိုင်မှုအမျိုးအစား)	Organization
(g)	Duration of validity (သက်တမ်းကုန်ဆုံးရက်)	31 March 2018

Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Areas of Expertise Permitted
(ခွင့်ပြုသည့် ကျွမ်းကျင်မှုနယ်ပယ်များ)

1. Ecology and Biodiversity
2. Ground water and Hydrology
3. Meteorology, Modeling for Air Quality
4. Modeling for Water Quality
5. Socio-Economy

Appendix 2

PTTEP SA Manuals

PTTEP

PTT Exploration and Production Public Company Limited

Myanmar Asset
Waste Management Procedure

Document Code: Myanmar-SSHE-11027-PDR-510

Revision No: 1

June 2016

Approval Register	
Document Subject	Myanmar Asset Waste Management Procedure
Document Code	Myanmar-SSHE-11027-PDR-510
Document Owner	Waranon Laprabang (PMM)
Prepared by	Surasak Chonchirdsin (Senior Environmental Engineer)
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Approval			
Name		**Signature**	**Date**
Document Owner	Khomsan Lertwiriyaprapa PMM/S		30/6/16
Approval Authority	Waranon Laprabang PMM	Waranon	15/07/16

THIS DOCUMENT WILL BE REVIEWED **5 YEARS** FROM DATE OF APPROVAL OR REVISED EARLIER IF NECESSARY

Revision History			
Rev.	Description of Revision	Authorized by	Date
0	New Document		
1	The following items have been included; - specific Roles and Responsibilities of each party - Myanmar National Environmental Quality (Emission) Guideline (NEQG)'s Disposal Criteria for Offshore and Onshore Waste Type - check List for Evaluation of Third Party Waste Management Facilities. The following items have been revised; - document coding of this procedure - disposal methods to comply with NEQG - available qualified third party disposal facility - make it comprehensive to align with current operation and practice as well as identify the possible routes as the key transit stations from one to another one		

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7.0 APPENDICES 17

1.0 PURPOSE

This Procedure is developed to ensure correct and safe handling and disposal of non-hazardous and hazardous waste generated from PTTEPI sites.

2.0 SCOPE

This Procedure applies to all sites managed by PTTEPI and to all personnel including contractors. This plan deals with waste classification, segregation, handling, temporary sites, waste transfer, storage, disposal facilities, record and reporting of non hazardous waste and hazardous waste produced by PTTEPI.

3.0 REFERENCES

3.1 PTTEP SSHE CONTROLLING DOCUMENTS

Document Number	Document Title
SSHE-106-Manual-000	SSHE Management System Manual
SSHE-0106-STD-300	Corporate Oversight of SSHE MS
SSHE-106-STD-520	Environmental Management Standard
SSHE-106-STD-310	SSHE Contractor Management Standard
SSHE-106-STD-590	Chemical Management Standard
SSHE–106–GDL–521	Waste Management Guideline

3.2 OTHER REFERRENCE DOCUMENTS

Document Number	Document Title
N/A	OGP : Guidelines for waste management with special focus on areas with limited infrastructure, Report No. 413, revision 1.1 September 2008 (updated March 2009)
N/A	Myanmar National Environmental Quality (Emission) Guideline (NEQG)

4.0 DEFINITIONS

4.1 GENERAL DEFINITIONS

Terminology	Description
-	-

4.2 ORGANISATION AND DEPARTMENTS

Corporate	Refers to the PTTEP Business Groups hierarchically above Asset level, and located in the PTTEP headquarters, Bangkok.
Group	Refers to a corporate level Business Group. These may have associated Divisions, Departments, or operational Assets within their hierarchy.
Division	A Business Group may have one or more distinct groups within its hierarchy. These are referred to as Divisions.
Asset	Refers to an operational Asset, site, or location within a respective Business Group.
Department	A subgroup within a Business Group, Division or Asset.

4.3 LANGUAGE

May	Indicates a possible course of action
Should	Indicates a preferred course of action
Shall	Indicates a course of action with a mandatory status

4.4 COMMON ACRONYMS

Set out below are common specific terms presented in alphabetical order:

MOGE	Myanma Oil and Gas Enterprise
TKA	Thaketa Support Base
YCDC	Yangon City Development Committee
ZPQ	Zawtika Processing and Living Quarter Platform
ZOC	Zawtika Operating Centre
ZMS	Zawtika Metering Station

5.0 ROLES AND RESPONSIBILITIES

5.1 OWNERSHIP OF THE DOCUMENT

The ownership describes the owner of the document with the responsibilities for:

- The approval of the document
- Issuing the document and any revisions
- Leading and demonstrating commitment by personal involvement in the implementation of the document.
- Giving clear directives on how the document is to be implemented and maintained.

5.2 CUSTODIAN OF THE DOCUMENT

Custodian is the department manager originating the document who is responsible for the document and its contents, and ultimately responsible for:

- Identifying deficiencies or potential improvements
- Initiating periodic revision
- Maintaining revision history and document status register.
- Advising the document administrator of any document changes, including register status
- Ensuring all relevant document information is received by the document administrator.

5.3 KEY PERSONNEL ROLES AND RESPONSIBILITIES

PMM/S (MYANMAR ASSET SSHE DEPARTMENT)

- Ensure effective implementation of onsite waste management in accordance with this Procedure for all sites
- Technical advice and clarification upon request.
- Support PMO/L and site SSHE to implement this Procedure.
- Report Myanmar Asset Monthly Waste Records to Corporate SSHE

PMO/L (MYANMAR ASSET LOGISTICS DEPARTMENT

- Act as one single point of contract to execute the final waste disposal with the qualified third party waste disposal facilities of all sites (Onshore and offshore) and budget preparation.
- Provide support for waste transportation and storage at Thaketa Supply Base as required.

SITE SSHE OR WASTE MANAGEMENT OPERATIONAL PERSONNEL

- Ensure that waste is managed and implemented to comply with this procedure.
- Develop site specific waste management instruction/procedure to align with the procedure.

- Provide onsite training for the contractor personnel who will work on site location
- Routine site audit to ensure onsite waste generation is properly segregated and handling
- In charge of the waste manifests record system and monthly waste reporting

6.0 GENERAL REQUIREMENT

6.1 WASTE CLASSIFICATION

The classification of PTTEPI waste generated shall be categorized in 2 main groups according to criteria of danger as non-hazardous waste and hazardous waste as shown in **Figure 1-Waste Classification**. However, laboratory analysis of its waste component is sometime required for certain wastes.

It is noted that only ship waste is allowed to transfer and offload at Ranong Support Base (RSB) in Thailand for further disposal.

6.1.1 Non-Hazardous Waste

Non-Hazardous waste is the waste which is not harmless but they present a lower level of risk to human health and the environment. There are 2 types of non-hazardous waste as follows:

1) General non-hazardous wastes from office, catering services, laundry, household and similar ones from industrial activities, e.g.
   - General waste (e.g. scrap metal, non-biodegradable waste, gardening waste, construction material)
   - Recyclable or reusable waste (e.g. paper, wood, drinking plastic bottle, glass)
   - Biodegradable waste (e.g. food waste, sewage)
2) Waste containing or contaminated with hazardous substance in concentration before or after treatment to meet the specified international or regulatory discharge criteria which do not exceed the standard limit of country, e.g.
   - Produced water
   - Produced sand
   - Drilled cutting

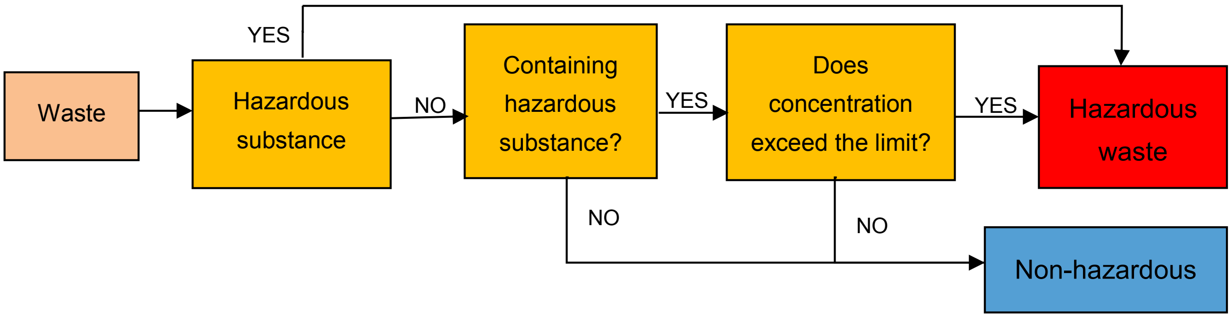

Figure 1 – Waste Classification

6.1.2 Hazardous Waste

Hazardous waste defines as any waste which cause danger or likely to cause danger to health or the environment by reason of their chemical activity or toxic, flammable, explosive, corrosive, or

other characteristics, whether alone or when coming into contact with other wastes. Form of hazardous waste comprises solids, sludge, liquid and containerized gas and hydrocarbon waste.

Hazardous waste shall be categorized into 2 main types as follows:

1) Wastes creating nuisance due to flammability, reactivity, corrosiveness, radioactive, infection, toxicity for humans & the environment or , e.g.

   - General hazardous wastes (e.g. chemical waste and residue, paint, spent and used oil, contaminated packing material, special maintenance waste, contaminated sludge, combustion residue, photocopy machine, PC printers polluting cartridge, medical waste, filter, fluorescent, bulb)
   - Heavy metal wastes (e.g. mercury, arsenic, cadmium)
   - Batteries

   Gas canisters have to be thoroughly bled off if possible prior to being disposes of.

   It is noted that if there will be a presence of incoming heavy metal from reservoir, the incurred wastes in contact with the incoming gas or fluid shall be considered as the heavy metal (e.g. mercury, arsenic, cadmium) waste which will require specific handing procedure apart from this procedure.

2) Waste containing or contaminated with hazardous substance in concentration which belong exceed the standard limit of country regulation or international hazardous waste standard for example oil concentration or heavy metals containing waste. Laboratory analysis of its waste component shall be applied to properly classify this type of waste. Furthermore any wastes that belong to any category in the country regulation.

NEQG's Disposal Criteria for Offshore Waste Type is shown in the **Appendix 1.**

NEQG's Disposal Criteria for Onshore Waste Type is shown in the **Appendix 2.**

Waste Classification of Waste Generated from PTTEPI's Offshore and Onshore Operation Activities is shown in the **Appendix 3.**

6.2 WASTE COLLECTION, SEGREGATION, AND HANDLING

6.2.1 Collection and Segregation

Waste that is collected shall be handled, stored and transported in a manner that reduces the risk of escape to the environment (for example by particulates, infiltration, runoff or odors). Waste either at the source or after collection that require different treatment or disposal systems shall be segregated as much as possible at source for collection, storage, transportation, and disposal in accordance with waste classification. In addition, it will reduce the risk of contamination of hazardous waste with non-hazardous waste.

Wastes should be segregated at least 4 types on each location where there have no area constrains which are;

- General non-hazardous waste
- Biodegradable waste (food waste, sewage)
- Reusable and Recyclable waste

- Hazardous waste

Medical or Clinical waste including infectious waste from human health service shall be separated from other wastes because they may contain infectious agents such as syringes and scalpels, blood-stained bandages, other wound cleaning waste and potentially toxic substance; sharp objects shall be packed in puncture-proof containers.

Site representative or housekeeping is a must and all wastes whatsoever must be collected and disposed of in appropriate bins/skips/containers. All containers are particular importance:

- Clear identification/labeling is required to assist in sorting out and dispatching of the containers,
- Strict color coding is required to separate non-hazardous wastes from hazardous wastes.

6.2.2 Handling

6.2.2.1 Containers

All containers should be as follows;

- Make from durable materials compatible with the waste to be collected, leakage proof, sturdy, stable and easily handled,
- Design to prevent the ingress of animals, escaping odor and place under cover if necessary to avoid leachate
- Dedicated containers (bins, skips, etc.) should be labeled clearly by type of waste for example by homogeneous color-coding and illustrated by pictographs, and the potential need for multiple language labeling (English and Myanmar)
- Install adequately in the vicinity of working area, accommodation and office area,

Containers used for medical or clinical waste shall be marked prominently with universal warning signs and/or the word “**Medical Waste**”. Used needles and syringes represent a particular threat as failure to dispose of them safely may lead to recycling and repacking which in turn lead to unsafe re-use. Where possible, management of medical/clinical wastes should be integrated into existing healthcare waste management system. Infectious waste must be collected and shipped in suitable containers. Each on duty of site doctor should handle the medical/clinical wastes shipment for further final disposal at the end of his/her rotation.

6.2.2.2 Color Coding and Labelling

Color coding should be coherent and homogeneous from one PTTEPI site to another. The number of waste categories to be collected must not be excessive, to avoid getting site personnel confused and discouraged.

General color principles are as follows;

- Red : Hazardous waste
- Blue : General Non-hazardous waste
- Yellow: Recyclable waste
- Green: Food Waste
- Black : Spent oils waste

- Yellow : Medical waste (specific container for sharp objects and used needle)

A special attention should be paid to waste that may be reused and recycled and need to be segregated and clearly marked:

- Metal scrap which might be either reused in workshops or melt in steel mills, and old slings (blue skip),
- Used batteries which have to be temporary stored at sites of generation or TKA (specific area and containers),
- Spent oils which are to be reused or recycled for other purposes (black drums),
- Drinking water plastic bottles, wood, paper, cardboard etc.

6.2.2.3 Quantity Estimation Method

Waste must be estimated according to the available waste estimation table which is needed to be regularly updated as required.

Non-Hazardous and Hazardous Waste Estimation is shown in the **Appendix 4.**

6.3 TEMPORARY ONSITE WASTE STORAGE

Risk assessment may identify some wastes that should be handled using special holding arrangements at the site of generation at the waste management facility e.g. stored on an impervious surface and/or in a bund area. It may be appropriate for some of these facilities to be connected to a drainage and collection system.

The storage site will be such that its operation will not be a source of danger for the environment, the operating personnel or local populations. Avoid flying particles or spillage of products out of the containers, and avoid runoff or accumulation of rainwater inside the waste storage area. Hazardous liquid wastes must not be stored on the ground, but on a leak proof bundled area (double containment).

Take measures to prevent direct spillage of dangerous/insalubrious matter to the drains or natural environmental. Spillage recovery equipment to be readily available on site (shovels, absorbent materials, etc.)

The storage area should be equipped with suitable fire-fighting equipment and spillage recovery equipment such as shovels and absorbent materials. Access to the waste storage site should be limited to trained personnel. A restricted/controlled area should be required for some types of waste for example, radioactive waste and explosives. Waste storage areas and access ways should be kept clean and clear of trips/slips hazards.

Smoking and burning is prohibited near to flammable products. Suitable fire-fighting materials and "**No Smoking**" signs must be available and visible in the vicinity.

6.4 TRANSFER, STORAGE, DISPOSAL AND DISPOSAL FACILITIES

6.4.1 Transfer, Storage and Disposal

6.4.1.1 Offshore Operation

- General non-hazardous waste will be transferred to TKA then immediately continue delivery to either MOGE or YCDC for final disposal.
- Biodegradable waste (food waste and sewage) will be treated on site to in line with MARPOL and dumped at sea.
- Produced water will be treated to meet the country regulation (NEQG's emission criteria) and dump at sea.
- There are 2 alternatives of produced sand disposal;
    - **Alternative 1**: Discharge overboard - The produced sand shall be analyzed first. If the analytical result is identified to comply to country regulation (NEQG's emission criteria), it can be dumped at sea which subject to MOGE or authorities agreement and approval.
    - **Alternative 2**: Disposal onshore – The produced sand will be stored and packed in UN drum then transferring to TKA for temporary storage and continue to certified or qualified waste management facilities for final disposal.
- Hazardous waste will be stored on the hazardous waste skip then transferring to TKA for temporary storage and continue to certified or qualified waste management facilities for final disposal.
- Special waste from offshore seismic, drilling and operation shall be disposed to comply with NEQG

6.4.1.2 Onshore Operation

- General non-hazardous waste shall be burned at ZOC's incinerator and ash incurred to be landfilled.
- Food waste shall be handed over to local villagers for livestock feeding if there is a demand. If no demand, this waste shall be burnt off at ZOC incinerator. Landfill is not recommended to avoid the animal disturbance
- Domestic sewage shall be treated and infiltration in soak pit where there is no properly discharge point. If it will be discharged to external environment, the discharge quality shall comply with NEQG.
- Recyclable and reusable waste shall be handed over to local villagers for further reuse or recycling shop for further process.
- Hazardous waste shall be transferred and temporary stored at ZOC. All hazardous wastes except batteries shall be. Batteries shall be continuing transferred and stored at TKT for further send back to manufacturers for disposal.

- Special waste from onshore seismic, drilling and operation shall be disposed to comply with NEQG.

6.4.1.3 PTTEPI Yangon Office

- General non-hazardous waste and food waste shall be handed over or picked up by YCDC for further disposal at YCDC disposal facilities.
- Hazardous waste (e.g. batteries, printer cartridge) shall be stored separately in the hazardous waste containers then transferring to TKA for temporary storage and continue to certified or qualified waste management facilities for final disposal.
- Recycle waste shall be sold to local for further recycle or reuse.

6.4.2 Disposal Methods and Facilities

The waste disposal methods and facilities available for PTTEPI wastes are as follows;

- Recycling or reusing whenever beneficial for local villagers and/or local recycling industry.
- TKA MOGE surface disposal yards and incinerators
- Yangon City Development Committee (YCDC) surface disposal yards and incinerators.
- Non-hazardous waste Incinerator at ZOC.
- Dumping at sea (e.g. biodegradable waste from offshore, treated cutting, treated produced water.)
- Soak away pits (e.g. sewage from onshore sites)
- Qualified third party hazardous waste landfill location at Thilawa Industrial Estate.

6.5 EVALUATION OF THIRD PARTY WASTE MANAGEMENT FACILITIES

An assessment of third-party, off-site recycling and waste treatment and disposal facilities helps to gain assurance that effective controls are in place to comply with appropriate regulations and to reduce any potential need for future human health and environmental activities associated with waste management activities. Third party waste management facilities should be evaluated with input from a waste management practitioner.

An assessment and inspection program would typically include collection of data about the history and operation of the facility, a site visit to see the facility in person, a risk ranking, or evaluation of the information and periodic re-audits and site visits to confirm the facility stays in an acceptable condition.

Check list for evaluation of Third Party Waste Management Facilities are shown in the **Appendix 5**.

6.6 WASTE RECORD AND REPORTING

Tracking of waste types, quantities and methods and location of final disposal of these wastes shall be conducted as part of an overall waste management system to document the intended management of the waste.

There are 3 separate registers developed by PTTEPI, namely, solids, liquids and gases. The objective is to record accurately every waste generated on site

6.6.1 Solid

Waste is to be weighted on the weighing scales provides, where possible. Where it is not possible to weight the waste directly on the scales, the following steps shall be adopted in estimating the weight of the waste materials.

The collected drums of the wastes are multiple to the standard weight per drum of specific waste type (see Appendix 3"Non-Hazardous Waste Estimation and Hazardous Waste Table).

For example:

- Half-filled drum of oily rags is to be estimated as 0.5 drums X 84 kg/drum = 45 kg.

Some wastes are difficult to collect in the drum such as bulbs, fluorescent, aerosol cans, production filters etc. In such case, the counted numbers of items are to be multiplied with the estimated standard weight per number of items in 10 units.

For example:

- Production filters are to be estimated as 100 filters X 40 = 400 kg (10 filters = 40 kg standardized weight)

Weight evaluation can only be accurate if the wastes have been correctly segregated. It is thus essential that waste streams should be segregated with the appropriate monitoring to ensure that personnel comply with such requirements.

6.6.2 Liquid

Liquid discharges shall be calculated as daily measurement on the metering or monthly average based on daily production report. Specific note shall be made of any non-routine liquid discharges.

6.6.3 Gas

Any pressure relief or blow-downs shall also be reported by the site representative on the monthly waste and/or environmental report to allow involved parties to estimate the GHG emission.

6.6.4 Waste Tracking Documents and Report Preparation

Waste tracking documents or waste manifests shall give the exact description of the content of the skips/drums/containers.

The following routes have been identified as the key transit stations between;

- ZPQ to TKA
- ZOC to TKA
- Other onshore and offshore sites to TKA
- TKA to qualified disposal facilities for hazardous waste
- ZOC to qualified disposal facilities for hazardous waste disposal

- ZMS to ZOC
- TKA to government disposal facilities (MOGE or YCDC) for non-hazardous waste

The waste manifests shall be filled in and filed by both sender and receiving parties. Site SSHE representative and/or waste management operational personnel are in charge of the waste manifests. He/she shall calculate or weight the quantity of each waste stream transferred from their particular site. This shall be totaled on a monthly basis.

Site SSHE representative and/or waste management operational personnel shall prepare monthly waste management report to PMM/S and PMO/L for further waste reporting and disposal purposes which shall be included, as a minimum

- Type of waste
- Location of waste generated
- Quantity or volume of waste including generating, storing and disposal.
- Method used for transferring waste.
- Method used at disposal facility.
- Final disposal location.
- Waste manifest

Waste tracking system or manifest is shown in the **Appendix 6**

7.0 APPENDICES

Appendix 1. NEQG's Disposal Criteria for Offshore Waste Type

Waste Type	Disposal
Drilling fluids and cuttings (Non-aqueous drilling fluid)	Non-aqueous drilling fluid:-re-inject or ship-to-shore, no discharge to sea. Drilled cutting:-re-inject or ship-to-shore, no discharge except: - Oil concentration: lower than 1% by weight on dry cuttings - Mercury: maximum 1 mg/kg dry weight in stock barite - Cadmium: maximum 3 mg/kg dry weight in stock barite - Discharge via a caisson at least 15 meters below sea surface
Drilling fluids and cuttings (Water-based drilling fluid)	Water-based drilling fluid: re-inject or ship-to-shore, no discharge to sea Water-based drilling fluids and cuttings:-re-inject or ship-to shore, no discharge to sea except: - Mercury: maximum 1 mg/kg dry weight in stock barite - Cadmium: maximum 3 mg/kg dry weight in stock barite - Maximum chloride concentration must be less than four time's ambient concentration of fresh or brackish receiving water - Discharge via a caisson at least 15 meters below sea surface
Produced water	Re-inject Discharge to sea maximum one day oil and grease should not exceed 42 mg/L; 30 day average should not exceed 29 mg/L
Completion and well work – over fluids	Ship-to-shore or re-inject No discharge to sea except: - Maximum one day oil and grease discharge should not exceed 42 mg/L; 30 day average should not exceed 29 mg/L - Neutralize to attain a pH of 5 or more
Produced sand	Ship-to-shore or re-inject No discharge to sea except when oil concentration lower than 1% by weight on dry sand
Hydrotest water	- Send to shore for treatment and disposal - Discharge offshore following environmental risk analysis, careful selection of chemicals - Reduce use of chemicals
Cooling water	The effluent should result in a temperature increase of no more than 3 C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge
Desalination brine	Mix with other discharge waste streams if feasible
Sewage	Compliance with MARPOL 73/78

Food waste	Compliance with MARPOL 73/78
Storage displacement water	Compliance with MARPOL 73/78
Bilge water	Compliance with MARPOL 73/78
Deck drainage (non-hazardous and hazardous drains)	Compliance with MARPOL 73/78

Appendix 2. NEQG's Disposal Criteria for Onshore Waste Type

Waste Type	Disposal Criteria
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in IFC Onshore Oil and Gas Development EHS guideline
Produced sand	Treatment and disposal in accordance with applicable standards provided in IFC Onshore Oil and Gas Development EHS guideline
Produced water	Treatment and disposal in accordance with applicable standards provided in IFC Onshore Oil and Gas Development EHS guideline For discharge to surface waters or to land: - 5-day Biochemical Qxygen Demand (BOD) 25 mg/L - Chemical Oxegen Demand (COD) 125 mg/L - Chlorides 600 mg/L (average), 1,200 mg/L maximum - Heavy metals (Total) 5 mg/L - pH 6-9 - Phenols 0.5 mg/L - Sulfides 1 mg/L - Total hydrocarbon content 10 mg/L - Total suspended solids 35 mg/L
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in IFC Onshore Oil and Gas Development EHS guideline For discharge to surface waters or to land: - 5-day Biochemical Qxygen Demand (BOD) 25 mg/L - Chemical Oxegen Demand (COD) 125 mg/L - Chlorides 600 mg/L (average), 1,200 mg/L maximum - Heavy metals (Total) 5 mg/L - pH 6-9 - Phenols 0.5 mg/L - Sulfides 1 mg/L - Total hydrocarbon content 10 mg/L - Total suspended solids 35 mg/L
Completion and well work-over fluids	Treatment and disposal in accordance with applicable standards provided in IFC Onshore Oil and Gas Development EHS guideline For discharge to surface waters or to land: - pH 6-9 - Total hydrocarbon content 10 mg/L
Storm water drainage	Storm water runoff should be tre4ated through an oil/water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent should result in a temperature increase of no more than 3 C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge
Sewage	Holding and discharge to municipal or centralized wastewater treatment systems or onboard treatment to achieve: - 5-day Biochemical Qxygen Demand (BOD) 30 mg/L - Chemical Oxegen Demand (COD) 125 mg/L - Oil and grease 10 mg/L maximum - pH 6-9 - Total coliform bacteria 400 MPN/100 ml - Total nitrogen 10 mg/L - Total phosphorus 2 mg/L - Total suspended solids 50 mg/L

Appendix 3. Waste Classification of Waste Generated from PTTEPI's Offshore and Onshore Operation Activities

Name	Type of Waste		
	Hazardous	Non-Hazardous	Analysed
• Acids/Alkalis	x		
• Activated carbon - Used in water treatment plant		x	
- Used in E&P process	x		
• Aerosol can	x		
• Asbestos/refractory materials	x		
• Ash(combustion residues)	x		
• Battery electrolyte	x		
• Cementing waste	x		
• Chemical-unused or spent chemicals and residues	x		
• Condensate	x		
• Construction and demolition material - Non-contaminated material		x	
- Oil/chemical contaminated material	x		
• Contaminated soil	x		
• Chemical containers (empty)-can/drum/barrels including bag & sag	x		
• Domestic wastes/trash/food wastes		x	
• Drilling mud		x	
• Drilled cutting		x	
• Drum rinse			x
• Electronic & computer wastes	x		
• Explosive waste	x		
• Fibreglass waste	x		
• Filters (air/water/other) - Non-chemical/oil contaminated filter-general filter		x	
- Oil/chemical contaminated filter including CO_2 filter-production filter	x		
• Foam pig	x		
• Food waste		x	
• Garnet		x	
• Gas cylinder	x		
• Glass bottles		x	
• Glass wool	x		
• Glycol and Antifreeze	x		
• Hydro-test fluids			x
• Incinerator ash	x		
• Insulating material (non-asbestos)		x	
• Ion exchange resins/molecular sieves	x		
• Lubricants, coolant and hydraulic fluids waste	x		
• Maintenance waste - Loose spools/metallic(pipe, valve, equipment)	x		
• Medical waste	x		
• Mercury-containing waste e.g. PPE, fabric, drum, fluorescent tubes	x		
• Mercury contaminated filter	x		
• Mercury contaminated sludge and sand	x		
• Metal can		x	

Name	Type of Waste		
	Hazardous	Non-Hazardous	Analysed
• Oil & chemical contaminated material e.g. rags, glove, acrylic, wood, paper, plastic.	x		
Oil contaminated water			x
Oily sludge	x		
• Paper & packaging wastes		x	
• Paint and other coating wastes	x		
• PCBs & PCB-containing wastes	x		
• Pallet		x	
• Plastics & rubber wastes		x	
• Plastic drinking water bottles		x	
• Produced sand			x
• Treated produced waterwithout mercury and arsenic substance		x	
• Radioactive materials (not including NORM)	x		
• Refrigerants	x		
• Scale from pipe/tank cleaning.	x		
• Scrap metal		x	
• Spent catalysts			x
• Spent oil	x		
• Sludge from domestic sewage treatment		x	
• Stranded chemicals/solvents-halogenated, non-halogenated, corrosive etc.	x		
• Toner cartridge	x		
• Tyres		x	
• Wood		x	
• Wastewater - Treated Sewage and treated process wastewater		x	
- Treated and Untreated process wastewater			x

Appendix 4. Non-Hazardous and Hazardous Waste Estimation

Non-Hazardous Waste Estimation					
Type of Waste	**kg/1 unit**	**kg/10 units**	**No. of items in 1 kg**	**kg/drum**	**Kg/m3**
General filter		1		72	283
Glass bottles		5		67	263
Non-recyclable plastic				13	51
Pallet	16				
Paper				10	40
Plastic drinking water bottles			20	6	24
Scrap (light)				30	118
Scarp (heavy)				192	754
Used garnet				255	1000
Wood				180	706

Hazardous Waste Estimation					
Type of Waste	**kg/1 unit**	**kg/10 units**	**No. of items in 1 kg**	**kg/drum**	**Kg/m3**
Aerosol can		1		86	338
Burnt production filter	1.25	12.5			
Bulbs		0.6	20		
Condensate				200	785
Contaminated soil				265	1041
Fluorescent		1	10		
Glass wool				40	157
Glycol				200	785
Incinerator ash				84	330
Oily rags		2		84	330
Paint waste				200	785
Production filter	4	40			
Toner cartridge	1	10			
Spent Oil				200	785
Used glove and PPE		1		42	165

Appendix 5. Check List for Evaluation of Third Party Waste Management Facilities

Point to consider	Evident Includes
What types of waste are accepted at the site for treatment and disposal, and what methods are used?	• Applicable site licence in place. • Site procedures.
Are the treatment and disposal methods appropriate for the types of wastes accepted?	• Local legislation. • Company policy. • Good practice.
Are all required regulatory permits in place?	• Copies of relevant permits/licences for site and equipment (if required).
Is the facility in compliance with regulations and permits?	• Reports submitted to regulator • Regulator site inspection reports. • Records of breaches/fines.
Are the facilities located, designed and constructed to provide environmental protection?	• Was an Environmental Impact Assessment performed? • Appropriateness of design in relation to e.g. local geology, land use, topography, presence of usable groundwater, soil permeability. • Evidence of e.g. landfill lining, emission controls (for incinerators etc.), and integrity testing for disposal wells.
Does the site have effective management and monitoring controls?	• Site procedures. • Environmental monitoring program. • Evidence of monitoring and tracking emissions against maximum permissible limits. • Organized and effective waste manifest system. • Use of competent, accredited or certified laboratories for analysis. • Vehicle maintenance and service records.
Have steps been taken to mitigate the risk of HSE incidents?* HSE management plan.	• Condition of containers holding waste materials. • Provision of secondary containment and/or impervious barriers to prevent migration of materials and spills. • Level of housekeeping. • Any apparent spills and stains. • Training and awareness of staff.
Does the facility respond quickly and effectively to any incidents?	• Spill response plan. • Spill observation and reporting system. • Spill response training records. • Provision of spill kits on-site.
Does the facility have a good safety culture with adequately trained and resourced employees (including appropriate protective equipment)?	• Appropriate risk assessments. • Training plan and training records. • PPE availability on site. • Appropriate PPE, SDS, warning signs. • Performance track record.
Does the site have soil or groundwater impacts from previous or current operations?	•.Site EIA/licence. • Records of previous use
Are impacts from nearby sources potentially affecting the site, for instance from groundwater migration?	• Groundwater monitoring programme results.
How close is the facility to nearby residents, cultural properties, or sensitive environmental areas?	• Site location plan. • Site location observation/patrolling.
Is security at the site adequate to prevent unauthorized access?	• Adequate fencing/patrolling. • History of security breaches.

Point to consider	Evident Includes
	• Sightings of unauthorized personnel on site.
Are any sub-contracted services selected and managed responsibly?	• Evidence of effective sub-contractor audits.
What is the financial security of the facility, in terms of its longevity of operation and its ability to pay for potential incidents?	• Company funding/share owners, date of company founding, market share.
What are the relations with the surrounding community and regulators; is the facility a 'good neighbour'?	• Records of complaints, fines, and local perceptions.
Does the facility have an end-of-life reinstatement plan and provision for its implementation, e.g. financial assurance?	• Decommissioning plan.

Appendix 6. Waste Tracking System or Manifest

WASTE TRACKING SYSTEM-MANIFEST					
Site Name:					
Vessel/Truck ref: **Vehicle Control Name:**		**Origin:** **Destination:**		**ETD from origin:** **ETA at destination:**	
1. WASTE DESCRIPTION					
NON-HAZARDOUS WASTES					
Waste Originator	**Waste Type**	**Type of Packing**	**QTY/Weight**	**Recyclable Yes/No**	**Remark**
		Total Weight			
HAZARDOUS WASTES					
Waste Originator	**Waste Type**	**Type of Packing**	**QTY/Weight**	**Recyclable Yes/No**	**Remark**
		Total Weight			
2. WASTE HANDLER (LOGISTICS/ENVIRONMENT) CHECK LISTS					
			Yes	**No**	**Remark**
Waste properly segregated					
Packing/Container in good condition, sealed/covered, no leak					
Packing/Container properly labeled/marked					
Packing/Container properly fastened					
Others, please specific					
3. TRANSPORTER ACCEPTANCE					
Acceptance to transport: **Date:**			**Refusal to transport (give reasons)** **Date:**		
4. WASTE RECEIVER					
Name:		**Date:**	**Comments:**		

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PTTEP

PTT Exploration and Production Public Company Limited

Myanmar Asset Emergency Management Plan

Document No: 11027-PDR-SSHE-340-005-R01

April 2018

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THIS DOCUMENT WILL BE REVIEWED EVERY **5 YEARS** FROM DATE OF APPROVAL OR REVISED EARLIER IF NECESSARY.

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Rev.	**Description of Revision**	**Authorised by**	**Date**
0	New Document	IMA	May 2013
1	- Separated from PTTEPI Emergency and Crisis Management Plan - Revised to reflect organization change - Revised EMT's role and responsibility - Defined scope to cover all Myanmar Assets - Added key activities and processes of EMT	PMM	April 2018

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1. PURPOSE

The purpose of this Myanmar Asset Emergency Management Plan (EMP) is to clearly define roles and responsibilities of Emergency Management Team (EMT) and to determine incident action plan, resources and processes before, during and after emergency situation. This plan is aligned and complied with Corporate PTTEP Emergency and Crisis Management Standard (SSHE-106-STD-500).

2. SCOPE

This plan covers the processes to manage emergency on Tier 2 level to all Myanmar Asset operations, activities and projects by Emergency Management Team (EMT).

This plan does **not** cover details of Emergency Response Plan (ERP) and contingency plan (CP) at workplaces or worksite.

3. REFERENCES

3.1 PTTEP SSHE CONTROLLING DOCUMENTS

Document Number	Document Title
SSHE-106-STD-500	PTTEP Emergency and Crisis Management Standard
SSHE-106-PDR-501	PTTEP Crisis Management Plan
SSHE-106-PDR-502	PTTEP Emergency Management Plan
11038-STD-SSHE-600-011-R06	PTTEP Incident Management Standard
Myanmar-0050-PDR-008	Myanmar Asset Crisis Communication Plan

3.2 OTHER REFERENCE DOCUMENTS

Document Number	Document Title
OGP Report Number 517: Aug 2014	Incident management system for the oil and gas industry
-	The Code of Criminal Procedure, Myanmar Legislation

4. DEFINITIONS

4.1 GENERAL DEFINITIONS

For the purposes of this EMP, the definitions of emergency and crisis are:

Terminology Description	Terminology Description

Crisis	A major or catastrophic event (out of control emergency). A crisis could result in sustained national impacts over a prolonged period of time; almost immediately exceeds resources normally available to the company, local authorities and country in the impacted area; and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened. Crisis may challenge the ability and capacity of communities, company and country to achieve a timely recovery Crisis situation includes terrorism that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, company reputation, national morale, and/ or government functions. In PTTEP crisis situation is treated by **a tier 3 response levels.**
Myanmar Asset Crisis Management Team Leader(CMT Leader)	Myanmar Asset General Manager (GM) who has the top authority to overall manage Myanmar Asset impact related to any crisis situations. He has the authority to activate Myanmar Asset Crisis Management Team and work closely with Myanmar Asset Emergency Management Team Leader.
Emergency	An occurrence or event, natural or human caused, that requires an emergency response under determination of Affected Operation Leader or Acting Person, to protect life, environment, property and reputation or to lessen or avert the threat of a major or catastrophe in any part of the company premises. The external assistance may or may not be needed to supplement the company efforts and capabilities to save lives, environmental, protect property, public health and safety. Emergency situations can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, fires, floods, oil and hazardous material spills, marine vessel and aircraft accidents, earthquakes, tropical storms, typhoon, war-related disasters, outbreak of diseases and medical emergencies, and etc. In PTTEP emergency situations can be evaluated and treated by using a tier 1 – 2 response level.

Myanmar Asset Emergency Management Team Leader (EMT Leader) or Incident Commander (IC)	Affected Operation's Leader or Acting person such as VP, Manager etc., who has overall authority and responsibility for supporting and providing tactical activities and incident action plans to the Emergency Response Team Leader or On Scene Commander (OSC), including the development of strategic objectives. EMT Leader also sets priorities and defines organization of the EMT and the overall action plans for the particular response.
Myanmar Asset Emergency Management Response Team Leader (ERT Leader) or On Scene Commander (OSC)	An individual responsible for all onsite responses, especially providing direction and onsite tactical operations and always retains the authority to determine the appropriate course of response actions. The operational sites / fields are as example, ZPQ, ZOC, ZMS, TKA, MOGE-3 and etc. OSC shall the top authorized person at that site/ field who has the authority to activate the onsite Emergency Response Team (ERT).

4.2 ORGANISATION AND DEPARTMENTS

Corporate	Refers to the PTTEP Business Groups hierarchically above Asset level, and located in the PTTEP headquarters, Bangkok.
Group	Refers to a corporate level Business Group. These may have associated Divisions, Departments, or operational Assets within their hierarchy.
Division	A Business Group may have one or more distinct groups within its hierarchy. These are referred to as Divisions.
Asset	Refers to an operational Asset, site, or location within a respective Business Group.
Department	A subgroup within a Business Group, Division or Asset.

4.3 LANGAUGE

May	Indicates a possible course of action
Should	Indicates a preferred course of action
Shall	Indicates a course of action with a mandatory status

4.4 COMMON ACCRONYMS AND ABBRAVIATIONS

BCP	Business Continuity Plan

CCMT	Corporate Crisis Management Team
CCT	Crisis Communication Team
CMP	Crisis Management Plan
CMT	Crisis Management Team
CP	Contingency Plan
CSR	Company Site Representative
EMP	Emergency Management Plan
EMR	Emergency Management Room
EMT	Emergency Management Team
ERT	Emergency Response Team
ERP	Emergency Response Plan
GM	Myanmar Asset General Manager
IAP	Incident Action Plan
IC	Incident Commander
IT	Information Technology
JV	Join Venture
MOGE	Myanmar Oil and Gas Enterprise
OSC	On Scene Commander
OSRL	The Oil Spill Response Limited
PCML	Petronas Carigali Myanmar Limited
POB	Personnel On Board
PSC	Production Sharing Contract
PTTEP	PTT Exploration and Production Company Limited
RRT	Relative Response Team
SSHE	Safety, Security Health and Environmental
TEPM	Total Exploration and Production Myanmar
TKA	Thaketa Supply Base
VP	Vice President

5. EMERGENCY MANAGEMENT

Following PTTEP Emergency and Crisis Management Standard (SSHE-106-STD-500), the organizational structure of Myanmar Asset emergency and crisis management is categorized into a 3-Tier response level. Myanmar Asset Emergency Management Team will be activated on Tier 2 and/or Tier 3 since the notification and request support from ERT Leader (OSC).

5.1 EMERGENCY MANAGEMENT ORGANISATION AND TEAM

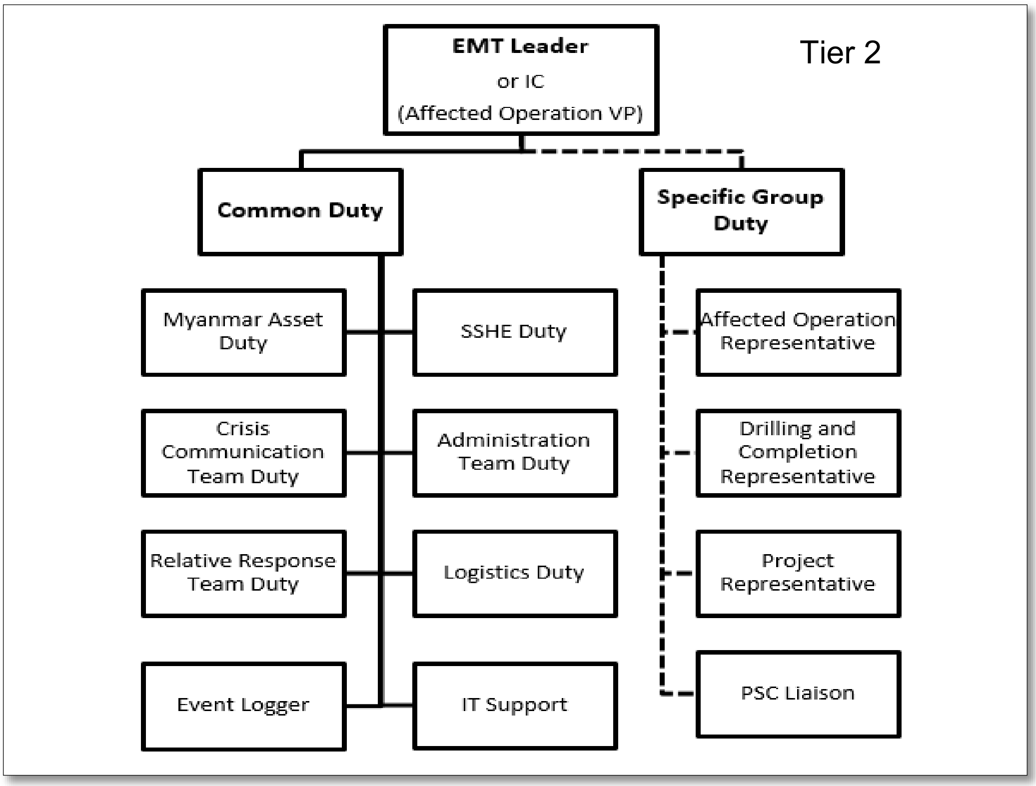

Figure 1: Myanmar Emergency Management Team organization

5.2 TEAM ROLES AND RESPONSIBILITIES

5.2.1 Common Group Duty

EMT Leader (Affected Operation VP)
• Ensure that proper EMT is activated and ready to provide supports to the affected site. • Ensure that the formally notify JV Partner, MOGE and Duty Persons that an emergency has arisen are conducted. • Ensure to follow and comply with Myanmar legislation. • Seek additional supports from internal and / or external expertise if the situation requires. • Continual monitor and identify the situation of the emergency and decide whether the situation is or likely to escalate to become a crisis.

• Provide a regular update (at least once an hour) of important events, commitments, decisions, etc., regarding the emergency status to Myanmar Asset GM. (Refer Appendix B: Emergency Hourly Situation Report Form). • Approve and follow up the Incident Action Plans. • Complete specific tasks refer Appendix C "EMT Leader specific tasks".

Myanmar Asset Duty
• Liaise with affected Operation VP during first notification • Complete Emergency Report Form in Appendix A up on receiving emergency report from OSC/CSR for internal communication • Act as EMT Leader during EMT Leader is unavailable in EMR • Ensure all required duty personnel are presented at Emergency Management Room (EMR) • Support EMT Leader to coordinate with other duty persons and EMT on Emergency supports • Work closely with other EMT members to ensure resources are effectively utilized • Work closely with the Event Logger to ensure they are provided with accurate information • Complete specific tasks refer Appendix C "Myanmar Asset Duty specific tasks"

Crisis Communication Team Duty (CCT)
• In conjunction with the EMT Leader, establish a pro-active media liaison and public affairs strategy. • To brief the EMT Leader on media interest, issues developing and requests from the media for information. • To assist in developing/ delivering a response to the media as directed by the EMT Leader • Notify and coordinate with Corporate PTTEP Crisis Communication Team duty (PTTEP Emergency Management Duty Roster). • Maintain communications with the Crisis Communication Team (CCT) and provide regular updates. • Maintain a personal log of events of all activities undertaken during the incident life cycle and pass completed log sheets to the Event Logger. • Follow Myanmar Crisis Communication Plan (Myanmar-0050-PDR-008). • Complete specific tasks refer Appendix C "Crisis Communication Team specific tasks"

Relative Response Team Duty (RRT)
• Advise the EMT Leader on personnel and welfare issues relating to staff. • Maintain POB on site and the status of casualties. • Enact company personnel policies relating to staff welfare.

• Arrange for necessary support for employees involved in emergency response and/or crisis management operations and their families. • Co-ordinate with hospitals for the treatment of injured persons, provide additional support of required. • Ensure appropriate legal advice is available for the EMT Leader when making critical decisions. • Follow Corporate PTTEP Relative Response Team Emergency Response Plan (PTTEP-MS-E04-P001). • Complete specific tasks refer Appendix C “Relative Response Team specific tasks”.

SSHE Duty
• Advice on SSHE related requirements to EMT Leader. • Identify parties (authorities) to be contacted or advised of the situation as dictated by statutory and other requirements. • When the emergency has been declared as finished, collect a copy of the Emergency Log, and originals of all other communications (e.g. other Log Sheets, Questionnaire Notes, Faxes, etc.) made by EMT members, for analysis and improvement of emergency preparedness. • Complete specific tasks refer Appendix C “SSHE Duty specific tasks”.

Administration Team Duty
• Ensure the Emergency Management Room, Crisis Communication Room and Relative Response Room ready for using. • Ensure that the room facilities are working properly. • Coordinate with IT support on IT and communication equipment readiness for using. • Ensure the electricity, lighting and air-conditioning is available. • Be a coordinator in the Myanmar Administrative Office Team. • Be a Affected Operation Representative Duty when incident has occurred at office buildings • Provide administrative supports to the EMT, i.e., search & supply necessary stationary • Provide foods, accommodations which may be required by the EMT, etc. • Complete specific tasks refer Appendix C “Administration Duty specific tasks”

Logistics Duty
• Serve as advisor to EMT on all logistics related matters. • Provide workable solutions to all identified logistical issues & concerns arising from incident or emergency response operations

• Be a Affected Operation Representative Duty when incident has occurred at site under Logistic Department responsible • Liaison with air transport service providers for transportation in an emergency. • Complete specific tasks refer Appendix C "Logistics Duty specific tasks"

Event Logger
• Ensure that POB, weather forecast information and other information on the relevant Log Boards. • Liaise with the all EMT to ensure that all information is recorded. • Ensure that all events are precisely and accurately recorded as they occur. • Complete specific tasks refer Appendix C "Event Logger specific tasks"

IT Support
• Ensure that IT and telecommunication equipment required by EMT in the Emergency Management Room, Crisis Communication Room and Relative Response Room ready for using. • Operate fax machine, computers, printers and to receive or send information as requested by the EMT. • Resolve any IT related issues requested by EMT. • If requested, provide additional IT & telecommunication equipment such as "Hot Line" to EMT / CMT • Complete specific tasks refer Appendix C "IT Support specific tasks"

5.2.2 Specific Group Duty

Affected Operation Representative Duty
• Act as focal point to communicate between the site ERT Leader and EMT Leader to handle the Emergency Situation • Support EMT as requested by the EMT Leader • Formally notify JV partner(s) • Complete specific tasks refer Appendix C "Affected Operation Representative specific tasks"

Other Specific Duty
Specific Duty Members will be called in when their assets have an emergency, or as required by EMT Leader discretion. • Provide advice to EMT Leader relating to concerned issues in support of emergency. • Complete specific tasks refer Appendix C "Specific Group Duty specific tasks"

The team will consist but not limit to the following members: o Affected Operation Representative (Duty responsibility see below table) o Drilling & Completion Representative o Project Representative o PSC Liaison o Medical Advisor o Security Specialist o Environmental Engineer

Regarding Duty Roster nomination and handover duty refer Appendix D: Duty Roster Guideline.

5.3 NOTIFICATION AND COMMUNICATION

5.3.1 Notification and Communication at Myanmar Asset Site

According to the 3-Tier response levels, the activation of on-site ERT, EMT and CMT will be the responsibility of ERT Leader (OSC), EMT Leader (IC) and CMT Leader respectively.

A Weekly "*Myanmar Asset Duty*" is assigned as the first contact for any incident and emergency / crisis in Myanmar Asset.

Emergency Contact Numbers can be found on "Myanmar Asset Weekly Duty Call Sheet" which shall be distributed via e-mail to all concerned personnel every Thursday evening.

1) In emergency situation, the ERT Leader (OSC) shall contact Myanmar Asset Duty as soon as practical.
2) Upon receiving the emergency call, Myanmar Asset Duty will notify the Affected Operation VP. In case Myanmar Asset Duty cannot be contacted the next person to be contacted is an Affected Operation Duty or SSHE Manager.
3) ERT Leader (OSC) consults with Myanmar Asset Duty and Affected Operation VP to identify the Tier level, In case of Tier 1, Myanmar Asset Duty and Affected Operation VP closely follows up the situation with ERT Leader (OSC) until the normal situation is declared.
4) In case of Tier 2 or above, the Affected Operation VP activates Myanmar Asset EMT then Myanmar Asset Duty shall immediately call EMT members and or CMT Leader respectively via telephone operator or mobile phone as per Myanmar Asset Weekly Duty Call Sheet.
5) Affected Operation VP will then assume the role of the EMT Leader.

5.3.2 Notification and Communication at Contractor Sites under Myanmar Asset Operational Control

In case of an emergency occurring at contractor sites, for example:

- Drilling rig (Onshore / Offshore site)
- Work-over rig

- Seismic survey site
- Construction site (Onshore / Offshore site excluding contractor yard)
- Marine Vessels / Barges working in Myanmar Asset concessionaire area

In the above mentioned cases, contractor's OSC and contractor's on-site ERT will take initial response to control the incident / emergency situation. However, when the situation is escalated, additional supports are required, the contractor's OSC will normally request supports from contractor's EMT and Myanmar Asset Company Site Representative (CSR) respectively. The CSR will report to Myanmar Asset Duty who will notify and consult with Affected Operation VP as EMT Leader to activate Myanmar Asset EMT if the case is Tier 2 or above.

1) If the contractor's OSC & contractor's on-site ERT can put the situation under control then the case will be declared as Tier 1 meaning can be managed within site capacity without support required from external sources.
2) If the emergency is escalated to become Tier 2 or above, Myanmar Asset EMT Leader in consultation with CSR will activate Myanmar Asset EMP and keep Myanmar CMT Leader informed of the situation.
3) The contractor's OSC & the contractor's on-site ERT will cooperate & coordinate with the CSR for the following issues:
   a) Local supports required such as authorities' notification, Myanmar Asset' logistics & other resources etc.
   b) Specialist advice / technical support via the emergency organization between contractor's EMT and Myanmar Asset EMT.

It should be noted that joint emergency organization & arrangements, site specific ERP and contingency plans, between Myanmar Asset and its contractor, should be addressed, agreed upon and documented in the bridging document.

The structure of emergency organization and communication flowchart is shown in Figure below.

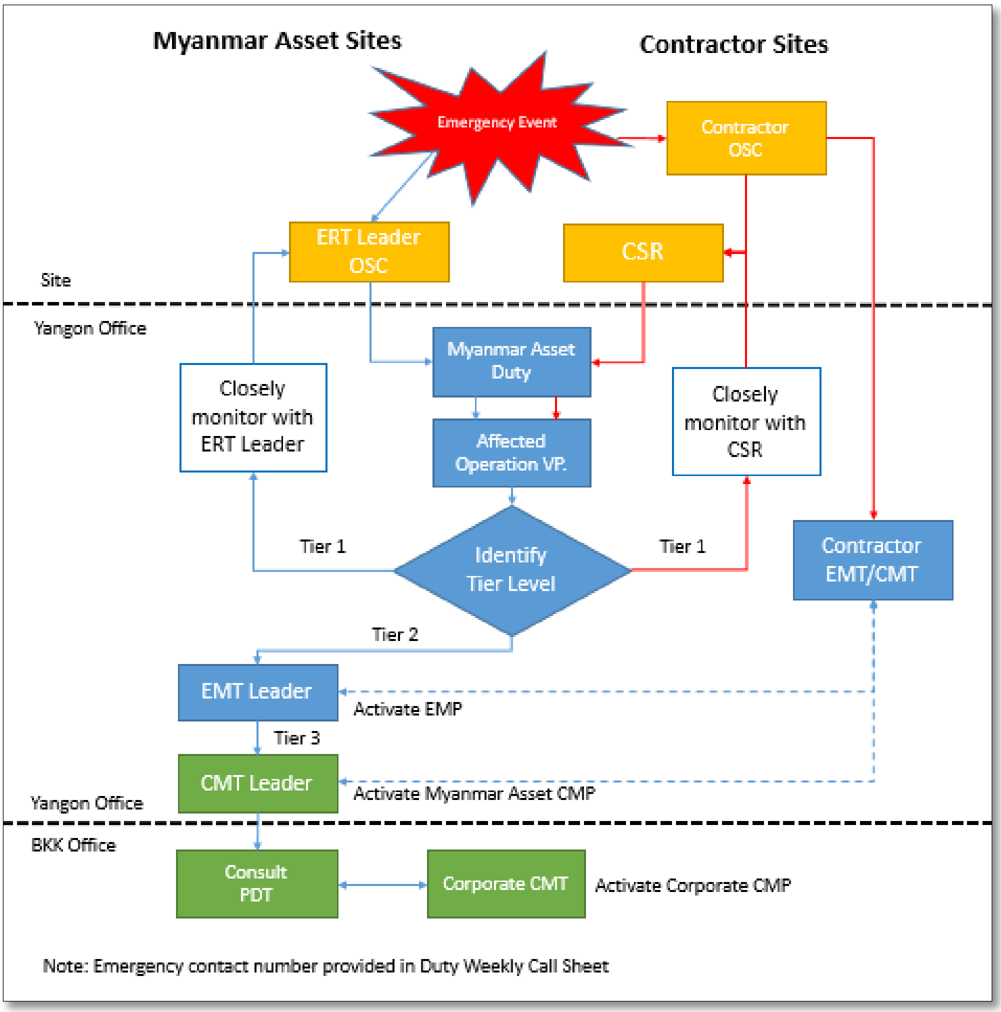

Figure 2: Notification and Communication flowchart

5.4 ACTIVATION AND DEACTIVATION

The activation of this plan shall be done by Affected Operation VP in consultation with ERT Leader (OSC) and Myanmar Asset Duty or by authorized person following the notification process, for deactivation the EMT Leader, in consultation with the OSC, is the sole authority for deactivating an emergency. Deactivation should only begin when the OSC and EMT Leader agree that the emergency has been contained, and satisfactorily overcome in all respects.

The activities and procedures which must be undertaken to recover from an emergency incident, the EMT Leader shall ensure that the OSC conduct the following activities include, but are not limited to:

- The clean-up, maintenance and testing of equipment.
- The re-commissioning of facilities, plant, and equipment.
- The replenishment of stocks (such as, firefighting foam, spill clean-up materials, replacement parts).
- The accounting for all expenses incurred as a result of the incident.
- The filing of insurance claims.

- Preparation and dispatch of final reports to relevant Shareholders, Government and Local Authorities.

5.5 KEY ACTIVITIES AND PROCESSES OF EMERGENCY MANAGEMENT TEAM

The EMT is responsible for providing support and assistance to EMT Leader & on-site ERT and ensuring that all tasks assigned are tracked, followed up & completed in a safety & efficient manner.

The following table shall be utilized by EMT during planning process.

Phase	Activity
Evaluate the situation and progress of the response	• Gather, record, analyses and display situation and resource information • Obtain a clear picture of the scale and complexity of the incident, and assess the incident potential • Assess worst-case potential • Determine resources required to implement the Incident Action Plan
Establish and refresh incident objectives and strategy	• Formulate and prioritize response objectives. • Identify analyses and evaluate reasonable response strategies to accomplish the overall objectives of the response.
Develop the Incident Action Plan	• Determine the tactical direction (i.e. what, why, who, when, where and how) and the resources, logistics and strategies for the next operational period. • Define operational periods. • Identify resource status and availability. • Configure organizational structure to implement tactics, and determine work assignments and specific resource requirements. • As needed, develop and prioritize Incident Action Plan.
Prepare and disseminate the Incident Action Plan	• Format the Incident Action Plan in accordance with the level of complexity of the incident, and produce a well-prepared outline for an oral briefing or written plan. • Obtain Incident Action Plan attachments and review for completeness and approval. • Ensure the Incident Action Plan is up-to-date and complete in relation to the incident situation. • Reproduce the Incident Action Plan and distribute before the start of the next operational period.

Phase	Activity
Evaluate and revise the Incident Action Plan	• Compare planned progress with actual progress on a regular basis, and identify deviations or changes in resource availability, mission failure or unexpected success, and new safety and environmental considerations. • Input new information and changes in the situation into the first step of the planning process as necessary to modify the Incident Action Plan for the current or subsequent operational period.

5.6 EMERGENCY MANAGEMENT ROOM AND FACILITIES

5.6.1 Emergency Management Room (EMR)

The main Emergency Management Room (EMR) for Myanmar Asset Emergency Management Team and their support team is located in the Vantage Tower building, on 4th floor meeting room 404. In case of emergency at Vantage Tower building and unable to use the room, the alternative or back up EMR shall be provided according to Myanmar asset Business Continuity Plan (BCP).

The require equipment for use in EMR are as follows but should not limit to;

- Communication equipment (Telephone, Fax, Tele-conference, Radio, Sat. Phone)
- Presentation equipment (Projector and screen, Computer and software)
- Logging equipment (Computer and software, Sound recorder)
- Board (IAP board, Logistic board, POB board, Electronic board)
- Television
- Map
- Wall Clocks (for local and Headquarter time)
- Stationary
- Etc.

The room shall be protected from unauthorized person at all time. Emergency power is required for essential electronic equipment backup.

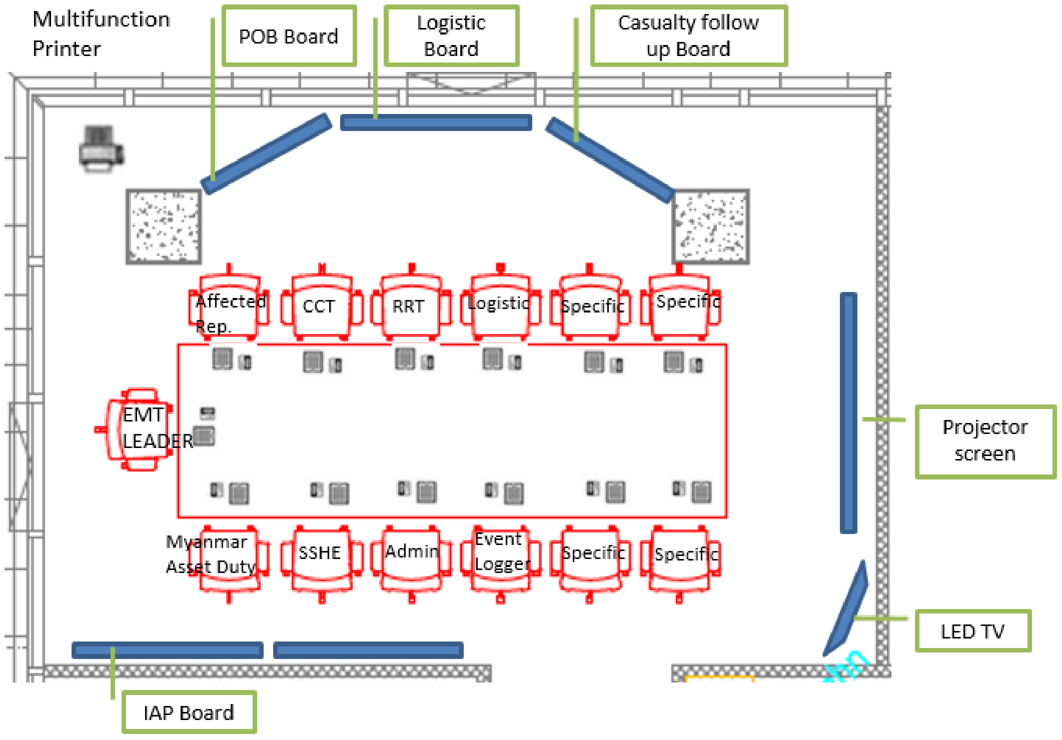

Figure 3: Emergency Management Room (Vantage Building Room 404)

5.6.2 Crisis Communication Room

Temporary room for CCT support team shall be setup using Vantage Building meeting room 401 when requested by EMT Leader or CCT duty. It is the responsibility of Administration duty who shall liaise with administration team and IT team to setup the room as request. Designated telephone number shall be provided in advance in order to contact with local, national and international media agencies.

The require equipment for use in Crisis Communication Room are as follows but should not limit to;

- Communication equipment (Telephone, Fax, Tele-conference)
- Projector and screen
- Notebook Computer
- Printer
- Sound recorder
- Earphone
- Board
- Television
- Stationary
- Etc.

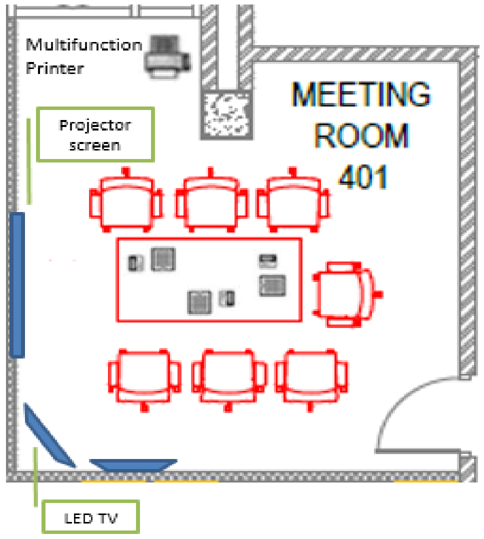

Figure 4: Crisis Communication Room (Vantage Building Room 401)

5.6.3 Relative Response Room

Temporary room for Relative Response support team shall be setup using Vantage Building meeting room 717 when requested by EMT Leader or RRT duty. It is the responsibility of Administration duty who shall liaise with administration team and IT team to setup the room as request. Designated telephone number shall be provided in advance in order to contact with staff next of kin.

The require equipment for use in Relative Response Room are as follows but should not limit to;

- Communication equipment (Telephone, Fax)
- Projector and screen
- Notebook Computer
- Sound recorder
- Earphone
- Board
- Stationary
- Etc.

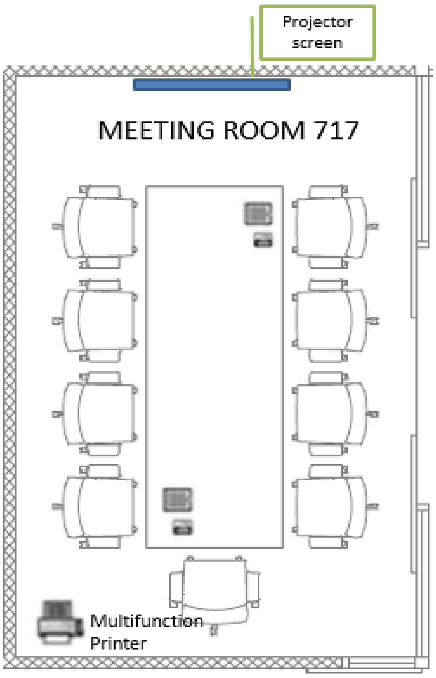

Figure 5: Relative Response Room (Vantage Building Room 717)

5.7 END OF EMERGENCY AND INCIDENT INVESTIGATION

5.7.1 Emergency End and Final Actions

Once a decision has been made that no further actions are outstanding and that an emergency is over, many issues need to be considered before standing down. There is a need to consider the following:

- Ascertain the current position of each team member as regards their roles, responsibilities and any on-going / outstanding actions.
- Identify and assign any outstanding actions including debriefing of interested external parties, such as partners.
- Put in place a review procedure to ensure the completion of outstanding actions.
- Liaise with CMT as necessary to ensure that they have no further requirements.

- Understand any outstanding human resource issues and ensure that the necessary information is provided and the appropriate steps are being taken.
- Ensure that all staff are aware of the incident close out and update them regarding the short and long-term issues affecting the company (if known).
- Ensure that all information has been captured and recorded.
- Have a Team Debrief before staff leave or return to normal duties.
- Ensure to plan a future debrief time when all actions can be analyzed. This can usually be within 24 - 48 hours of emergency closed. Consider including the participation of an independent reviewer.
- This review should also address the sensitivity of the report information and determine the most appropriate means of secure storage.

After the review a Close-Out Report should be prepared. The report should cover the following:

- Understand and document the cause(s) of the emergency.
- Document all involved parties and details of participating personnel.
- Analyze the response and identify any learning points to be incorporated into the appropriate procedures and/or to be shared with other parts of the business.
- Incorporate a full picture of the costs incurred as a result of the incident.
- Review the effectiveness of all actions taken.

5.7.2 Investigations

It is the responsibility of Myanmar Asset GM to designate a team responsible for conducting detailed / in-depth incident investigation. As per PTTEP Incident Management Standard requirement, all incidents which have resulted in the activation of an emergency response must be thoroughly investigated.

5.7.3 Post Emergency Reviews

The Company requires that a post-incident review be conducted to examine the Company's response to the emergency incident. Myanmar Asset EMT Leader shall convene a Review Meeting of the emergency. Those attending the Review meeting shall include the EMT members, and all other Emergency Team members who participated in the emergency management. Minutes of the review meeting shall be recorded and archived for future analysis.

The Review Meeting shall determine (but not limited to) the following:

- Were employees properly informed of company procedures?
- Did employees respond according to company procedures?
- Were employee's responses timely?
- Were the procedures adequate?
- What were problems encountered during the response activities?
- What can be improved?

- How can similar events be avoided in the future?
- If public emergency services were involved they shall be invited to participate in the critique.

5.8 TRAINING AND EXERCISES

5.8.1 Emergency Management Training

Myanmar Asset GM, Line Managers / VPs & SSHE Manager shall arrange and provide emergency management training and refresher training to EMT, duty personnel and other support teams. This aims to establish and maintain competency of all personnel assigned to perform emergency & crisis duties. Assigned staff are responsible for attending emergency management & refresher training arranged by the company.

Following table contains schedule of training;

Training			
Topic	**Target Group**	**Frequency**	**Responsible Party**
Incident Command Training (EMT Leader)	Employees who will be assigned as EMT Leader and alternative EMT Leader	Yearly/When assign	Myanmar Asset GM
PTTEP Emergency Management Standard Introduction & Myanmar Asset Emergency Management Plan	All EMT personnel	Yearly/When assign	Myanmar Asset GM/ Line Managers/SSHE Manager

5.8.2 Emergency Management Exercise

SSHE Manager is responsible for arranging and scheduling of Tier 2 emergency exercises for EMT. All duty personnel must be participated in the exercise.

Tier 2 emergency exercises should cover the possible scenario which impact and could escalate to Tier 2 or above level to Myanmar Asset include Tropical Cyclone exercise.

After any exercise, an emergency exercise report is to be produced. The exercise report should recommend potential improvements to plans, policies, standards, systems / processes, closure of gap or additional training required. The identified corrective actions are to be tracked until properly closeout.

In addition, the report shall be reviewed by management in order to incorporate lessons learned and best practices into the revised plans.

The 5 years plan of **Tier 2** exercise programs are shown in Table below:

Location	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022
Offshore operation	At least 1	At least 1	At least 1	At least 1	At least 1
Onshore operation	At least 1	At least 1	At least 1	At least 1	At least 1
Head Office			At least 1		At least 1
Supply Base		At least 1		At least 1	
Drilling operation	At least 1		At least 1		At least 1
Other Projects	At least 1 during the project commence				

APPENDIX A:

EMERGENCY REPORT FORM

APPENDIX B:

EMERGENCY HOURLY SITUATION REPORT FORM

APPENDIX C: EMT SPECIFIC TASK CHECKLIST

INITIAL / ONGOING ACTIONS			✓
Affected VP (EMT Leader / IC)	1.	When arrive at EMR, sign in the Entry Log.	
	2.	Confirm situation with Myanmar Asset Duty or the Affected Asset Duty.	
	3.	Take over the EMT Leader role form Myanmar Asset Duty.	
	4.	Implement the EMP and supervise the EMT to support the Site ERT/OSC/CSR.	
	5.	Ensure that the focus of support is aimed at protecting people, environment and property.	
	6.	Consider mobilisation of additional EMT specialist support depending on the incident.	
	7.	Assess the situation and allocate tasks to the EMT members, and ensure all actions are tracked and monitored.	
	8.	Update GM hourly using “Emergency Hourly Situation Report Form” shown in Appendix B.	
	9.	Review and approve official letter or memo in order to notify concerned external parties.	
	10.	Retain the emergency overview (the Big Picture) and delegate emergency support objectives to the EMT.	
	11.	Liaise with the CCT over any reputation issues and preparing of issuing press statements.	
	12.	Confirm that media and human resource issues are being addressed with CCT and RRT.	
	13.	If the situation is escalated and there is a potential to become Crisis, inform Myanmar Asset GM of a potential to activate CMT.	
	14.	Consider the need for personnel change over during the emergency lifecycle.	
	15.	Declare for emergency is over (Deactivate EMP).	
	16.	Conduct post emergency briefing for EMT after declaring emergency over.	
	17.	Initiate post investigation meetings & damage with the related team members.	

INITIAL / ONGOING ACTIONS			✓
Myanmar Asset Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	Complete the "EMT Emergency Report Form" shown in Appendix A	
	3.	Advise Telephone Operator to contact EMT members after consult with EMT Leader to activate EMP.	
	4.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	5.	Be a focal point to communicate with the OSC/CSR and keep updating situation until taking over by EMT Leader/Affected Asset Duty.	
	6.	Assess existing response and support and advise EMT Leader on the potential escalation of the incident.	
	7.	Work closely with other EMT members to ensure resources are effectively utilized.	
	8.	Follow up and update EMT Leader to ensure effective support / priorities are clearly understood & maintained.	
	9.	If assigned, keep EMT Leader informed of critical issues and on-going activities / tasks assigned to EMT members.	
	10.	Work closely with the Event Logger to ensure accurate information is provided and logged.	
	11.	Maintain a personal log of events of all activities undertaken during the incident life cycle.	

		INITIAL / ONGOING ACTIONS	✓
Affected Asset Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive situation briefing from Myanmar Asset Duty or EMT Leader.	
	4.	Establish contact with the OSC / CSR, if not done so.	
	5.	If assigned by IC, notify other EMT members of the incident and establish a protocol for communications between on-site ERT and EMT including incident command network.	
	6.	Monitor and follow up Incident Action Plan implementation	
	7.	Update Action Plan implementation status to ERT/OSC/CSR.	
	8.	Assist EMT Leader with provision of operational advice & tactics to mitigate the consequences including command & control approach.	
	9.	Ensure all information, data, records are being documented and secured.	
	10.	Advise EMT Leader to consider the need for personnel change over during the incident lifecycle.	
	11.	Advise EMT Leader to mobilize additional EMT specialists depending on the incident / emergency situation.	
	12.	Work with EMT Leader to conduct impact and damage assessment (Interim and Full reports).	
	13.	Nominate one of affected asset member to take the role of Event Logger.	

Crisis Communication Team Duty		INITIAL / ONGOING ACTIONS	✓
	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive a brief on the situation from EMT Leader/Myanmar Asset Duty.	
	4.	Act as a focal point for all external communications related issues (Refer to Crisis Communication Plan).	
	5.	Determine potential level of media interest and mobilize the CCT members as necessary (If in doubt call the entire team out). Liaise with Administrative duty for Crisis Communication Room setup.	
	6.	Complete the Initial “Media Holding Statement”.	
	7.	Begin work on developing the first “Media Press Release”.	
	8.	Pass any press releases to the EMT Leader and CMT Leader for their approval. The CMT Leader has to approve all press releases.	
	9.	Once the press releases are approved ensure all members of the EMT, CMT, RRT, CCT other support teams receive a copy.	
	10.	Update the EMT Leader on all media and external communications issues.	
	11.	Support the Receptionist / Security if the press / media begin to show interest.	
	12.	Maintain communications with the OSC, EMT Leader & CMT Leader and provide regular updates or a request of press interviews / conference.	
	13.	Ensure that a complete distribution list of press statements has been established & maintained.	
	14.	Start planning a relief team for the CCT members as appropriate.	
	15.	Consider using a Media Monitoring Service (on call-off contract) to monitor electronic media and record relevant broadcasts.	
	16.	Maintain a log of events of all activities undertaken during the incident life cycle. Pass complete log sheets to the Event Logger.	
	17.	Ensure there is a consistent and coordinated media response from all access points to Myanmar Asset.	

INITIAL / ONGOING ACTIONS			✓
Relative Response Team Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive a brief on the situation from EMT Leader / Myanmar Asset Duty.	
	4.	Establish numbers of personnel involved in incident. Obtain POB list if an offshore incident.	
	5.	Establish status of personnel involved in emergency response including injuries and movements to other locations.	
	6.	Consider the mobilization of other RRT members to support any enquires from family and relatives. (If in doubt call the team out). Liaise with Administrative duty for Relative Response Room setup.	
	7.	Maintain regular communications with EMT Leader & CMT Leader to ensure they have all relevant information related to HR issues.	
	8.	Ensure HR personnel available to dispatch to reception points as required (Logistics Base, hospitals, hotels etc). Maintain close communications with personnel at all times.	
	9.	Work closely with the EMT Leader and CCT to determine appropriate message to employees & their families.	
	10.	Ensure cash are available for assistance to employees and families (consult with EMT Leader & HR Manager as required).	
	11.	In the event of a very serious injury or fatality, liaise closely with the EMT Leader in determining timely notification to the Next of Kin.	
	12.	Keep details of those seriously injured and fatalities within EMT. Minimize risk of information leakage to the public.	
	13.	Establish the requirement for counselling services for those affected by the incident (open to all employees and contractors).	
	14.	Work with HR manager (RRT Leader) on contingency plan to secure enough HR resources. These resources will be available until restoring / returning to normal operations.	
	15.	Maintain a personal log of events of all activities undertaken during the incident life cycle. Ensure completer log sheets are passed on to Event Logger.	
	16.	Consider the need for personnel change over during the incident lifecycle.	

		INITIAL / ONGOING ACTIONS	✓
SSHE Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR	
	3.	Receive a brief on the situation from EMT Leader / Myanmar Asset Duty.	
	4.	Act as a focal point and advice on issues relating to SSHE.	
	5.	Consider mobilization of additional SSHE specialists / support depending on the emergency situation & type.	
	6.	Work with EMT Leader to plan for the anticipated SSHE related issues and actions arising from site emergency response operations.	
	7.	Update the IC on all related SSHE Issues / assignments and provide solutions based on SSHE policy & strategic objectives.	
	8.	Ensure the appropriate Myanmar authorities have been notified (Fire Brigade, Police, Army, Navy etc.) of the incident and request support if deems necessary. Pass on any instructions / concerns from the authorities to the EMT Leader / EMT members.	
	9.	Ensure that all EMT members are made aware of all SSHE implications of supports provided to OSC / on-site ERT.	
	10.	Advise EMT members on all SSHE issues and refer to Emergency & Crisis management / contingency plans.	
	11.	Identify response priorities while taking account of agreed strategic objectives.	
	12.	Utilize the Time Outs to update the EMT Leader / EMT on the ongoing situation regarding SSHE support / activities & assignments.	
	13.	Maintain a log of events of all activities undertaken during the incident life cycle. The log will be utilized during incident investigation & post incident review.	
	14.	Consider the need for personnel change over during the incident lifecycle.	
	15.	After stand down, collect copies of Emergency / Crisis log sheets and original of all documents i.e. other complete forms, complete checklists, notes, faxes, emails etc.) made by all EMT members, for post incident analysis and continuous improvement of emergency preparedness.	

INITIAL / ONGOING ACTIONS			✓
Administration Team Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, liaise with IT Support Team to set up EMR.	
	3.	Ensure the electricity, lighting and air-conditioning is available.	
	4.	Ensure that the room facilities are working properly.	
	5.	Receive a brief on the situation from EMT Leader / Myanmar Asset Duty.	
	6.	Provide administrative supports to the EMT, i.e., search & supply necessary stationary, providing foods, accommodations which may be required by the EMT, etc.	
	7.	Arranging for the press conference room if required by CCT.	
	8.	Support the need of EMT, if the emergency requires a shift work of EMT.	
	9.	Make a note of all relevant information received and consequential activity performed. Pass each note to Event Logger for logging.	
	10.	Maintain a personal log of events of all activities undertaken during the emergency life cycle	

INITIAL / ONGOING ACTIONS			✓
Logistics Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive a brief on the situation from EMT Leader/Myanmar Asset Duty.	
	4.	Act as the focal point for the logistical support & establish secure links with the TKA supply base (For an offshore related emergency).	
	5.	Consider mobilization of additional specialist logistical support depending on the emergency.	
	6.	Liaison with services providers to arrange for the provision of all logistical requirements to aid the emergency response (Air, Sea and Land based assets).	
	7.	Establish the latest weather reports and forecast for the area of the emergency scene.	
	8.	Work closely with EMT Leader to ensure that the supply of logistical support is effective.	
	9.	Ensure that the Logistics Status Board is maintained with the up to date information and may request support from the Event Logger as appropriate.	
	10.	Where appropriate give estimated time of arrival and relevant parties for all logistical support.	
	11.	Utilize the Time Outs to update the EMT of the ongoing situation regarding logistical support.	
	12.	Maintain a personal log of events of all activities undertaken during the emergency life cycle and ensure the completed log sheets are passed to the Event Logger.	
	13.	Consider the need of personnel change over during the emergency lifecycle.	
	14.	Retain all information regarding mobilization of resources and liaise with the EMT Leader regarding longer term financial implications.	
	15.	Advise the EMT Leader of logistics support status.	
	16.	Ensure that all logistical support is stood down following the emergency.	

		INITIAL / ONGOING ACTIONS	✓
Event Logger Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive a brief on the situation from EMT Leader/Myanmar Asset Duty.	
	4.	Call for additional support to help manage log sheets, status boards and with any other administration.	
	5.	Ensure all EMT members utilize their individual logbooks and pass completed sheets to the Event Logger position.	
	6.	Upon assigned by the EMT Leader, initiate Event Log on the event logging board and commence compiling a log of events, actions, decisions, and communications.	
	7.	Begin logging information onto the relevant status boards using the completed log sheets.	
	8.	Ensure that Event Data is clear and displayed to all.	
	9.	Ensure understand the details of any events are passed to you via log sheets– information on log sheets should be short, clear and easy to read.	
	10.	Continually check and monitor all status boards within the room for accuracy.	
	11.	Ensure information on the status boards is cross-checked with all other docs such as Situation Reports, Press Releases etc.	
	12.	Ensure that all emergency documentation is retained for the post investigation phase.	
	13.	Consider the need for personnel change over during the incident lifecycle	

		INITIAL / ONGOING ACTIONS	✓
IT Support Duty	1.	When arrive at EMR, sign in the Entry Log.	
	2.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	3.	Receive a brief on the situation from EMT Leader/Myanmar Asset Duty.	
	4.	Call additional support when require.	
	5.	Operate fax machine, computer, email, printers to receive or send information as requested by the EMT	
	6.	To monitor incoming information via fax or e-mail and if requested by IC, display information on the status boards or display screen equipment or LCD projector	
	7.	Distribute / disseminate printed information / documents to the EMT & CMT members and other support teams upon request	
	8.	Update critical information displayed on LCD projector / screen display equipment (computer) which requires to be addressed and handled urgently	
	9.	Provide IT support to the EMT / CMT. Coordinate with Corporate IT to ensure continuous of IT systems during emergency / crisis management operations	
	10.	Ensure that all incident documentation especially electronic files is retained for the incident investigation data gathering process and the post incident review	
	11.	Act as trouble shooter for all IT systems and telecommunication equipment required for emergency response & crisis management operations	
	12.	Consider the need for personnel change over during the incident lifecycle	

INITIAL / ONGOING ACTIONS			✓
Specific Duty	13.	When arrive at EMR, sign in the Entry Log.	
	14.	If the first person to arrive at EMR, ensure that EMR has already been set up. If not, liaise with Administration duty to set up EMR.	
	15.	Receive a brief on the situation from EMT Leader/Myanmar Asset Duty.	
	16.	Call additional support when require.	
	17.	Liaise with EMT member concerning your specific dicipline.	
	18.	Liaise or communicate and coordinate with external stakeholders when require.	
	19.	Make a note of all relevant information received and consequential activity performed. Pass each note to Event Logger for logging.	
	20.	Maintain a personal log of events of all activities undertaken during the emergency life cycle.	
	21.	Consider the need for personnel change over during the incident lifecycle.	

APPENDIX D: DUTY ROSTER GUIDELINE

Duty Roster Groups

The Duty Roster is designed to provide support for resolving an Emergency Tier 2 / 3. Duty Roster name list and contact numbers are enclosed in PTTEP Myanmar Asset Weekly Duty Call Sheet (Refer to Figure 7 - Sample of Weekly Duty Call Sheet) then will be distributed to all concerned party.

Common Duty Group:

The Common Group is the main group, which will be always called in when emergency level 2 / 3 is initiated. The group comprises of following duties:

- Myanmar Asset Duty
- Event Logger
- SSHE Duty
- Logistics Duty
- CCT Duty
- RRT Duty
- Administration Duty
- IT Support

Specific Duty Group:

The Specific Duty Group will be assigned from various Assets or Disciplines' representatives. The selected persons will be called in when their related asset or discipline has sustained an emergency, or the EMT requires assistance. The Specific Duty Group is comprised of (but not limit to) the following specific duty groups:

- Affected Operations Duty e.g. Zawtika Asset Rep., MOGE-3 Rep., etc.
- Drilling & Completion Representative
- Project Representative
- PSC Liaison
- Medical Advisor
- Security Specialist
- Environmental Engineer
- Etc.

Back-up Duty Roster Team:

- If an emergency takes long time to last, EMT Leader shall consider having a relieve team. The Duty Roster Team in a later week will be called for backup.
- In the event of two emergencies happen at the same time, the backup team will be called.

PTTEP MYANMAR ASSET WEEKLY DUTY CALL SHEET

WEEK 10 Rev 0 (6th – 13th March 2018)		ROLE	MOBILE	OFFICE EXT	RESIDENCE / 2ARY TEL.
Myanmar Asset DUTY	Nathawut SATTAYAKHUNNASAKUL	PMM Duty Manager	+66 (0) 8 4211 69218	804-2813	09 4210 12864
CMT REP	Piya SUKHUMPANUMET	PTTEPI CMT Rep	+66 (0) 86 12 8851	804-2801	NA

PRIMARY EMERGENCY CONTACTS FOR EACH SITE, UNIT OR FUNCTION ARE HIGHLIGHTED IN RED TEXT

Contact PTTEP Extensions from an outside line & request extension via PTTEP Yangon Operator: +95 1 652 700 or via PTTEP Bangkok Switchboard: +66 2537 4000

YANGON EMERGENCY MANAGEMENT TEAM (OPERATIONAL EMERGENCIES)

EMT DUTY OFFICERS	NAME	MOBILE	OFFICE
Common Duty (Be available within 2 hours radius of Yangon office at all time)			
SSHE Duty	Natthawut CHOOSUWAN	09 4319 3368	804-1839
CCI Duty	Suphachittra THONGCHAVEE	09 4211 80119	804-2845
HRI Duty	Aeint Myat Noe ZAW	09 9747 36398	804-3801
Admin. Team Duty	Saowaluk MATURAPORN	09 4211 80119	804-3861
Logistic Duty	Kritsanachai YIN[illegible]EYOM	[illegible] 59207	[illegible]4-287[illegible]
EMT IT Support	Khin Myat Sanda [illegible]	[illegible]11 8011[illegible]	[illegible]-383[illegible]
Specific Group Duty (Stand by on phone [illegible] available [illegible])			
Offshore Drilling & Completion Rep. (M9)	Meth FOLLETT	09 4319 3357	804-1834
Medical Officer	Dr. Aung AUNG	09 4224 55455 09 517 5569	804- 3880
Zawtika Asset Rep.	Kolawat SWASDIPHANICH	09 7772 51227	804-1807
PSC Liaison Advisor	Khin MAUNG GYI	09 9772 21790	804-2814

OFFSHORE OPERATIONS CONTACTS

LOCATION	CONTACT	PRIMARY TEL	SECONDARY TEL
Zawtika Process Quarters – M9 In an emergency, use 'CCR' to Notify & Mobilise OIM (On Scene Commander)	CCR 24/7 Zawtika	814 – 1116	+8707 76711929
	ZPQ Clinic	814 - 1169	814 - 1411
	Radio Room (0700-1900hrs)	814 - 1109	+8707 76743201
Edril[illegible] M9 DSV [illegible]	DSV	300 - 6841	Radio Room: 814 - 3082
	[illegible]	814 - 3084	Sat: +66 600 024134
	Med[illegible]	814 - 3081	

YANGON EMERGENCIES (NON OPERATIONAL / DOMESTIC)

MEDICAL	ISOS 24/7 Assistance Line	01 657 840	
	ISOS Yangon (Clinic Reception)	01 657 822	
	LEO FAMILY 24/7 Alarm Centre	09 977 808 089	
	LEO FAMILY 24/7 Duty Doctor	09 482 184 10	
FIRE	EMERGENCY: 191	01 262 011 / 01 262 022	
PTTEPI YANGON (Vantage Tower Office)	PTTEPI 24/7 OPERATOR	Ext. 04 / 2880 or 09 512 8850	
	Vantage Tower 24/7 Security Control Room	01 230 7780	
PCML (Petronas) Duty Mgr	Yangon	09 519 3387	
TEPM (Total) Duty Manager	Yangon	09 500 8241	09 883 2332

ONSHORE OPERATIONS / PARTNER ORGANISATIONS

Sataporn Petchpong PTTEPI Building Construction	(PMO/E)	804-1826	09 4015 00139
Zawtika Operations (ZOC): In an emergency, use 'CCR' to Notify & Mobilise Site Manager (On Scene Commander)	CCR 24/7 ZOC	814 - 2117	814 - 2122
	Site Manager	09 4826 7787	814 - 2100
	Superintendent	09 4824 3537	814 - 2102
	Radio Room		814 - 2109
	ZOC Clinic	09 4827 2588	814 - 2181
	ZMS CCR	814 - 2216	814 - 2222
	Social Dev. Eng.	09 4888 7336	09 460 337 719
PTTEP Chief Medical Advisor	Dr. Athitaya J.	300 - 7840	+66 81 801 2883

Figure 7 - Sample of Weekly Duty Call Sheet

Duty Roster Nomination

Myanmar Asset Duty is nominated from staff based in Yangon office with senior, team leader and/or manager levels at operational department. Event logger shall be nominated from Commercial and Planning Department, for other duties, each discipline/department shall nominate one of staff in their team.

Staff are nominated for duty roster for a period 7 consecutive calendar days, *starting on Friday at 0800 hrs.* The Duty Roster is updated weekly by SSHE section. The roster will be distributed every Thursday to the following week's duty holders, and the personnel who will be on duty during the following weeks.

The assigned Department / Section Focal Points are responsible for providing the SSHE section with information regarding the forward planning of the Duty Roster.

Changes during a Duty Roster Week are allowed, but it shall be the responsibility of the person scheduled for duty. The change must be amicably agreed by the nominated recipient and shall be

communicated, by the person requesting the change, to SSHE section focal point as soon as possible. The requested change shall only be to another qualified duty person in the group.

Communication for Duty Roster Personnel

Myanmar Asset Duty will receive an emergency duty handover kit which consists of a mobile telephone (for Company Emergency Duty only), phone battery charger, and a log book. Details of all calls, received and transmitted, should be entered into the log book. The emergency duty handover kit must be handed over to the next person of duty.

Duty Roster Mobile Phone Test

- The Duty Roster mobile phone will be tested by Telephone Operator every Friday at 13.00 hrs. The message will be;

  "Duty Telephone Test, please confirm it is working … over".

This is to ensure that the mobile phones are workable and also to remind assigned Duty Persons that they are on duty.

- If by 16.00 hrs. the Duty Person has not been phoned, he/ she must ring the Telephone Operator and report that they did not receive the test call.
- The Telephone Operator will then test that number again.

Generic Duty Roster Responsibilities

- For **Common Duty** shall be available and be within 2 hours radius of Yangon Office at all times.
- For **Specific Duty** shall standby on phone and/or available at EMR as request by IC.
- Carry the duty mobile phone at all times.
- Ensure that the mobile telephones are always working.
- Be aware of specific responsibilities during an emergency.
- When receiving an emergency call, respond as directed by the call message.
- Immediately report any problems with duty communications equipment to IT section.
- Inform SSHE section focal point of any changes to the published duty roster.
- Must not have a blood alcohol level above the National legal limit.
- Notify SSHE section focal point of any changes in mobile telephone numbers.

Duty Roster Personnel Qualification Requirement

The Duty Roster Personnel shall be qualified and be approved by Myanmar Asset GM. Each discipline is required to have the following qualifications;

- Duty Roster Team members shall be assigned from experience and competence personnel of each discipline.
- Expertise in their areas of responsibility, including knowledge and experience.
- Understand the Myanmar Asset EMP and know the response process under his/her responsibilities.
- Has no record of disabilities that may impair his/her ability to perform the functions assigned to them.
- All Duty Roster Personnel shall obtain training and participate in the emergency response exercise as indicated in 5.8 Training & exercises.

EMERGENCY REPORT

Callers Details				
Callers Name: Telephone: 1. 2.				
Emergency Details				
Date of Emergency: Time of Emergency:				
Emergency Location:…………………..………………………… Type of Emergency (Circle): Gas Emission / Fire / Explosion / Pollution / Road Traffic Accident / Security Other:.. Does the caller require help? Yes / No What help is needed? Medical / Search & Rescue / Oil Spill Response / Technical Other:..				
Scale of Emergency: People				
Details	PTTEP	Contractors	Third Parties	Unknown
Fatalities:				
Injured:				
Missing:				

Scale of Emergency: Environment			
Detail	Oil	Chemical	Gas
Type:			
Quantity Released:			
Quantity Remaining:			
Scale of Emergency: Involvement at the scene			
Is there a Company Representative (CSR) at the scene? Yes / No Name:... Contact Number:..................................... Organisations at scene (Circle) : Police / Fire / Ambulance / Navy / Media Other:..			
Recorders Details			
Emergency level: (Circle)Tier 1/ 2/ 3 Date/Time of Alert:			
Recorders Name: Contact Number:			

Note:

EMT Emergency Hourly Situation Report

Report No	Date	Report Start Time	Local Time

This status report is to be prepared by the IC for distribution to the CMT Leader and is to be used in all major emergencies/crisis events involving fatalities, serious injuries, fire, explosion, major chemical, gas or liquid emission or other dangerous occurrences. (Update at hourly intervals).

1. Title of Emergency:

----

2. Location:

----

3. Date/Time of Emergency:

----

4. Type of Facility Affected: (QP/ PP / Vessel/ Rig/ Plant):

----

5. PTTEP's Interest **PTTEP Operated? Yes / No**

Main Partners:

Main Contractor:

----

6. Number of Casualties/ Survivors:

	FATALITIES	INJURIES	MISSING
PTTEP Employees			
Contractors			
Public			
Total			

Description of Injuries:

----

7. Brief Account of Emergency – Issues & Actions:
(Consider: People, Environment, Community, Authorities, Media, NGOs, Business Continuity & Incident Investigation)

PTTEP

PTT Exploration and Production Public Company Limited

Myanmar Asset Crisis Management Plan

Document No: 11027-PDR-SSHE-340-006-R01

May 2018

Approval Register	
Document Subject	Myanmar Asset Crisis Management Plan
Document Code	11027-PDR-SSHE- 340-006-R00
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Approval			
Name		Signature	Date
Document Owner	Piya Sukhumpanumet PMM	Piya S. Pan	10/5/2018
Approval Authority	Piya Sukhumpanumet PMM	Piya S. Pan	10/5/2018

THIS DOCUMENT WILL BE REVIEWED EVERY **5 YEARS** FROM DATE OF APPROVAL OR REVISED EARLIER IF NECESSARY.

Revision History			
Rev.	**Description of Revision**	**Authorised by**	**Date**
0	New Document	IMA	May 2013
1	- Separated from PTTEPI Emergency and Crisis Management Plan - Revised to reflect organization change - Revised CMT's role and responsibility - Defined scope to cover all Myanmar Assets - Added key activities and processes of CMT	PMM	May 2018

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1. PURPOSE

The purpose of this Myanmar Asset Crisis Management Plan (CMP) is to clearly define roles and responsibilities of Crisis Management Team (CMT) and to efficiently and effectively manage the potential crisis or crisis situation then to resume normal operations as soon as possible while protecting PTTEP (Myanmar Asset) reputation. This plan is aligned and complied with Corporate PTTEP Emergency and Crisis Management Standard (SSHE-106-STD-500).

2. SCOPE

This plan covers the processes to manage potential crisis or crisis situation to all Myanmar Asset operations, activities and projects by Crisis Management Team (CMT). It comprises of team organisation, roles and responsibilities, and the actions to be taken before, during and after crisis situation including coordination and communication both among response teams and concerned stakeholder.

This plan does **not** cover details of Emergency Management Plan (EMP), Emergency Response Plan (ERP) and contingency plan (CP) at workplace or worksite.

3. REFERENCES

3.1 PTTEP SSHE CONTROLLING DOCUMENTS

Document Number	Document Title
SSHE-106-PDR-400	PTTEP SSHE Risk Management Standard
SSHE-106-STD-500	PTTEP Emergency and Crisis Management Standard
SSHE-106-PDR-501	PTTEP Crisis Management Plan
SSHE-106-PDR-502	PTTEP Emergency Management Plan
11038-STD-SSHE-600-011-R06	PTTEP Incident Management Standard
11027-PDR-SSHE-340-005-R01	Myanmar Asset Emergency Management Plan
Myanmar-0050-PDR-008	Myanmar Asset Crisis Communication Plan

3.2 OTHER REFERENCE DOCUMENTS

Document Number	Document Title
OGP Report Number 517: Aug 2014	Incident management system for the oil and gas industry

4. DEFINITIONS

4.1 GENERAL DEFINITIONS

For the purposes of this CMP, the definitions of emergency and crisis are:

Terminology Description	Terminology Description
Crisis	A major or catastrophic event (out of control emergency). A crisis could result in sustained national impacts over a prolonged period of time; almost immediately exceeds resources normally available to the company, local authorities and country in the impacted area; and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened. Crisis may challenge the ability and capacity of communities, company and country to achieve a timely recovery Crisis situation includes terrorism that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, company reputation, national morale, and/ or government functions. In PTTEP crisis situation is treated by **a tier 3 response levels.**
Myanmar Asset Crisis Management Team Leader(CMT Leader)	Myanmar Asset General Manager (GM) who has the top authority to overall manage Myanmar Asset impact related to any crisis situations. He has the authority to activate Corporate Crisis Management Team and work closely with Asset Emergency Management Team Leader.
Emergency	An occurrence or event, natural or human caused, that requires an emergency response under determination of affected Asset Leader or Acting Person, to protect life, environment, property and reputation or to lessen or avert the threat of a major or catastrophe in any part of the company premises. The external assistance may or may not be needed to supplement the company efforts and capabilities to save lives, environmental, protect property, public health and safety. Emergency situations can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, fires, floods, oil and hazardous material spills, marine vessel and aircraft

	accidents, earthquakes, tropical storms, typhoon, war-related disasters, outbreak of diseases and medical emergencies, and etc. In PTTEP emergency situations can be evaluated and treated by using a tier 1 – 2 response level.
Myanmar Asset Emergency Management Team Leader (EMT Leader) or Incident Commander (IC)	Affected Operation's Leader or Acting person such as VP, Manager etc., who has overall authority and responsibility for supporting and providing tactical activities and incident action plans to the Emergency Response Team Leader or On Scene Commander (OSC), including the development of strategic objectives. EMT Leader also sets priorities and defines organization of the EMT and the overall action plans for the particular response.
Myanmar Asset Emergency Management Response Team Leader (ERT Leader) or On Scene Commander (OSC)	An individual responsible for all onsite responses, especially providing direction and onsite tactical operations and always retains the authority to determine the appropriate course of response actions. The operational sites / fields are as example, ZPQ, ZOC, ZMS, TKA, and etc. OSC shall the top authorized person at that site/ field who has the authority to activate the onsite Emergency Response Team (ERT).

4.2 ORGANISATION AND DEPARTMENTS

Corporate	Refers to the PTTEP Business Groups hierarchically above Asset level, and located in the PTTEP headquarters, Bangkok.
Group	Refers to a corporate level Business Group. These may have associated Divisions, Departments, or operational Assets within their hierarchy.
Division	A Business Group may have one or more distinct groups within its hierarchy. These are referred to as Divisions.
Asset	Refers to an operational Asset, site, or location within a respective Business Group.
Department	A subgroup within a Business Group, Division or Asset.

4.3 LANGAUGE

May	Indicates a possible course of action
Should	Indicates a preferred course of action
Shall	Indicates a course of action with a mandatory status

4.4 COMMON ACCRONYMS AND ABBRAVIATIONS

BCP	Business Continuity Plan
CCMT	Corporate Crisis Management Team
CCT	Crisis Communication Team
CMP	Crisis Management Plan
CMR	Crisis Management Room
CMT	Crisis Management Team
CP	Contingency Plan
EMP	Emergency Management Plan
EMR	Emergency Management Room
EMT	Emergency Management Team
ERT	Emergency Response Team
ERP	Emergency Response Plan
GM	Myanmar Asset General Manager
IT	Information Technology Section
MOGE	Myanmar Oil and Gas Enterprise
OSC	On Scene Commander
OSRL	The Oil Spill Response Limited
PCML	Petronas Carigali Myanmar Limited
PTTEP	PTT Exploration and Production Company Limited
RRT	Relative Response Team

SSHE	Safety, Security Health and Environmental
TEPM	Total Exploration and Production Myanmar
HR	Human Resource section

5. CRISIS MANAGEMENT

The impact and consequence within SSHE Risk Assessment Matrix in SSHE Risk Management Standard (SSHE-106-STD-400) contains severity rating which has been used as criteria to consider the appropriate levels of emergency response to any particular situation or emergency situation.

There is not necessary that the situation or incident escalate from tier 1 through tier 3, the incident may be as a result of activation of CMP in tier 3 at the beginning e.g. brand and reputation attack, financial crisis and etc.

The following schematic of PTTEP Emergency and Crisis Management demonstrates 3-Tier response structure.

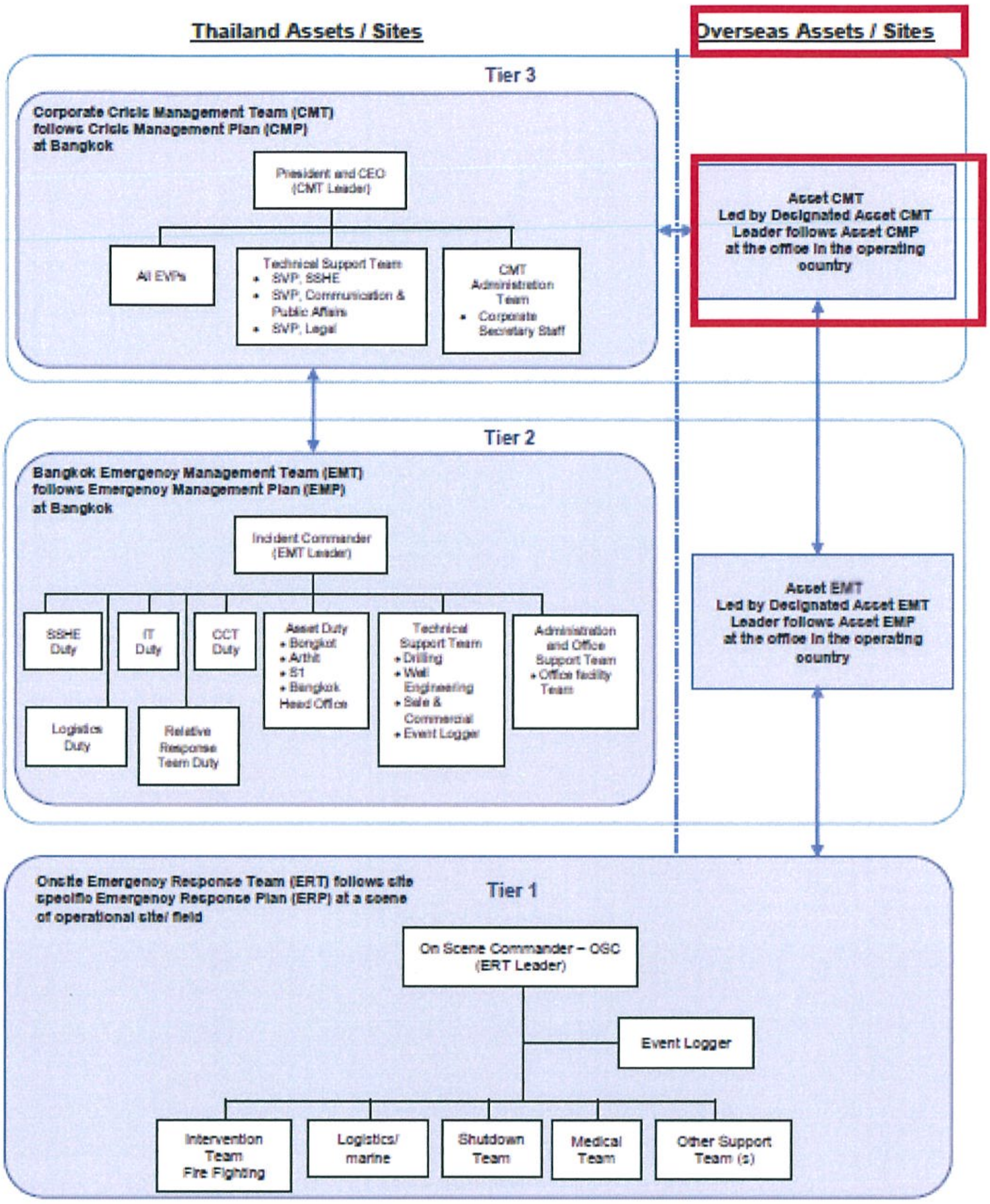

Figure 1 - Expanded PTTEP Organizational Structure of Emergency and Crisis Management

5.1 CRISIS MANAGEMENT ORGANISATION AND TEAM

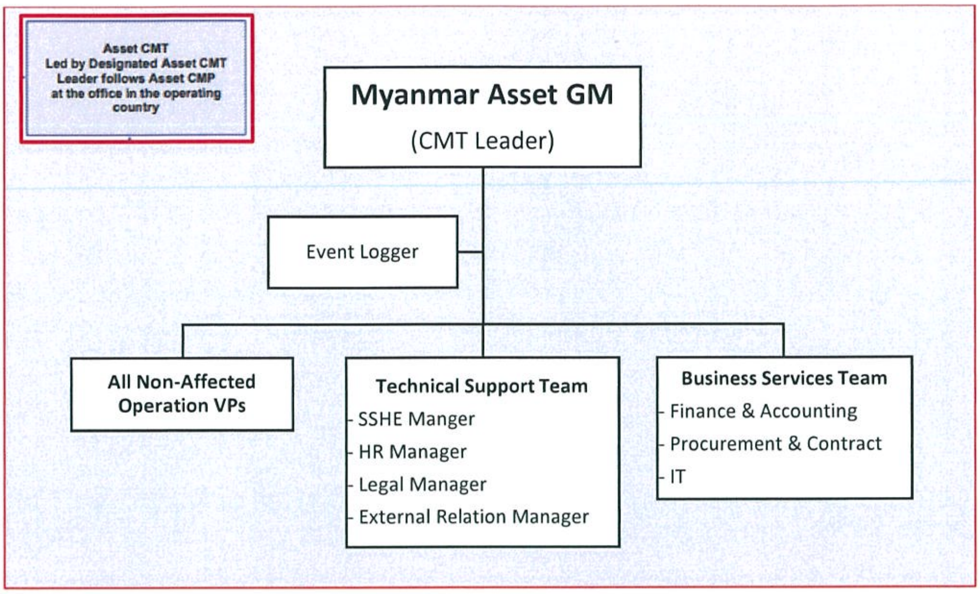

Figure 2: Myanmar Asset Crisis Management Team organization

5.2 TEAM ROLES AND RESPONSIBILITIES

Myanmar Asset GM (CMT Leader)
• Ensure Fully implement Myanmar Asset Crisis Management Plan and to ensure compliance with PTTEP Emergency and Crisis Management standard • Ensure that all CMT members are briefed the situation • Ensure all required internal and external notifications have been made • Liaise with PTTEP Corporate to determine the need to active Corporate CMT • Be a focal point in organizing and managing crisis management operations and ensure that focus of CMT members remains strategic rather than tactical in nature • Brainstorm with CMT members to identify and prioritize strategic considerations • Develop specific strategic objectives for current crisis situation • Liaise with EMT Leader to establish and maintain emergency/crisis network • Assess potential impacts and provide briefing to strategically important stakeholders • Work with Relative Response Team (RRT) and Crisis Communication Team (CCT) to develop messages that address concerns of employees, families of impacted personnel, government agencies/authorities, public, media and strategically important stakeholders • Determine severity and duration of business interruptions. If necessary, ensure that Business Continuity Planning (BCP) is undertaken • Appoint the Company Spokesperson • Review and approve critical resources requested by EMT Leader • Review and approve media holding statements and media press releases

- Determine when it is appropriate to stand down all or a portion of the CMT

Non-Affected Operation VP.
• Serve as Advisor to CMT Leader on all matters relating to technical and operations • Define actions to be taken to address requests for assistance, issues and concerns • If assigned by CMT Leader, liaise with PTTEP Corporate CMT to establish and maintain crisis management network • Handle any tasks assigned or delegated by CMT Leader • If requested, conduct briefing and assessment meetings on behalf of CMT Leader • Assist CMT Leader to develop specific strategic objectives for current emergency/crisis situation and provide technical support to EMT • If assigned by CMT Leader, review requests from EMT then assigned requested tasks to support staff • Work to minimize disruptions/interruptions in unaffected portions of affected operations • Assist CMT Leader to carry out impact analysis to identify strategically important stakeholder issues and concerns that have potential to create a crisis situation • Assist CMT leader to assess whether incident response may result in new scopes of work in order to develop strategy to address such new scopes • If necessary, activate other support staff and manage work carried out by the support staff

Technical Support Team (SSHE, HR, Legal, External Relation)
• Provide advice and guidance on particular area of expertise to the overall crisis response • Carry out an initial assessment of the impact the emergency may have on your particular responsible part of the business • Establish links with specific function contacts and establish if additional support is required or can be provided • Keep the CMT Leader informed of any significant impacts/issues relating to PTTEP business • Assist the CMT Leader implement appropriate business continuity plan

Business Services Team (Finance, Procurement, IT)
• Provide support or advice CMT Leader on particular area of expertise • To assist in developing messages to concerned stakeholder • Keep the CMT Leader informed of any significant impacts/ issues relating to PTTEP business • Assist the CMT Leader implement appropriate business continuity plan

Event Logger
• Liaise with the all CMT to ensure that all information is recorded. • Ensure that all events are precisely and accurately recorded as they occur.

5.3 NOTIFICATION AND COMMUNICATION

In the event of the emergency is escalated to crisis in **rating 4 and 5** of impact and consequence within SSHE Risk Assessment Matrix in SSHE Risk Management Standard (SSHE-106-STD-400), the VP of Affected Operation (EMT Leader) must notify and consult with the Myanmar Asset GM as CMT Leader immediately to consider the stage activation requirement. Myanmar Asset GM will then inform the EVP of Production Asset Group for Corporate CMT initial notification and/or further processes may be required.

If the potential crisis event has not been notified by EMT, Myanmar Asset GM shall initial assess the situation and consider the stage activation requirement.

It depends on the nature of the incident or situation of crisis, Myanmar Asset GM shall decide to activate CMP and then call CMT member weather a full team CMT member or partial members.

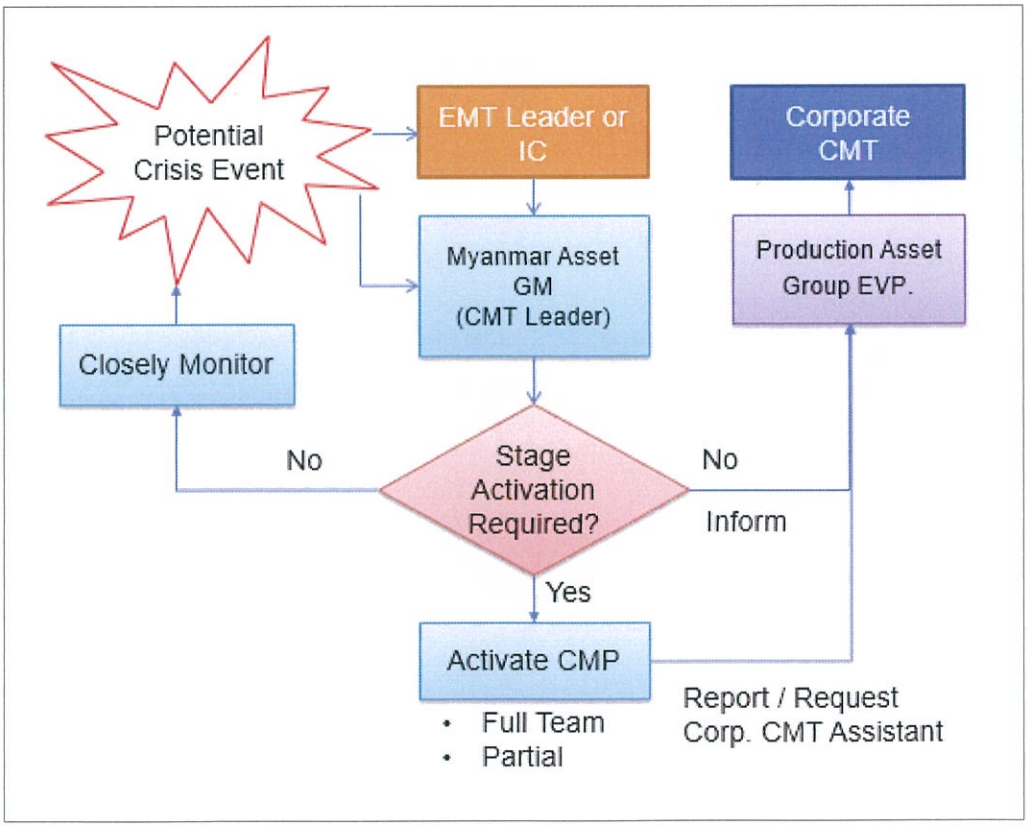

Figure 3 - Flow Chart of Crisis Notification

5.4 ACTIVATION AND DEACTIVATION

The activation of this plan shall be done by Myanmar Asset GM or by authorized person following the notification process, for deactivation the CMT Leader is the sole authority for deactivating CMP. Deactivation should begin when;

- CMT and EMT Leader agree that the critical emergency or incident has been under controlled by EMT, ERT and not need assist or further support from CMT
- CMT agree that there is no more potential impact significantly to Myanmar Asset' Assets especially people and reputation

The activities and procedures which must be undertaken to recover from an emergency incident, the CMT Leader shall ensure that the EMT Leader conducts the activities according with deactivation processes on EMP.

5.5 KEY ACTIVITIES AND PROCESSES OF CRISIS MANAGEMENT TEAM

The CMT is responsible for providing strategic objectives of incident response to EMT Leader and ensuring prudently handles with stakeholder. Key stake holder list and contact numbers are provided in appendix A, and stake holder mapping template in appendix B. The processes include but not limited to the following.

- Assess and reassess the situation;
  - Consider new facts and developments
- Articulate mission statement;
  - Ensure all actions and communications are founded on it and aligned with it
- Map and remap stakeholder;
  - Consider stakeholder perceptions when making decisions
  - Acknowledge that team will not please everyone
  - Help team to focus on area that can be influenced
- Build scenarios permutations;
  - Define corresponding robust yet flexible strategies
  - Expect rumors and be ready for them
  - Can help team hold and defend company position

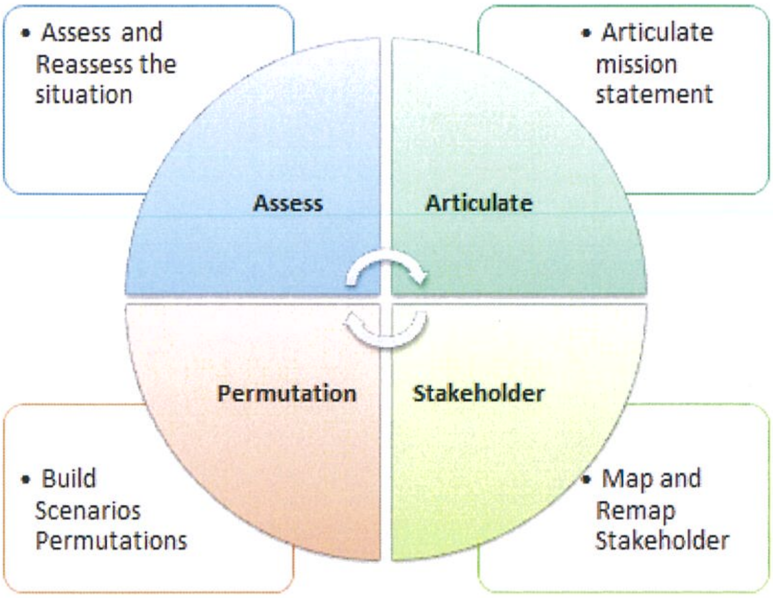

Figure 4 - Flow Chart of CMT key activities

5.6 CRISIS MANAGEMENT ROOM AND FACILITIES

The Crisis Management Room (CMR) for Myanmar Asset Crisis Management Team and their support team is located in the Vantage building, on 7th floor meeting room 702. In case of emergency at Vantage building and unable to use the room, the alternative or back up CMR shall be provided according to Myanmar asset Business Continuity Plan (BCP).

It is the responsibility of GM secretary to liaise with administration section and IT support team to setup the room as per request by CMT Leader.

The require equipment for use in CMR are as follows but should not limit to;

- Communication equipment (Telephone, Fax, Tele-conference, Radio, Sat. Phone)
- Presentation equipment (Projector and screen, Computer and software)
- Logging equipment (Computer and software, Sound recorder)
- Board (Stakeholder mapping board)
- Television
- Etc.

The room shall be protected from unauthorized person at all time. Emergency power is required for essential electronic equipment backup.

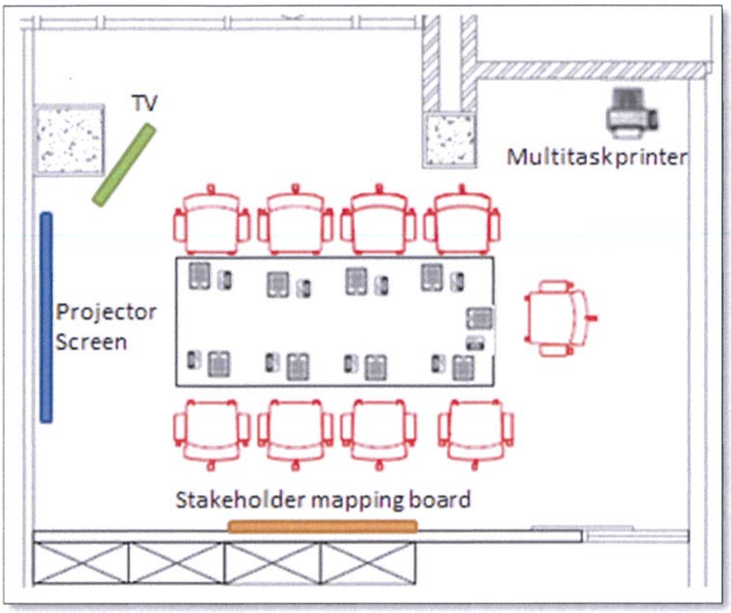

Figure 5: Crisis Management Room (Vantage Building Room 702)

5.7 END OF CRISIS AND POST INCIDENT INVESTIGATION

5.7.1 Business Recovery

Once a decision has been made that no further actions are outstanding and that an emergency and crisis is over, for business disruptive incident, Business Continuity Plan (BCP) shall be monitored and assess until return to normal status has been made before CMT standing down.

5.7.2 Post Incident Investigations

It is the responsibility of Myanmar Asset GM to designate a team responsible for conducting detailed/in-depth incident investigation. As per PTTEP Incident Management Standard requirement, all incidents which have resulted in the activation of an emergency and crisis response must be thoroughly investigated.

5.7.3 Post Crisis Reviews

The Company requires that a post-incident review be conducted to examine the Company's response to the emergency or crisis incident.

Myanmar Asset GM as CMT Leader needs to collect and collate information and report from CMT members and EMT in order to improve Crisis Management Plan and effective and efficiency of incident response team.

5.8 TRAINING AND EXERCISES

5.8.1. Emergency Management Training

Myanmar Asset GM shall arrange and provide crisis management training and refresher training to CMT and other support teams. This aims to establish and maintain competency of all personnel assigned to handle with crisis situation.

Following table contains schedule of training;

Training			
Topic	**Target Group**	**Frequency**	**Responsible Party**
Crisis Management and Crisis Communication	All CMT personnel	Yearly	Myanmar Asset GM
PTTEP Crisis Management Standard Introduction & Myanmar Asset Emergency and crisis Management Plan	All CMT personnel	Yearly/When assign	Myanmar Asset GM

5.8.2. Crisis Management Exercise

Myanmar Asset GM via SSHE manager is responsible for arranging and scheduling an exercise for CMT. All CMT personnel must be participated in the exercise.

The exercise shall be held at least once in a year and cover the possible scenario which impact and escalate to Tier 3 level.

After the exercise, CMT exercise report is to be produced. The report should recommend potential improvements to plans, policies, standards, systems / processes, closure of gap or additional training required. The identified corrective actions are to be tracked until properly closeout. In addition, the report shall be reviewed by management in order to incorporate lessons learned and best practices into the revised plans.

APPENDIX A KEY STAKE HOLDER LIST AND CONTACT NUMBERS

Stake holder	Contact Number/Person	Responsibility
Government		
- MOEE		
- MOGE		
- Ministry of Transport and Communication		
- Myanmar Defence Force		
- Regulatory body		
- Army		
- Navy		
- Police		
Partners		
- TEPM		
- PCML		
Contractors		
-		
-		
Medias		
- National Media		
- International Media		
NGOs		
-		
-		

Stake holder	Contact Number/Person	Responsibility
Employees		
Relatives		
Surrounded Communities		

APPENDIX B STAKE HOLDER MAPPING FORM

Stakeholder	Priority	Objectives	Strategy	Stakeholder Owner	Format of Engagement	Key Message	Result/Status
	-Required regulatory - High -Medium -Low	- Why engage?	- Proactive or reactive?	- Identify relationship owner within PTTEP	- E.g. face to-face meeting? Letter?	- See key messages template	- Who, when, where etc.

In any crisis it is essential that PTTEP identifies its priority stakeholders and manages communication with them carefully. This template, which should be used alongside Myanmar Asset's main contact list, will allow the CMT to assess:

(i) Each stakeholder's interest in the specific incident, and

(ii) Their impact on Myanmar Asset's reputation.

Appendix 3

Biodiversity Report

Biodiversity Field Survey and Reconnaissance Report

Prepared by:

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February 2018

I. EXECUTIVE SUMMARY

The project area is situated in Thayet Township, Magway Region which is in the lower part of central Myanmar. One reserved forest which is named as Thae Phyu RF (7280 AC) and one Protected Public Forest, Kadoe Taung (5905 AC) are found to be existed in the project area. The objective of this biodiversity survey is to provide information concerning with existing Biodiversity, identify the potential impacts and also suggest mitigation measure and management plan.

The flora survey was carried out by forest inventory method to identify the species composition, density and distribution. Sample plotting methods, random transect methods were carried out to identify the vegetation types and endangered species in the area. biodiversity fauna focused community interviews identified potentially 10 species of bird, and 6 species of mammal, 7 species of reptile /amphibian, 1 species of invertebrate, and 17 species of fish.

The biodiversity field program took a total of 6 days beginning from 6th February 2018 to 11th February, 2018. The vegetation map and animal survey map were drawn by using UTM map and satellite image. A total of 54 plant species were identified in five survey sites for plants.

We incorporated biodiversity into the Environmental impact assessment as follows. At the screening stage, potential red flag issues e.g sites designated as important for biodiversity were identified. Then we undertook site visit survey and consulted key stakeholders to identify issues and data gaps at the EIA scoping. In the EIA investigation stage (Baseline studies), we conducted the below mentioned field surveys to identify biodiversity and ecosystem services to support impact assessment. After that, we determined the nature, temporal and spatial scale, reversibility, magnitude, likelihood, extent and significance in the impact assessment. Then, we applied the mitigation hierarchy to eliminate or reduce negative impacts on biodiversity and included in the management plans.

II. INTRODUCTION

2.1 Magway Region

Magway Region is located in the western part of the middle Myanmar. It borders with Mandalay Region in the East, Bago Region in the South, Rakhine State in the west, Chin state in the North-west and Sagaing Region in the North. Generally Magway Region is divided into Eastern part and Western part by Ayarwaddy River. The Western part, near the border of Rakhine State and Chin State, is hilly and continuous with the mountain ranges of Rakhine Yoe-ma and Chin Hills.

The unique feature of Magway Region is the network of streams running from north to south that drain into the Ayarwaddy River. The well-known streams are Kyaw Stream, Yaw Stream, Mone Stream, Mann Stream, Salin Stream, Pin Stream, Pani Stream and Mintone Stream. In terms of biodiversity, two wildlife sanctuaries such as shwesettaw (55271 hectares) and wethtigan (453 hectares) are included in Magway region.

2.2 Thayet Township

Thayet Township is located in the South-eastern part of the Magway Region. The township has an area of 1,202 square kilometers and the density was about 86.81 per square kilometers; the total rainfall in a sample year was about 40.23 inches and average temperature was about 27.71°C. The population of the district was estimated at 104,347 (Gender : Male 49,385 / Female 54,962 and Urbanization : Rual 84,096 / Urban 20,251) according to the 2014 Myanmar Population and Housing Census. On the west is the Arakan Yoma range, and on the east the Pegu Yomas; and the face of the country, where it does not rise into mountains, is everywhere broken by low ranges of hills, many of which are barren and lack vegetation. It borders with Mintone Township in the West, Kanma Township in the South-west, Taungup Township and Ann Township of Rakhine State in west and Minhla Township in North. It is located at 19° 19' 30’’N and 95° 10' 59’’E.

The greater part of the district is wooded, and the mountains to the east and west are covered with forests. Thayet has several salt and hot springs. The chief river is the Ayeyarwaddy River, which traverses Thayet from north to south. The drainage finds its way to the Ayeyarwady River by three main streams, the Pwon, Ma-htun and Ma-de on the west, and by two, the Kye-ni and Hput on the east. The geomorphology of the area comprises slops and ridges between mounds, saddles and low hills. Most of the low hills and mounds are now became farm lands and abandoned farm due to shifting cultivation.

There are one reserved forest namely Thae Phyu (7280 acre) and one Protected Public Forest namely Kadoe Taung (5906 acre) in the project area. We were observed Euralyptus Plantation 5 AC, and also we discovered one gold mine in the reserved forest, Thae Phyu. There are three types of forest namely Mixed Deciduous Forests (62253 acres), Dry Forests (85258 acres) and Indaing Forests (46614) in Thayet Township according to Forest Department. However, the forests are highly degraded due to the over exploitation and expansion of farm land in the reserved forests. Due to deforestation and illegal hutting wild animals became decreasing in population.

2.3 The Project Area

The project area is located in the Thayet Township within the Ayarwaddy River Basin, the catchment of BagoYoma and the foot hills of Rakhine Yoma.

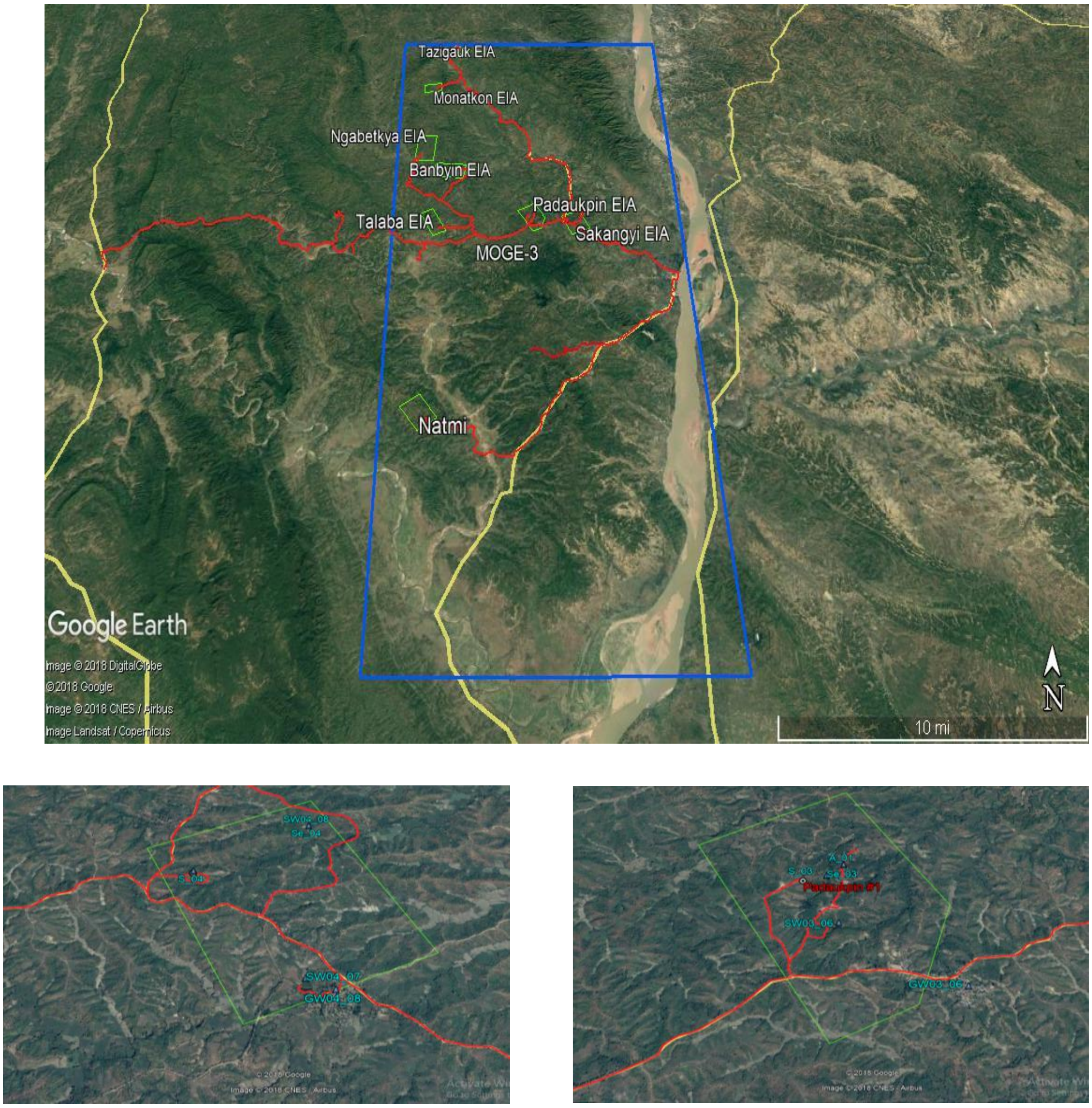


Figure 1: Flora Survey Map

2.4 The Vegetation

The forests areas included in the project area are 13185 acres. The unique features of the forests are the Bamboo, In and Teak trees. Teak, In and Bamboo are the dominant species in the project area. There is evidence of teak plantations in patches in the forest area and even in the degraded forest (which has now become bamboo forests). The young teak plants and secondary teak trees growing from the stumps are found everywhere in the forests. Another evidence is that almost all houses in the near-by villages are built from teak and the also monastery was built by teak pillar.

The dominant tree species in this area are *Tectona grandis* L.f. (Kyun) followed by *Lagerstroemia venusta* (Zaung-pa-lae), Terminalia pyrifolia (Lein), Dipterocarpus tuberculatus (In), *Terminalia alata* (Heyne) Roth (Htauk-kyant), and *Diospyros burmanica* (Te).

Figure 2: Monsatery and house were built by teak

III. AIM AND OBJECTIVE

1. To collect, identify and list the plants and animals (Biodiversity data) in the area.
2. To record the dominant tree species and evaluate the vegetation types (forest type).
3. To record the animal species and determine the habitat type.
4. To collect the ecological data and evaluate the existing ecosystems in the project area.
5. To identify and records the endanger species according to IUCN Red List.
6. To set up the Satellite imagery vegetation cover and land use map
7. To record and list the Myanmar protected species in the area.

IV. MATERIAL AND METHOD

4.1 Approach and Methodology of the Study

The MOGE-3 Biodiversity Site Reconnaissance and Assessment was carried out in two parts:

1) Review and synthesis of secondary data on local biodiversity, significant supporting habitat and landscape features in the project area of influence.
   Secondary sources included:
   a. Biodiversity databases relevant to the area[1].
   b. Satellite imagery of vegetation cover and land use in the project area.
   c. Available information on Regional and Local Protected Areas or Sites: description, designation criteria (including boundaries, status, legal requirements, etc) and mapping
   d. IUCN listings of Threatened species according to the IUCN Red List.
   e. Information on endangered wildlife species listed as protected wild animals, in respect of their categories under the Forest Department Notification No. 583/94 (26 October 1994)
   f. Information on presence of endemic, migratory and congregatory species and/or key (highly threatened and/or unique) ecosystems in the project area of influence
   g. Information on key species ecology including distribution, habitat requirements, and sensitivities.
   h. Available information on culturally important and iconic species that may be present.
   i. Available information on the potential presence of alien invasive species;

2) Collection of primary data within the seismic survey study area. Primary data was obtained using the following techniques:
   a. Field biodiversity reconnaissance surveys of representative habitat types within the study area. Four areas of what were considered representative habitats dominated by native vegetation were subject to reconnaissance level biodiversity inspections and forest inventory 20 m x 20 m flora plots by the survey team. These four areas provided broad coverage near the PTTEP SA well site areas. The present survey was practically constrained such that intensive, multi-season transect-based techniques to confirm the presence of species which typically occur at low density, are rare or uncommon were not feasible. Data collection on the occurrence of less common species relied instead on local ecological knowledge interviews as discussed below. Ground surveys for rare plants were not undertaken.
   b. Ecological knowledge interviews involving local residents were undertaken to tap into local knowledge and observation on species, seasonality, migration, etc. This activity was supported by reference to species photographs and drawings. Photographs included wildlife species, which were Critically Endangered and Endangered, which had some potential to have historically occurred in the broad area. A list of field guides used during the interviews is provided in the References section of this report.

[1] http://www.iucnredlist.org/
https://species.wikimedia.org/wiki/Main_Page
Endemics : http://lntreasures.com/burma.html
Flora and Fauna International : http://www.fauna-flora.org/explore/myanmar/
Biodiversity and Nature Conservation Association
https://myanmarbiodiversity.org/

Local knowledge is invaluable in providing long-term observation of biodiversity and ecological change in an area. Observations of species types which are not subject to routine harvest or which are not in conflict with the local population are less reliable than those that are.

The communities proximate to the well site areas are detailed in **Table 1**.

Table 1: Ecological & Biodiversity Interview Locations

Date	Public Consultation Meeting Venue	Villages cover for PC
5th February	Padaukpin village	1. Kyauk-o 2. Nga Hlaing Chon (Big) 3. Nga Hlaing Chon (Small) 4. Padaukpin 5. Sakangyi 6. Taung Baw 7. Myauk Baw 8. Yay Ban Nyay
6th February	Baw village	1. Tazigauk (E) 2. Tazigauk (W) 3. Talokpin 4. Monatkon 5. Tat ywa 6. Bawya (N) 7…….Bawya (S) 8. Inle 9. Paukphyu 10. Sanmagyi 11. Okpon
7th February	Ohn Mun Daw Village	1. Sanle 2. Ngabetkya 3. Okmundaw 4. Banbyin 5. Ywathit 6. Pegadin 7. Shanywakyaw 8. Yemyet 9. Pat Ma Kan 10. Zidaw 11. Ahlatlel 12. Ohnedegyi
8th February	Paput Village	1. Ton 2. Paput 3. Paukuga

c. Review of species habitat requirements relative to available satellite imagery and ground reconnaissance date.

d. Mapping of Natural and Modified[2] habitats according to IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management; and of possible critical habitats, if any.

[2] **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 functionsandspeciescomposition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimedwetlands. **Natural Habitats** are areas composed of viable assemblages of plant and/or animal speciesoflargelynativeorigin,and/orwhere human activity has not essentially modified an area's primary ecological functions and species composition.

Mitigation measures were developed to be consistent with IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management and related Guidance Notes[3].

Globally threatened status of Fauna species were categorized using The IUCN Red List of Threatened Species as shown in below:

Status	Code
Critically Endangered	(CR)
Endangered	(EN)
Vulnerable	(VU)
Near threatened	(NT)
and Least Concern	(LC)

Source: IUCN Red List of Threatened Species, Version 3.1. Accessed from www.iucnredlist.org on 01 November 2016.

4.2 Biological Ecoregions

Ecoregions are biogeographic units, which are relatively large units of land or water that contain distinct assemblages of natural communities, sharing a majority of species, dynamics and environmental conditions. Under this classification scheme, ecoregions exist within "bioregions" and typically contain numerous "ecozones". Within Block MOGE-3, the *Irrawaddy Moist Deciduous Forest*, has been defined (**Figure 3**) (WWF 2015).

This ecoregion is located within the Ayeyarwady River Basin, the catchments of the Bago Yoma Mountains, and the foothills of Rakhine Yoma. The ecoregion is strongly expressed within the study area and covers the entire region. The forest region covers large areas in Myanmar. The westward extension is across Ayeyarwady River onto the Yakhine Yoma foothills, and the northern extension is up to the Kachin State. Trees reach a height of more than 30 m. This ecoregion remains under various threats. Conversion of forests to agriculture and shifting cultivation is prevalent. Intense poaching of protected animals, such as star tortoise, for trade is reducing the population in the forests.

3 http://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?MOD=AJPERES

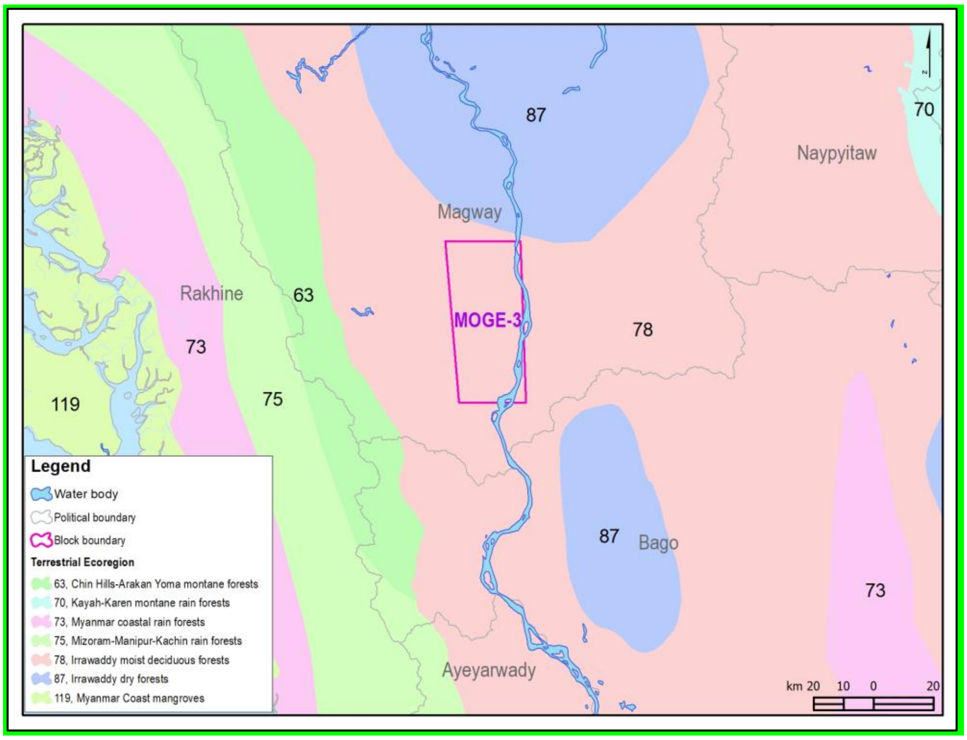


Figure 3: Bioregion in Central Myanmar

Regional mapping of native vegetation cover and land use in Block MOGE-3 shows the land is classified as scrubland. However, the predominance of land has converted to agricultural purposes for most of the block.

The dominant species of the *Irrawaddy Moist Deciduous Forest* ecoregion are teak (*Tectona grandis*) and *Pyinkado* or ironwood (*Xylia kerri*). Species composition is varied and intimately mixed with bamboo groves. In the matrix of deciduous species, some evergreen dominants appear in places.
Common tree species are teak, *Xylia kerri, Terminalia tomentosa, T. belerica, T. pyrifolia, Homalium tomentosum, Salmalia insigni, Ginelina arborea, Lannea grandis, Odina wodia, Pterocarpus macrocarpus, Millettia pendula, Berrya ammonilla, Mitravgyna rotundifdlia,* and *Vitex spp. Bambusa polymorpha* and *Cephalostachyum pergracile* are the most common bamboos in lower Myanmar. In the north *Dendrocalamus hamiltonii, D. membranaceus*, and *Cephalostachyum pergracile* are common bamboos.

The undergrowth often consists of *Leea spp., Barleria strigosa*, and other *Acanthaceae*. *Eupatorium odoratum*, a noxious weed, colonized the areas when timber extraction left gaps.

4.3 Potential for Species of Concern in Block MOGE-3

Block MOGE-3 occurs in the semi open, dry interior region of Myanmar. Wildlife habitats have been converted to agricultural lands over extensive area. Local inhabitants also make continued use of wildlife for food and medicine. The following subsections identify Species of Concern (SOC) which may occur in Block MOGE-3.

The endangered species in the ecoregion that may occur in MOGE-3 are list in **Table 2**.

Table 2: Endangered Animals of Irrawaddy moist deciduous forests

Scientific Name (Common Name)	IUCN Status
Aves (birds)	
Ardea insignis (White-bellied Heron)	CR
Asarcornis scutulata (White-winged Duck)	EN
Aythya baeri (Baer's Pochard)	CR
Emberiza aureola (Yellow-breasted Bunting)	EN
Gyps indicus (Indian Vulture)	CR
Heliopais personatus (Masked Finfoot)	EN
Leptoptilos dubius (Greater Adjutant)	EN
Rhodonessa caryophyllacea (Pink-headed Duck)	CR
Sarcogyps calvus (Red-headed Vulture)	CR
Sterna acuticauda (Black-bellied Tern)	EN
Mammalia (mammals)	
Axis porcinus (hog deer)	EN
Bos javanicus (banteng)	EN
Cuon alpinus (Dhole)	EN
Elephas maximus (Asiatic Elephant)	EN
Hadromys humei (Manipur bush rat)	EN
Manis javanica (Sunda Pangolin)	CR
Manis pentadactyla (Chinese Pangolin)	CR
Panthera tigris (Tiger)	EN
Prionailurus viverrinus (Fishing Cat)	EN
Trachypithecus phayrei (Phayre's leaf monkey)	EN
Reptilia (reptiles)	
Batagur trivittata (Burmese Roofed Turtle)	EN
Gavialis gangeticus (Gharial)	CR
Geochelone platynota (Burmese Star Tortoise)	CR
Indotestudo elongata (Elongated Tortoise)	EN
Nilssonia formosa (Burmese Soft-shelled Turtle)	EN

Source: http://www.globalspecies.org/, 2015

4.4 Protected Areas

A total of 45 protected areas have been established in Myanmar. The natural areas for protection are categorized as follows:

- Scientific Nature Reserve;
- National Park;
- Marine National Park;
- Nature Reserve;
- Wildlife Sanctuary;
- Geo-physically Significant Reserve; and
- Other Nature Reserve as determined by the Minister.

There are no officially established protected areas in Block MOGE-3. A global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. This key biodiversity areas runs along the eastern edge of the Block and is located far away from the proposed well locations.

In terms of regional protected areas, there are only two reserved forest areas near the 8 proposed wells location: Thel Phyu Reserved Forest and Ka Toe Taung Reserved Forest and two proposed reserved forest areas such as Inn Ma reserved forest and Sat Taung Reserved Forest. All wellsite areas are

outside the reserved forest as confirmed by Thayet Forestry Department.

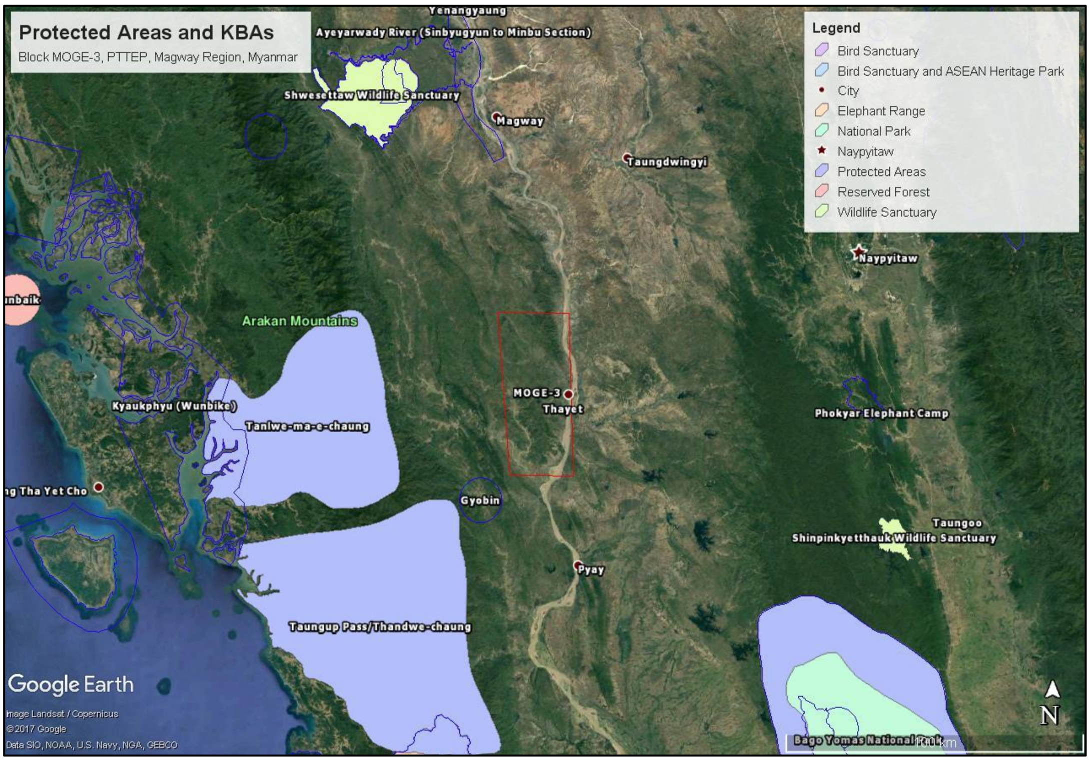


Figure 4: Protected Area and Key Biodiversity Areas in Central Myanmar

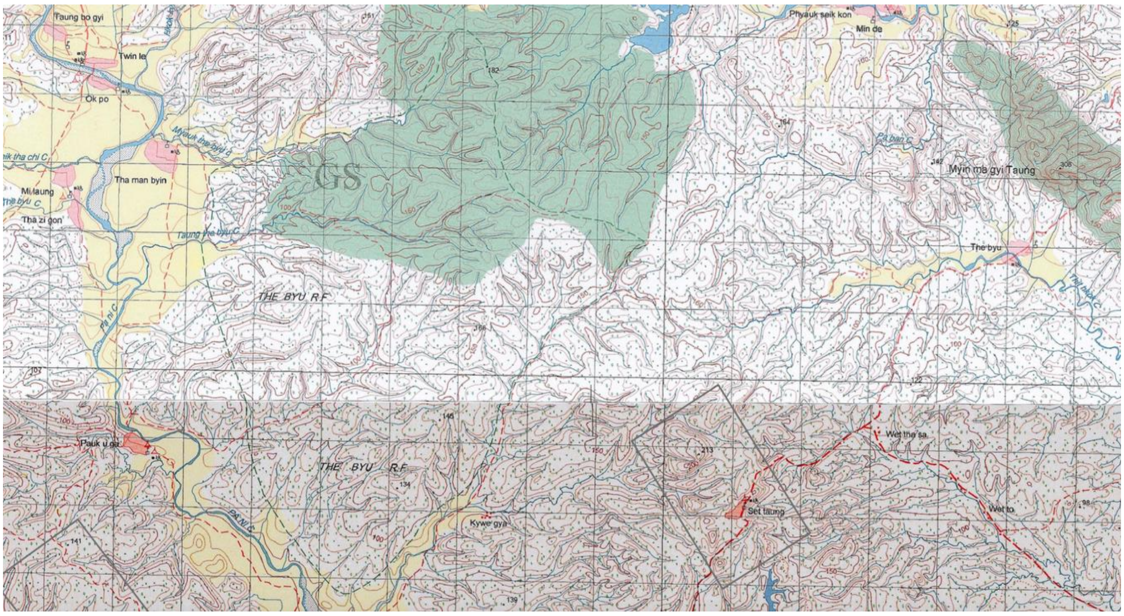


Figure 5: Thae Phyu Reserved Forest inside Block MOGE-3 Boundary

4.5 Key Biodiversity Areas

The global / national area of biodiversity importance near the project area is the Ayeyarwady River corridor. This key biodiversity areas runs along the eastern edge of the Block and is located far away from the proposed well locations.

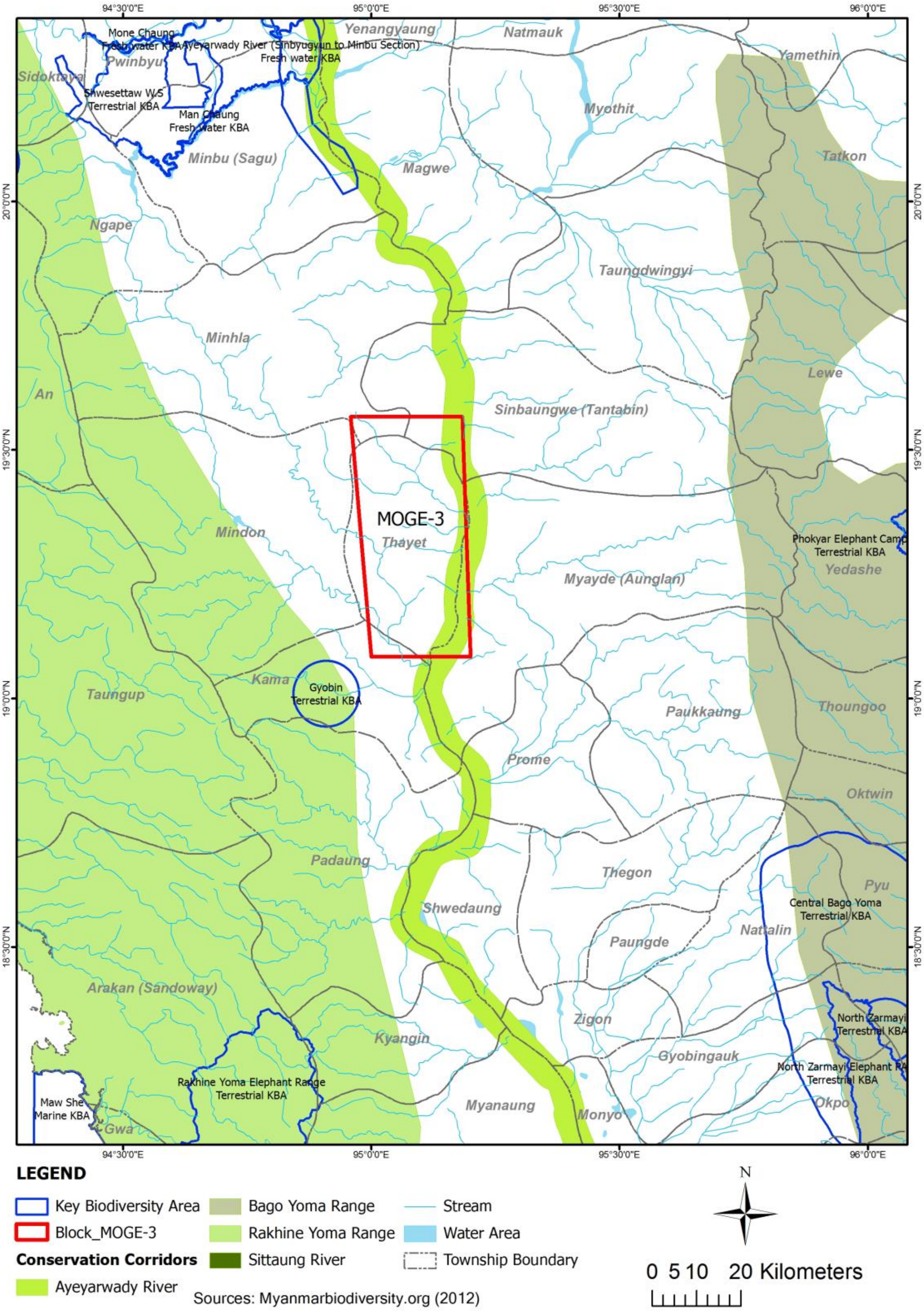


Figure 6: Key Biodiversity Areas in Central Myanmar

4.6 Field Findings / Observations of Flora

4.6.1 Method

The floristic data and ecological data collection were conducted by the following methods in the study Area.

4.6.1.1 Sample Plotting

The Global Positioning System was used to navigate and mark the coordinates of the sample plots. In order to obtain essential data for predicting tree species composition in the forest and vegetation types, 20x20 and 30x30 meter quadrants, were set up and tree species in the plot were collected and population of each species were also counted. For the Bamboo survey, 20x20 and 30x30 meter quadrants were set up and bamboo species were collected and number of clump of each species were also counted. The species identification was carried out by using key to families of flowering plants and appropriate literature and confirmed by matching with herbarium specimens of Department of Botany, University of Yangon.

4.6.1.2 Random Transecting

To get representative checklists of the tree species and bamboo species, plant collection was also carried out by random transect lines along the road side and between one plot and another wherever possible. Specimen collection was made within 10 meter on either side of the transect line.

4.6.1.3 Mapping

Location maps are set by the method based on the UTM map and Land sat 7 satellite images, coordinate system WGS 1984 UTM zone 46 to determine the forests of the proposed areas.

4.5.2 Materials

Materials used for recording are strings for sample plotting and transecting, digital camera for recording, GPS, maps, heavy duty plastic bags, old newspapers, corrugated paper, alcohol, spray jug (for fixing specimens), 10x lens, permanent marker, field note books, field press, drying press and dryers.

4.6.3 Data Analysis

After field survey, data entry was carried out in excel work sheet. Analysis of population per hectare percentage was conducted using excel work 2007.

4.6.3.1 Population of Individual Species (per hectare)

The population of species will show not only the composition of species but also the richness of the species in the study area. The population of individual species (per hectare) is determined by following formula. (Ref: R.He'dl, M Sva'tek, M. Dancak, Rodzay A.W., M. Salleh A.B., Kamariah A.S.(2009).

$$\text{Population of Individual Species} = \frac{\text{Total Individual species}}{\text{Total Plots Area } (m^2)} \times 10000m^2(1ha)$$

4.6.3.2 Relative Density of Tree species

The density of a species refers to the numerical representation of its individual and the availability of space in a unit area. The density index shows not only the richness of the texa but also the relative distribution of the individuals. According to Curtis (1959), the density index is determined by the following formula.

$$\text{Relative Density of Tree species} = \frac{\text{No. of Individual species}}{\text{Total no. of all individual Species}} \times 100$$

4.6.3.3 Relative frequency of Tree species

The relative frequency of a species refers to the percentage occurrence of its individuals and shows the frequency of different species growing in the study area. The species which fall in high frequency class can be considered as the most common species in the study area. According to Curtis (1959), the relative frequency is determined by the following formula.

$$\text{Relative frequency of Tree species} = \frac{\text{No. of sample plot occurs}}{\text{Total no. of all species occur}} \times 100$$

4.6.3.4 Species distribution by frequency class

According to Raunkiaer's Law of frequency (1934), each species was grouped into one of five frequency class (FC); Frequency range (1-20%) represents rare species, (20 - 40%) represents seldom species, (40 - 60%) represents often species, (60 - 80%) represents mostly species, and (80 - 100%) represents constantly present species. This frequency class will also clarify the homogeneity or heterogeneity of the floristic distribution in the study area.

4.6.3.5 Tree species in DBH class interval

Tree species in DBH class interval is calculated by

$$\text{Population of DBH class interval} = \frac{\text{No. of species}}{\text{Total no. of all species}} \times 100$$

Low DBH class interval shows the degraded and secondary forest height DBH class interval shows the primary forest.

4.6.3.6 Tree species in Height class interval

Tree species in Height class interval is calculated by

$$\text{Population of Height class interval} = \frac{\text{No. of species}}{\text{Total no. of all species}} \times 100$$

Low height class interval shows the degraded and secondary forest and high height class interval shows the primary forest.

4.6.4 Results

The forests areas included in the project area are 13185 acres. The unique features of the forests are the Bamboo, In and Teak trees. Teak, In and Bamboo are the dominant species in the project area. There is evidence of teak plantations in patches in the forest area and even in the degraded forest (which has now become bamboo forests). The young teak plants and secondary teak trees growing from the stumps are found everywhere in the forests. Another evidence is that almost all houses in the near-by villages are built from teak and the also monastery was built by teak pillar.

The dominant tree species in this area are *Tectona grandis* L.f. (Kyun) followed by *Lagerstroemia venusta* (Zaung-pa-lae), Terminalia pyrifolia (Lein), Dipterocarpus tuberculatus (In), *Terminalia alata* (Heyne) Roth (Htauk-kyant), and *Diospyros burmanica* (Te).

Figure 7: Flora Survey Map

Figure 8: Monsatery and house were built by teak

A forest inventory of 20 m x 20 m flora plots were completed by the survey team at four locations, around the well sites and Thae Phyu Reserved Forest to cover up the whole area, secondary data was examined in light of habitat conditions present in the MOGE-3 Block.

In Myanmar, there are an estimated 50 threatened plant species, of which 18 critically endangered, 16 Endangered and 16 Vulnerable based on the classification from IUCN Red List. Native vegetation cover within the exploration block has been subject to a prolonged period of alteration and human activity. Timber harvesting, fuel wood collection, clearing for agriculture and plantations and livestock grazing have occurred throughout much of the block.

Figure 9: Mixed Deciduous Forest and Indaing Forest

Endemic Species

Myanmar is reportedly home to over 1071 endemic species of flora. It is likely that endemic flora does occur in the project area with higher potential being the wetland complexes as well as in associated with the erosional landforms. During the field reconnaissance the endemic ***Tectona grandis L.f*** was noted. Confirmation of the presence of uncommon local endemics would require intensive, potentially multi-season surveys. In some cases, particularly for herbaceous species, detection may only be practically detected in certain years and under certain conditions.

Iconic Species

The main iconic floras in the exploration block are the more mature *Bombax*, large native *Acacia* and *Ficus,* species. Padauk *(Pterocarpus macrocarpus),* the national flower of Myanmar, is not anticipated to occur in this area.

Alien Invasive Species

During the biodiversity reconnaissance local community representatives were asked whether they had any unusual weed problems and whether they were seeing any new species of plant or animal in their area. Additional information was provided to the community regarding the basis for this concern (e.g. potential for unclean seismic equipment to bring invasive species into the area or spread weeds from field to field). In all cases the community representatives reported they did not have any major weed problems, nor had they noticed any new species in their areas.

Significant invasive plant species previously reported for Myanmar include *Prosopis spp., Acacia auriculiformis, Ageratum conyzoides, Leucaena leucocephala, Eucalyptus spp., Casurina equisetifolia, Chromolaena odorata, Hyptis suaveolens, Lantana camara, Mimosa diplotricha, Mikania micrantha, Sorghum halepense, Paspalum conjugatum, Imperata cylindrica, Echinochloa crus-galli, Eleusine indica, Pennisetum polystachion*. Previous assessment has noted that in Myanmar Dry Forest areas, *Prosopis juliflora and Euphorbia spp.* are widespread, particularly in more open areas.

Bamboo Forest

4.7 Findings / Observations of Fauna

The February 5 – 8, 2018 biodiversity focused community interviews identified potentially 10 species of bird, and 6 species of mammal, 7 species of reptile /amphibian, 1 species of invertebrate, and 17 species of fish.

Suitable habitat for a number of these latter species was noted in the area; however, confirmation of the actual occurrence of these species would require extensive, multi-season investigation.

Table 3: Number of Species with Special Conservation Status[4] Reported By Local Community as currently Occurring in general vicinity of the MOGE-3 Drilling Program

	Mammals	Birds	Reptiles & Amphibians	Insects	Fish
Critically Endangered	1	0	0	0	0
Endangered	3	2	1	0	0
Vulnerable	0	2	2	1	1
Near Threatened	1	1	3	0	2
Least Concern, DD or Not Evaluated	1	5	1	0	14

Threatened Fauna

Mammals

The threatened mammal species that were identified in the biodiversity site assessment and interviews included the Chinese Pangolin (*Manis pentadactyla* – CR), dhole (*Cuon alpinus* - EN, fishing cat (*Prionailurus viverrinus* – EN), Flat-headed Cat (*Prionailurus planiceps* - EN). The Common Flying Fox (*Pteropus vampyrus*) is NT.

The two species of pangolin (scaly anteater) are found in Myanmar: Sunda Pangolin (*Manis javanica*) and Chinese Pangolin (*Manis pentadactyla*) are severely threatened by intensive harvesting for trade to China. This is occurring across the entire species range and it is likely that much of the Myanmar population has already been significantly reduced (Duckworth et al., 2008). The Chinese Pangolin (*Manis pentadactyla*) which is CR was identified in the area.

Protection of mammals from impacts from development relies on avoidance of critical habitats and implementing designs and practices which reduce the potential project specific hazards which may impact wildlife species.

Birds

The threatened birds identified include; Green Peafowl (*Pavo muticus*) and Nordmann's Green Shank (Tringa guttifer) are EN and Myanmar Completely Protected, they are reported to be very rare in the area and only occasionally seen.

The Greater Spotted Eagle (*Aquila clanga*) is Vulnerable and Myanmar Completely Protected. The laggar falcon (*Falco jugger*) is NT and MCP and an owl white-fronted scops owl (*Otus sagittatus)* is VU and MCP

As elsewhere in the region large water birds have decreased greatly across the country and continue to be threatened by persecution and human disturbance to their nesting and feeding areas. Protection of bird species from unnecessary development impacts relies on avoidance of important habitats and creation of hazards that attract or otherwise place birds at risk (e.g., contaminated waste water pits, spills, unshielded or higher risk lighting, garbage etc).

[4] Species with special conservation status were considered those receiving special protecton under Myanmar law and or species which are listed as Critically Endangered, Endangered or Vulnerable

Reptiles

The following threatened snake species were identified Kind Cobra (*Ophiophagus Hannah*) which is VU and MCP. The Burmese Python (*Python bivittatus*) and the Reticulated Python (*Python reticulates*) are LC and MCP were also identified. The Bowring's Supple Skink (Lygosoma bowringii) that is NT was possible identified, but this could have been miss identified with a more common skink species.

Four species of tortoises are known to occur in Myanmar: the Burmese Star Tortoise (*Geochelone platynota*), Asian Forest Tortoise (*Manouria emys*), Impressed Tortoise (*Manouria impressa*), and the Elongated Tortoise (*Indotestudo elongate*). All are threatened to some extent by a combination of subsistence and commercial harvesting, over-collection for the pet trade, and to a lesser extent, habitat destruction. Conversion of natural vegetation to agricultural land is primarily a threat to tortoises in the Dry Zone. The Elongated Tortoise (*Indotestudo elongate*) that is EN was identified in the site reconnaissance.

The Elongated Tortoise apparently occurs throughout much of Myanmar and uses a variety of habitats ranging from desert-like scrub of the Dry Zone to moist evergreen forest in the Rakhine Yomas. Healthy populations remain in some remote areas (e.g., Rakhine Yomas; Platt & Khin Myo Myo 2009), although this tortoise is subject to subsistence harvesting wherever it occurs in close proximity to humans. Large numbers are illegally exported to markets in southern China (Platt et al. 2000). Current harvest levels are clearly unsustainable and field surveys suggest many populations are declining, particularly in the Dry Zone (Platt et al. 2001b).

The project-related concerns in MOGE-3 would only arise where there was potential for disturbance or pollution of riverine and wetland habitats. Project activities that disturb riverine habitats and wetlands are of greatest concern.

Amphibians

The threatened Amphibians identified included the Giant River Frog (*Limnonectes (Rana) blythii*) that is NT and the Big-lipped Burrowing Frog (*Glyphoglossus molossus*) that is also NT. From a project perspective, protection of amphibians hinges largely on avoiding direct disturbance to permanent and seasonal wetlands as well as preventing of offsite contamination of such locations. The Indoburman Torrent Frog (*Amolops indoburmanensis*) that is DD and endemic was identified.

Fish

The conservation status of fish in Myanmar is poorly understood. No specific references were identified for Central Myanmar and the project area; however, given the patterns of human exploitation, any species of fish present in these areas would be very vulnerable. A total of at least 17 species of fish were identified in the project area. Fish is important food source of the local people. The following threanetened or vulnerable species under IUCN were observerd:

- Wallago catfish *(Wallago attu)* is NT
- Mrigal carp *(Cirrhinus cirrhosis)* is VU
- Mozambique tilapia (*Oreochromis mossambicus*) is NT

Extraction of surface water and or intentional or accidental release of contaminated liquids could both pose a significant impact to native fish species.

Invertebrates

The Golden Birdwing (Troides aeacus) was identified in the site biodiversity reconnaissance. Relatively little is known about invertebrate species within Myanmar sufficient to allow classification for the purpose of identifying conservation status and needs for protection. Pollinators such as wild bees and numerous others can play critical roles in ecosystem function as well as human food security and health. Some species groups can have very specific habitat requirements (e.g., butterflies) that, in the absence of knowledge could be locally extirpated. As a general guide, identification and avoidance of uncommon native plant assemblages and retention of native forest cover is a priority. Similarly, indiscriminate use of herbicides and pesticides and failure to control and manage other hazardous substance, and light pollution can increase risks to these and other native fauna.

Endemic Fauna

According to the globally threatened status of recorded species, one is classified as Least Concern (LC) and MCP is the White-throated Babbler (*Turdotdes gularis*) which is endemic to Myanmar. The Indoburman Torrent Frog (Amolops indoburmanensis) that is DD and endemic was identified.

Iconic Species

No iconic species of fauna (eg. large carnivores, large herbivores, high profile endangered species) are believed to occur in the project area.

Alien Invasive Species

No alien invasive species of fauna were reported to occur in the project area.

4.8 Habitats

The project area is comprised of agricultural and open forestland area only. This would be classified under the 2012 IFC Performance Standard 6 (modified, natural and critical habitats) as modified. The military protected area present the best chance of natural or critical habitats identified near the project areas. As this area is off limits to most people, it was identified to contain natural undistrubed habitat for many wild species including the fea's barking deer, dhole, fishing cat and the flat-headed cat. This area is off limits to all activities and will not be disrupted by the project.

This was confirmed by site biodiversity reconnaissance survey along with ecological knowledge interviews with villagers and the Mindon Forestry Department.

Under IFC PS 6 "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 congregatory species;
iv. Highly threatened and/or unique ecosystems; and/or
v. Areas associated with key evolutionary processes.

4.9 Spatial & Human Pressure

As per interviews with the Thayet Forestry Department; in the area there are some fauna species such as deer, jungle chicken, Peacock, Woodpecker, water duck etc. and some teak species (local names of Kyun, pyinkado, Thit Yar, In gyin, Padauk, Didu, Let Pan, Gway, Taukkyan. Most of the teak species are regeneration plants and there is no endangered species because of the degraded forest.

The main forest types are Dry upper mixed deciduous forest and dry In daing forest. The Common bamboo species are the Myin wa and Taik Wa. The area also has eucalyptus fire wood plantation, agroforestry plantation and within the reserved forest area some community forestry areas. For the community forestry area, there are 370.403 acres in the Ka Toe Taung reserved forest and 150.794 acres in the Thel Phyu Reserved forest.

The threats to biodiversity are expansion of farmlands and monoculture plantation (eg. Teak plantation). Due to deforestation, the wild animals are facing food scarcity and habitat loss. The ecological knowledge interviews confirmed that populations of every animal species has decreased over the last 10 years and some have become locally extinct. Most of the Block is covered with shifting cultivation, bamboo forest and scatter trees.

It was found that hunting of wild animals is a low threat in this area with only small birds and squirrel being hunted by villagers. However, villagers reported that the Chinese Pangolin (*Manis pentadactyla*) is trapped and ate in the village. However, the occurrence of the Chinese Pangolin is rare.

Appendix 1 – Fauna Species Identification Assessment

Fish

ORDER	FAMILY	Local Name	SCIENTIFIC NAME	COMMON NAME	Photo	IUCN STATUS
SILURIFORMES	**SILURIDAE**	Nga Bat	*Wallago attu*	Wallago catfish		**NT**
Osteoglossiformes	**Notopteridae**	Nga Phae	*Notopterus notopterus*	Bronze Featherback		LC
Cypriniformes	**Cyprinidae**	Nga loon	*Cirrhinus reba*	*Reba carp.*		LC

Cypriniformes	**Cyprinidae**	Nga Kone Ma	*Cirrhinus rubirostris*	*red nosed fish*		DD
Cypriniformes	**Cyprinidae**	Nga Gyin	*Cirrhinus cirrhosus*	*Mrigal carp*		VU
Cypriniformes	**Cyprinidae**	Nga Khone Ma	*Puntius sophore*	Pool Barb		LC
Cypriniformes	**Cobitidae**	Nga Thale Toe	Pangio pangia	Loach		LC

Cypriniformes	**Cobitidae**	N/A	*Lepidocephalichthys goalparensis*	N/A		LC
Cypriniformes	**Cobitidae**	N/A	*Lepidocephalichthys berdmorei*	N/A		LC
Siluriformes	**Clariidae**	Nga Khu	*Clarias gariepinus*	North African Catfish		LC
Synbranchiformes	**Mastacembelidae**	Nga yint ma	Macrognathus dorsiocellatus	Spiny Eel		LC

Synbranchiformes	**Mastacembelidae**	Nga Mway Toe	Macrognathus aculeatus.	Lesser spiny eel		Not Evaluated
Perciformes	**Cichlidae**	Shwei-ni	*Oreochromis sp.*	Red Tilapia		Not Evaluated
Perciformes	**Cichlidae**	Tilapia	*Oreochromis niloticus*	Nile tilapia		LC

Perciformes	**Cichlidae**	Tilapia	*Oreochromis mossambicus*	Mozambique tilapia		**NT**
Perciformes	**Channidae**	Nga Yant Gaung Toe	*Channa gachua*	Dwarf Snakehead		LC
Perciformes	**Channidae**	Nga yan-panaw, Nga-thilon, Nga-yan-lon	*Channa panaus*	Spotted snakehead		LC

Mammals

ORDER	FAMILY	Local Name	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
PHOLIDOTA	MANIDAE	Ta Yoke Thin Khway Chat	*Manis pentadactyla*	Chinese Pangolin	**CR and MCP** **Rare**
Carnivora	Canidae	Kway aa	*Cuon alpinus*	Dhole	**EN**
Cetartiodactyla	Cervidae	Gyi	*Muntiacus feae*	Fea's Barking Deer	DD and MCP
Carnivora	Felidae	N/A	*Prionailurus viverrinus*	Fishing Cat	**EN**
Carnivora	Felidae	Kyaung wetno	*Prionailurus planiceps*	Flat-headed Cat	**EN**
Chiroptera	Pteropodidae	N/A	*Pteropus vampyrus*	Common Flying Fox	**NT**

Birds

ORDER	FAMILY	Myanmar Name	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
Galliformes	Phasianidae	Daung	*Pavo muticus*	Green Peafowl	**EN** **Rare in area**
Accipitriformes	Accipitridae	N/A	*Aquila clanga*	Greater Spotted Eagle	VU and MCP
Piciformes	Picidae	N/A	*Dendrocopos atratus*	Stripe-breasted Woodpecker	LC and MCP
Charadriiformes	Scolopacidae	Chay Sein Yay Nyaunt	*Tringa guttifer*	Nordmann's Green Shank	**EN and MCP**
Accipitriformes	Accipitridae	N/A	*Accipiter trivirgatus*	Cresred goshawk	LC and MCP
Passeriformes	Leiotrichidae	Swae	*Turdotdes gularis*	White-throated Babbler	LC and MCP endemic
Strigiformes	Tytonidae	Mai	*Tyto alba*	barn owl	LC and MCP
Strigiformes	Strigidae	Zee gwet, Deedok,	*Otus sagittatus*	white-fronted scops owl	VU and MCP
Falconiformes	Falconidae	Thein Nget	*Falco jugger*	laggar falcon	**NT and MCP**
Charadriiformes	Jacanidae	Kyar Phet Hnin	*Hydrophasianus chirurgus*	pheasant-tailed jacana	LC and MCP

Amphibians and Reptiles

ORDER	FAMILY	Myanmar Name	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
TESTUDINES	TESTUDINIDAE	Kone late	*Indotestudo elongata*	Elongated Tortoise	EN Rare in Area
Anura	Ranidae	N/A	Amolops indoburmanensis	Indoburman Torrent Frog	DD
Squamata	Elapidae	Ngan Taw Gyar	*Ophiophagus hannah*	Kind Cobra	VU
Squamata	Pythonidae	N/A	*Python bivittatus / reticulates*	Burmese Python	VU and MCP
Squamata	Scincidae	King late chaw	*Lygosoma bowringii*	Bowring's Supple Skink	**NT**
anura	Dicroglossidae	N/A	*Limnonectes (Rana) blythii*	Giant River Frog	**NT**
anura	Microhylidae	N/A	*Glyphoglossus molossus*	Big-lipped Burrowing Frog	**NT**

Appendix 2 – Flora Species

Table A1: List of tree species noted during Biodiversity Survey

No	Scientific Name	Local Name	Family Name	Habitat[1]
1	*Acacia catechu Willd.*	Sha	Mimosaceae	T
2	*Acacia leucophloea*	Hta-naung	Mimosaceae	CL
3	*Aibizzealebbek*	Kokko	Mimosaceae	T
4	*Albizialebbekoides(DC.) Benth.*	Anya-ko-ko	Mimosaceae	T
5	*Anogeissus acuminate*	Yone	Combretaceae	T
6	*Azadirachtaindeca*	Tama	Maliaceae	T
7	*BambusapolymorphaMunro*	Kya-thaung-wa	Poaceae	B
8	*BombaxceibaL.*	Let-pan	Bombacaceae	T
9	*Bombax insigne Wall.*	De-du	Bombacaceae	T
10	*ChukrasiavelutinaRoem.*	Yin-ma	Meliaceae	T
11	*Croton oblongifoliusRoxb.*	Tha-yin-gyi	Euphorbiaceae	ST
12	*Dalbergiacultrata*	Yin-diak	Fabaceae	T
13	*Dalbergiafusca*	YinSap	Fabaceae	T
14	*DalbergiamultifloraHeyne*	Thit-pa-gan	Fabaceae	T
15	*Dendrocalamusmembranaceu sMunro*	Hmyin-wa	Poaceae	B
16	*Diospyros kaki L.f.*	Te	Ebenaceae	T
17	*DipterocarpusSpp*	Ka-nyin	Dipterocarpaceae	T
18	*Dipterocarpustuberculatus*	In	Dipterocarpaceae	T
19	*Erythrinasuberosa*	Kathit	Rutaceae	T
20	*Eugenia jambos*	Tha-pyay	Myrtaceae	T
21	*GarugapinnataRoxb.*	Chin-yoke	Burseraceae	T
22	*GmelinaarboreaRoxb.*	Ye-ma-nae	Verbenaceae	T
23	*Heterophragmaadenophyllum*	Phatthan	Bignoniaceae	T
24	*Holopteleainteritolia*	Phauk-seik	Ulmaceae	T
25	*Lagerstroemia speciosa*	Hnaw	Lythraceae	T
26	*Lagerstroemia speciosa*	Pyin-ma	Lythraceae	T
27	*Lagerstroemia tomentosum*	Leza	Lythraceae	T
28	*Lagerstroemia villosa*	Zaung-pa-lway	Lythraceae	T
29	*Lanneacoromandelica*	Nabae	Anacardiaceae	T
30	*Largerstroemiaspeciosa*	Pyin-ma	Lythraceae	T
31	*Mangiteraindiaca*	Tha-yet	Anacardiaceae	T
32	*Millettiapendula.*	Thin-wun	Fabaceae	CL
33	*Mitragynarotundifolia(Roxb.) Kuntze*	Bin-ga	Rubiaceae	T
34	*Petrocarpusmacrocarpus*	Padauk	Fabaceae	T
35	*PhyllanthusemblicaL.*	Zi-phyu	Euphorabiaceae	ST
36	*Protiumsettata*	Tha-di	Not Know	T
37	*Schleichetaoleosa*	Kyoe	Sapindaceae	T
38	*Shoreasiamensis(Kurz)Miq.*	In-gyin	Dipterocarpaceae	T
39	*Shoteapbtusa*	Thit-yar	Dipterocarpaceae	T
40	*Spondiasmangifera*	Gwe	Not Know	T
41	*TectonagrandisL.f.*	Kyun	Verbenaceae	T
42	*Terminaliaalata*	Htauk-kyant	Combretaceae	T
43	*Terminaliachebula Retz.*	Phan-kha	Combretaceae	T
44	*TerminaliapyrifoliaKurz*	Lein	Combretaceae	T
45	*VitexpubescensVahl*	Kyet-yoe	Verbenaceae	T
46	*Xyliaxylocarpa(Roxb.) Taub.*	Pyin-ka-doe	Mimosaceae	T
47	*Ziziphus jujuba* Lam.	Zi	Rhamnaceae	T
48	*Leucaena leucocephala*	Baw Sa Khaing	Not Know	T
49	*Eucalyptus camuldulensis*	Eucalyptus	Myrtaceae	T
50	*Eupatorium cannabium*	Beat Hsat	Not Know	Medicinal Plant
51	Zingiber cassumunar	Mate Tahlin	Not Know	Medicinal Plant
52	Caralluma umbellata	Tha Saung	Not Know	Medicinal Plant

53	Croton roxburghiamus	Thet Yin Gyi	Not Know	Medicinal Plant
54	Leptadenia reticulata	Gon Khar	Not Know	Medicinal Plant
[1] Aq F=Aquatic Fern, Aq H= Aquatic Herb, B= Bamboo, CL= Climber, E=Epiphyte, F=Fern, G= Grass, H=Herbs, Mo=Moss, Mu=Mushroom, S=Shrubs, ST=Small Tree, T=Tree				

Table A2: Naturally growing tree species in MOGE-3

Local Name	Scientific Name
1. Nabe	*Lannea coromandelica*
2. Yon	*Anogeissus acuminate*
3. Neem	*Azadirachta indica*
4. In Gyin	*Shorea siamensis*
5. Sha	*Acacia catechu*
6. Didu	*Bombax insigne*
7. Let pan	*Bombax ceiba*
8. Tauk Kyan	*Terminalia crenulata*
9. Pyin Ma	*Lagerstoremia speciosa*
10. Kokko	*Albizzia Lebbek*
11. Baw Sa Khaing	*Leucaena leucocephala*
12. Eucalyptus	*Eucalyptus camuldulensis*

Table A3: Medicinal plant species Possible in MOGE-3

Local Name	Scientific Name
1.Beat Hsat	*Eupatorium cannabium*
2.Mate Tahlin	*Zingiber cassumunar*
3. Tha Saung	*Caralluma umbellata*
4.Thet Yin Gyi	*Croton roxburghiamus*
5. Gon Khar	*Leptadenia reticulata*

Threatened plant species in Myanmar

Scientific Name	Common name	Status
Anisoptera curtisii	Kaungmu	CR
Anisoptera scaphula	Taung-sagaing	CR
Bombax insigne	Didu/ Taung-letpan	CR
Dipterocarpus baudii	Kanyin	CR
Dipterocarpus dyeri	Ka-nyin	CR
Dipterocarpus grandiflorus	Kanyin/ Kanyin-byan	CR
Dipterocarpus kerrii	Kanyin-byan	CR
Dipterocarpus retusus	Kanyin-ni	CR
Dipterocarpus tuberculatus	–	CR
Dipterocarpus turbinatus	Kanyin-ni	CR
Hopea apiculata	No common name	CR
Hopea helferi	Thingan-net	CR
Hopea sangal	Thingan-magalay	CR
Parashorea stellata	Thingadu	CR
Shorea assamica	Kyilan	CR
Shorea farinosa	Thingan-phyu	CR
Sonneratia griffithii	Laba	CR
Vatica lanceaefolia	Pan-thitya	CR
Afzelia xylocarpa	Pyin-padauk	EN
Anisoptera costata	Kaban-bok	EN
Cleidiocarpon laurinum	No common name	EN
Cynometra ramiflora	Myinga	EN
Dalbergia oliveri	Tamalan	EN
Diospyros crumentata	Taung-bok	EN
Dipterocarpus alatus	Kanyin-phyu	EN
Dipterocarpus costatus	Kanyin-ywet-thay	EN
Heritiera fomes	Kanazo	EN
Heritiera littoralis	Pinle-Kanazo	EN
Picea farreri	No common name	EN

Scientific Name	Common name	Status
Shorea gratissima	U-ban-kaya	EN
Shorea henryana	Kaban-than-gyin	EN
Shorea roxburghii	Kaban-ywet-thay	EN
Syzygium zeylanicum	Tha-bye-bauk	EN
Vatica cinerea	No common name	EN
Acacia ferruginea	Sha-byu	VU
Aquilaria malaccensis	Thit-hmwe	VU
Cephalotaxus mannii	No common name	VU
Cycas pectinata	Mondaing madai	VU
Cycas siamensis	Mondaing	VU
Dalbergia fusca	Yinsat	VU
Halophila beccarii	No common name	VU
Hopea griffithii	No common name	VU
Hopea odorata	Thangan	VU
Intsia bijuga	Saga-lun	VU
Magnolia nitida	No common name	VU
Magnolia rostrata	No common name	VU
Myristica malabarica	Taw-zadeik-po	VU
Pterocarpus indicus	Pan-padauk	VU
Schima wallichii	Laukya	VU
Taiwania cryptomerioides	Tayok-khaung-pin	VU
Aegialitis rotundifolia	Pinle-sa	NT
Brownlowia tersa	No common name	NT
Ceriops decandra	Ma-da-ma	NT
Ceriops tagal	Ma-da-ma	NT
Excoecaria agallocha	Kayaw/ Thayaw	NT
Gnetum oblongum	No common name	NT

Plant species found in Myanmar assessed on the IUCN Red List of Threatened Species. Source: IUCN 2015

No	Scientific Name	Common Name	category
1	Anisoptera scaphula	Taung-sagaing	CR
2	Dipterocarpus baudii	Kanyin	CR
3	Dipterocarpus dyeri	Ka-nyin	CR
4	Dipterocarpus gracilis		CR
5	Dipterocarpus grandifloras		CR
6	Dipterocarpus kerrii		CR
7	Dipterocarpus turbinatus		CR
8	Hopea apiculata		CR
9	Hopea helferi		CR
10	Hopea sangal		CR
11	Magnolia gustavii		CR
12	Nardostachys jatamansi	Spikenard/muskroot	CR
13	Parashorea stellata	White Seraya	CR
14	Shorea farinose		CR
15	Sonneratia griffithii		CR
16	Vatica lanceaefolia		CR
17	Afzelia xylocarpa		EN
18	Anisoptera costata		EN
19	Cleidiocarpon laurinum		EN
20	Cypripedium lichiangense	The Lijiang Cypripedium	EN
21	Dalbergia oliveri		EN
22	Dipterocarpus alatus		EN
23	Dipterocarpus costatus		EN
24	Heritiera fomes		EN
25	Hopea ferrea		EN

26	Illicium gritfithii		EN
27	Magnolia rostrata		EN
28	Paphiopedilum areeanum		EN
29	Paphiopedilum bellatulum	Enchanting Paphiopedilum	EN
30	Paphiopedilum charlesworthii	Charlesworth Paphiopedilum	EN
31	Paphiopedilum concolor	One Colored Paphiopedilum	EN
32	Paphiopedilum insigne	Splendid Paphiopedilum	EN
33	Paphiopedilum parishii	Parish's Paphiopedilum	EN
34	Paphiopedilum spicerianum	Spicer's Paphiopedilum	EN
35	Paphiopedilum wardii	Ward's Paphiopedilum	EN
36	Shorea gratissima		EN
37	Shorea henryana	White Meranti	EN
38	Shorea roxburghii	White Meranti	EN
39	Taxus wallichiana	East Himalayan Yew, Himalayan Yew	EN
40	Vatica cinerea		EN
41	Aquilaria malaccensis	Agarwood, Aloewood, Eaglewood ,Lign-aloes	VU
42	Burretiodendron esquirolii		VU
43	Cayratia pedata		VU
44	Cephalotaxus mannii	Mann's Yew Plum	VU
45	Cleidiocarpon cavaleriei		VU
46	Curcuma candida		VU
47	Cycas pectinate		VU
48	Cycas siamensis		VU
49	Dipterocarpus retusus		VU
50	Eleiotis rottleri		VU
51	Halophila beccarii	Ocean Turf Grass, Species code: Hb	VU
52	Hopea griflithii		VU
53	Hopea odorata		VU

54	lntsia bijuga	Borneo Teak, Moluccan Ironwood	VU
55	Magnolia nitida		VU
56	Paphiopedilum hirsutissimum	Shaggy Paphiopedilum	VU
57	Paphiopedilum villosum	Villose Paphiopedilum	VU
58	Picea brachytyla	Sargent's Spruce	VU
59	Picea farreri	Farrer's Spruce	VU
60	Pterocarpus indicus	Amboyna Wood, Burmese Rosewood, Red Sandalwood	VU
61	Taiwania cryptomerioides	Coffin Tree, Taiwan Cedar, Taiwania	VU

Critically Endangered (CR), Endangered (EN), Vulnerable (VU)

Floristic composition

The total number of tree species collected in flora sample plots in this area is 35 species. The dominant tree species in this area are *Tectona grandis* L.f. (Kyun) followed by *Lagerstroemia venusta* Wall. ex C.B. Clarke.(Zaung-pa-lae), Terminalia pyrifolia (Lein), Dipterocarpus tuberculatus (In), *Terminalia alata* (Heyne) Roth (Htauk-kyant), and *Diospyros burmanica* (Te).

Table A4: Tree Species Population

No.	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha(%)
1	*Acaacia catechu*	3	8.847	1.56
2	*Lagerstroemia speciosa*	2	5.898	1.04
3	*Protium settata*	3	8.847	1.56
4	*Schleicheta oleosa*	2	5.898	1.04
5	*Chukrasia tabularis*	5	14.745	2.61
6	*Lagerstroemia tomentosum*	2	5.898	1.04
7	*Shotea pbtusa*	1	2.949	0.52
8	*Heterophragma adenophyllum*	2	5.898	1.04
9	*Erythrina suberosa*	3	8.847	1.56
10	*Anogeissus acuminate*	4	11.796	2.08
11	*Bombax ceiba* L.	3	8.847	1.56
12	*Pentacme siaminsis*	2	5.898	1.04
13	*Dipterocarpus Spp*	5	14.745	2.61

14	*Milletia pendula*	2	5.898	1.04
15	*Dipterocarpus tuberculatus*	14	41.286	7.29
16	*Aibizzea lebbek*	1	2.949	0.52
17	*Mangitera indiaca*	1	2.949	0.52
18	*Azadiractica indica*	4	11.796	2.08
19	*Bombax insitgne*	3	8.847	1.56
20	*Lagerstroemia villosa*	23	67.827	11.98
21	*Holoptelea interitolia*	2	5.898	1.04
22	*Tectona grandis*	42	123.858	21.88
23	*Eugenia jambos*	1	2.949	0.52
24	*Diospyros burmanica*	6	17.694	3.13
25	*Dalbergia cultrata*	3	8.847	1.56
26	*Lannea coromandelica*	5	14.745	2.61
27	*Mitragyna rotundifolia*	2	5.898	1.04
28	*Terminalia alata*	7	20.643	3.65
29	*Terminalia chebula*	5	14.745	2.61
30	*Terminalia pyrifolia*	20	58.98	10.42
31	*Xylia xylocarpa*	4	11.796	2.08
32	*Dalbergia fusca*	2	5.898	1.04
33	*Spondias mangifera*	2	5.898	1.04
34	*Lagerstroemia speciosa*	4	11.796	2.08
35	*Vitex pubescens*	2	5.898	1.04
	Total	**194**	**566.208**	**100.00**

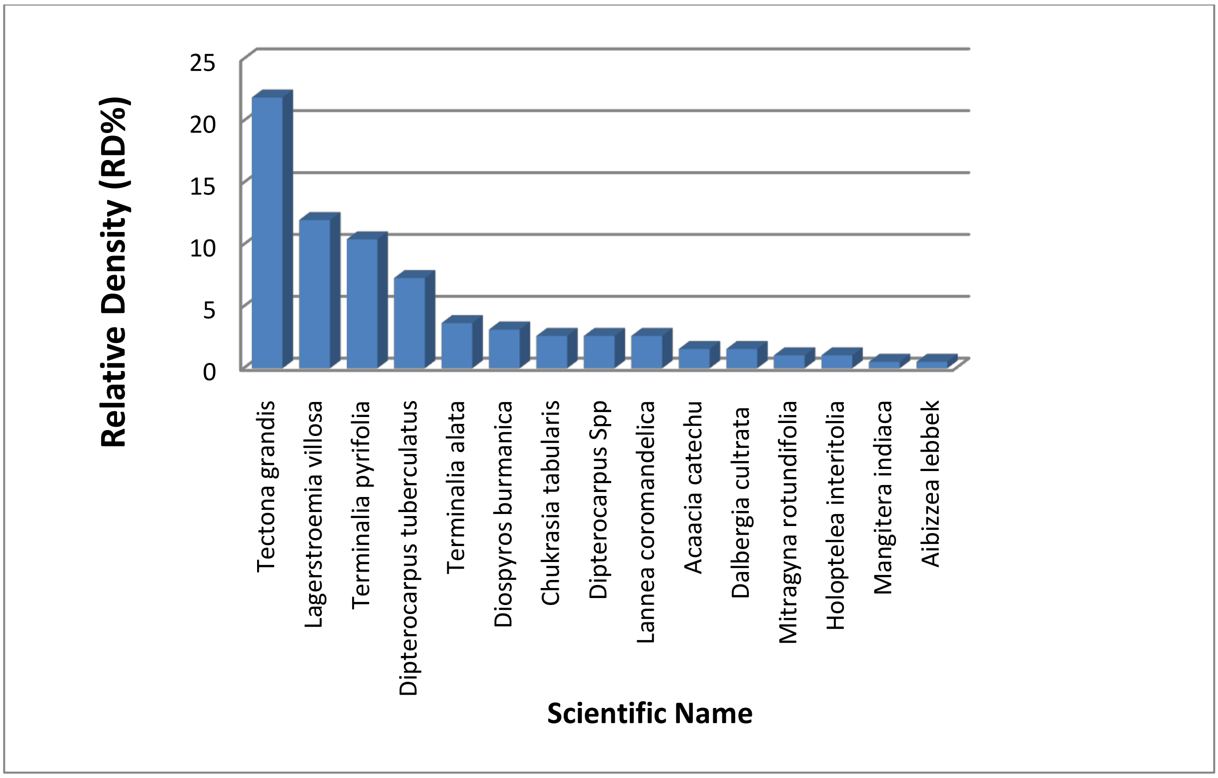
Relative density

Among the sample plots, species density per hectare is varied and the highest density was observed the *Tectona grandis*, *Lagerstroemia villosa*, *Terminalia pyrifolia* followed by *Dipterocarpus tuberculatus*, *Terminalia alata*, and *Diospyros burmanica*. This shows that these six species are abundant in this area.

Table A5: Relative density

No.	Scientific Name	Density (D)	Relative Density (R.D.%)
1	*Tectona grandis*	6	21.88
2	*Lagerstroemia villosa*	3.29	11.98
3	*Terminalia pyrifolia*	2.86	10.42
4	*Dipterocarpus tuberculatus*	2	7.29
5	*Terminalia alata*	1	3.65

6	*Diospyros burmanica*	0.86	3.13
7	*Chukrasia tabularis*	0.71	2.61
8	*Dipterocarpus Spp*	0.71	2.61
9	*Lannea coromandelica*	0.71	2.61
10	*Terminalia chebula*	0.71	2.61
11	*Lagerstroemia speciosa*	0.57	2.08
12	*Xylia xylocarpa*	0.57	2.08
13	*Azadiractica indica*	0.57	2.08
14	*Anogeissus acuminate*	0.57	2.08
15	*Acaacia catechu*	0.43	1.56
16	*Dalbergia cultrata*	0.43	1.56
17	*Protium settata*	0.43	1.56
18	*Bombax insitgne*	0.43	1.56
19	*Erythrina suberosa*	0.43	1.56
20	*Bombax ceiba* L.	0.43	1.56
21	*Vitex pubescens*	0.29	1.04
22	*Spondias mangifera*	0.29	1.04
23	*Dalbergia fusca*	0.29	1.04
24	*Mitragyna rotundifolia*	0.29	1.04
25	*Holoptelea interitolia*	0.29	1.04
26	*Milletia pendula*	0.29	1.04
27	*Heterophragma adenophyllum*	0.29	1.04
28	*Schleicheta oleosa*	0.29	1.04
29	*Lagerstroemia speciosa*	0.29	1.04
30	*Schleicheta oleosa*	0.29	1.04
31	*Pentacme siaminsis*	0.29	1.04
32	*Eugenia jambos*	0.14	0.52
33	*Mangitera indiaca*	0.14	0.52
34	*Aibizzea lebbek*	0.14	0.52
35	*Shotea pbtusa*	0.14	0.52



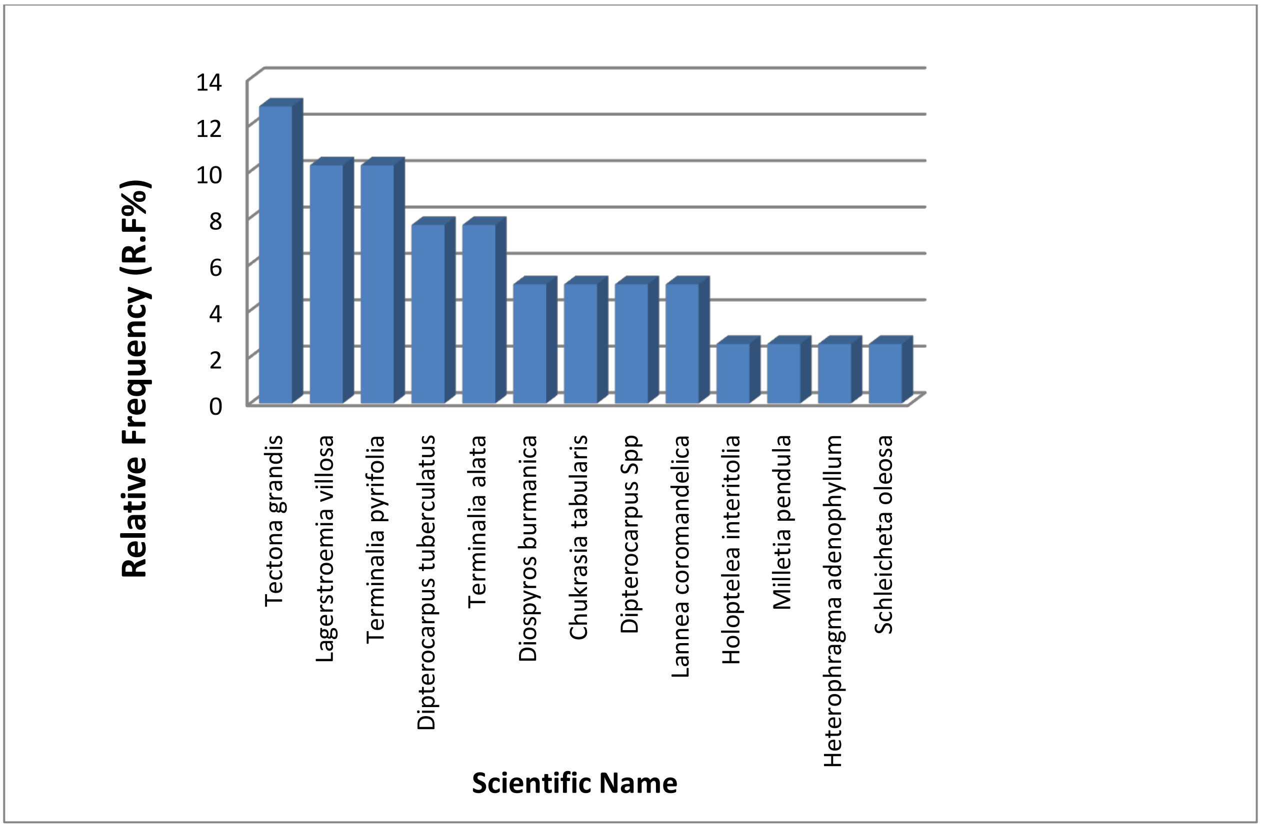
Relative frequency of Tree species

Relative frequency is the frequency of one species compared to the total frequency of all the species. According to the results**,** *Tectona grandis*, (12.8%) is high relative frequency class, followed by *Lagerstroemia villosa* and *Terminalia pyrifolia*, (10.26%) are equally; *Dipterocarpus tuberculatus* and *Terminalia alata* (7.69) are also equally; *Diospyros burmanica*, *Chukrasia tabularis* and other 17 species are (5.13 respectively. Therefore these species occur everywhere in the study area. The lower frequency of some species, such as *Eugenia jambos, Shotea pbtusa*, and other 9 species are demarcated as rare species in the area.

Table A6: Relative frequency of Tree species

No.	Scientific Name	Frequency (F)	Relative Frequency (RF)
1	*Tectona grandis*	0.86	12.8
2	*Lagerstroemia villosa*	0.57	10.26
3	*Terminalia pyrifolia*	0.57	10.26
4	*Dipterocarpus tuberculatus*	0.43	7.69
5	*Terminalia alata*	0.43	7.69
6	*Diospyros burmanica*	0.29	5.13
7	*Chukrasia tabularis*	0.29	5.13

8	*Dipterocarpus Spp*	0.29	5.13
9	*Lannea coromandelica*	0.29	5.13
10	*Terminalia chebula*	0.29	5.13
11	*Lagerstroemia speciosa*	0.29	5.13
12	*Xylia xylocarpa*	0.29	5.13
13	*Azadiractica indica*	0.29	5.13
14	*Anogeissus acuminate*	0.29	5.13
15	*Acaacia catechu*	0.29	5.13
16	*Dalbergia cultrata*	0.29	5.13
17	*Protium settata*	0.29	5.13
18	*Bombax insitgne*	0.29	5.13
19	*Erythrina suberosa*	0.29	5.13
20	*Bombax ceiba* L.	0.29	5.13
21	*Vitex pubescens*	0.29	5.13
22	*Spondias mangifera*	0.29	5.13
23	*Dalbergia fusca*	0.29	5.13
24	*Mitragyna rotundifolia*	0.29	5.13
25	*Holoptelea interitolia*	0.14	2.56
26	*Milletia pendula*	0.14	2.56
27	*Heterophragma adenophyllum*	0.14	2.56
28	*Schleicheta oleosa*	0.14	2.56
29	*Lagerstroemia speciosa*	0.14	2.56
30	*Schleicheta oleosa*	0.14	2.56
31	*Pentacme siaminsis*	0.14	2.56
32	*Eugenia jambos*	0.14	2.56
33	*Mangitera indiaca*	0.14	2.56
34	*Aibizzea lebbek*	0.14	2.56
35	*Shotea pbtusa*	0.14	2.56

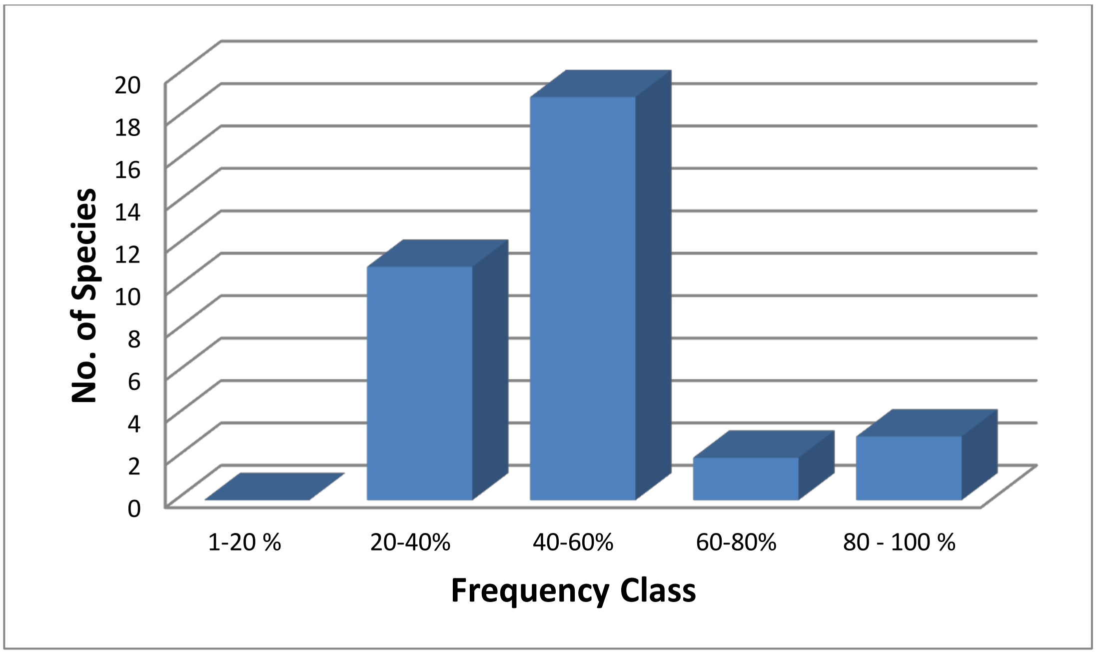


Species distribution by frequency class

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. According to the outcome of the frequency classes only three species is in high frequency class and 32 species are in low frequency class. This shows that this area is floristically low degree of homogeneity.

Table A7: Species distribution by frequency class

Frequency class	No. of species
1-20 %	0
20-40%	11
40-60%	19
60-80%	2
80 - 100 %	3



Tree species in DBH class interval

The distribution of DBH interval class reveals the dominant of small stem individuals in the area 86% of the tree species (167 species) are less than 40cm DBH. Large stem individuals with DBH more than 40cm are of 14 %. Majority of the trees are less than 40cm in girth, which indicates that the forests secondary types.

Table A8: Tree species in DBH class interval

DBH Class	No. of species	Total number of individual	% of total population
<40cm	167	487.64	86.12
41-60cm	15	43.8	7.74
61-80cm	8	23.36	4.13
81-100cm	3	8.76	1.55
>101cm	1	2.92	0.52
Total	**194**	**566.208**	**100.00**

5.7 Tree species in Height class interval

The distribution of Height shows that 508 individuals are less than 10 meter, comprising 90% and of the total population and 58 individuals are more than 15meter, comprising the 10%. Since most canopy height classes are less than 10m, the forests in the area could be classified as secondary forests.

Table A9: Tree species in Height class interval

Height Class	No. of species	Total number of individual	% of total population
<10m	174	508.04	89.73
11-15m	10	29.2	5.16
16-20m	6	17.32	3.06
21-25m	3	8.76	1.55
>26m	1	2.92	0.52
Total	**194**	**566.208**	**100.00**

Table A10: Vegetation type in the study area

No	Sample Quadrant	Vegetation type	Latitude/ Longitude	Altitude	Dominant species
1	PQ I	Mixed Deciduous Forest	N19 22 8.97 E95 04 43.95	147 m	*Tectona grandis,Lagerstroemia villosa Terminalia pyrifolia ,Dipterocarpus tuberculatus ,Terminalia alata Diospyros burmanica ,Chukrasia tabularis ,Dipterocarpus Spp ,Lannea coromandelica ,Terminalia chebula ,Lagerstroemia speciosa Xylia xylocarpa ,Azadiractica indica Anogeissus acuminate ,Acaacia catechu ,Dalbergia cultrata ,Protium settata ,Bombax insitgne Erythrina suberosa ,Vitex pubescens Spondias mangifera ,Dalbergia fusca Mitragyna rotundifolia ,Holoptelea interitolia ,Milletia pendula Heterophragma adenophyllum Schleicheta oleosa ,Lagerstroemia speciosa ,Schleicheta oleosa Pentacme siaminsis ,Eugenia jambos ,Mangitera indiaca Aibizzea lebbek ,Shotea pbtusa , Dendrocalamus membranaceus* Munro,*Bambusa polymorpha* Munro,Bombax cebia L.
2	PQ II	"	N19 22 08.10 E94 4 45.20	151 m	
3	PQ III	"	N19 21 44.45 E94 57 45.92	311 m	
4	PQ IV	Indaing Forest	N19 15 47.58 E95 06 19.11	112 m	
5	PQ V	"	N19 15 51.61 E95 06 15.06	123 m	
6	PQ VI	"	N19 15 49.03 E95 06 17.49	116 m	
7	PQ VII	"	N19 15 32.43 E95 05 45.84	134 m	
8	BQ I	Bamboo Forest	N19 25 41.66 E94 59 03.39	115 m	
9	BQII	"	N19 25 37.59 E94 59 03.59	115 m	
10	BQ III	"	N19 25 20.36 E94 59 02.21	117 m	
11	BQ IV	"	N19 30 37.00 E94 59 37.36	169 m	
12	BQ V	"	N19 30 39.57 E94 59 39.57	173 m	
13	BQ VI	"	N19 12 58.80 E95 01 58.08	119 m	
14	BQ VII	"	N19 21 44.80 E94 57 35.89	105 m	
15	BQ VIII	"	N19 21 20.04 E94 21 20.04	127 m	
16	BQ IX	"	N19 21 38.42 E94 57 42.29	128 m	
17	BQ X	"	N19 20 26.98 E94 57 03.32	91 m	

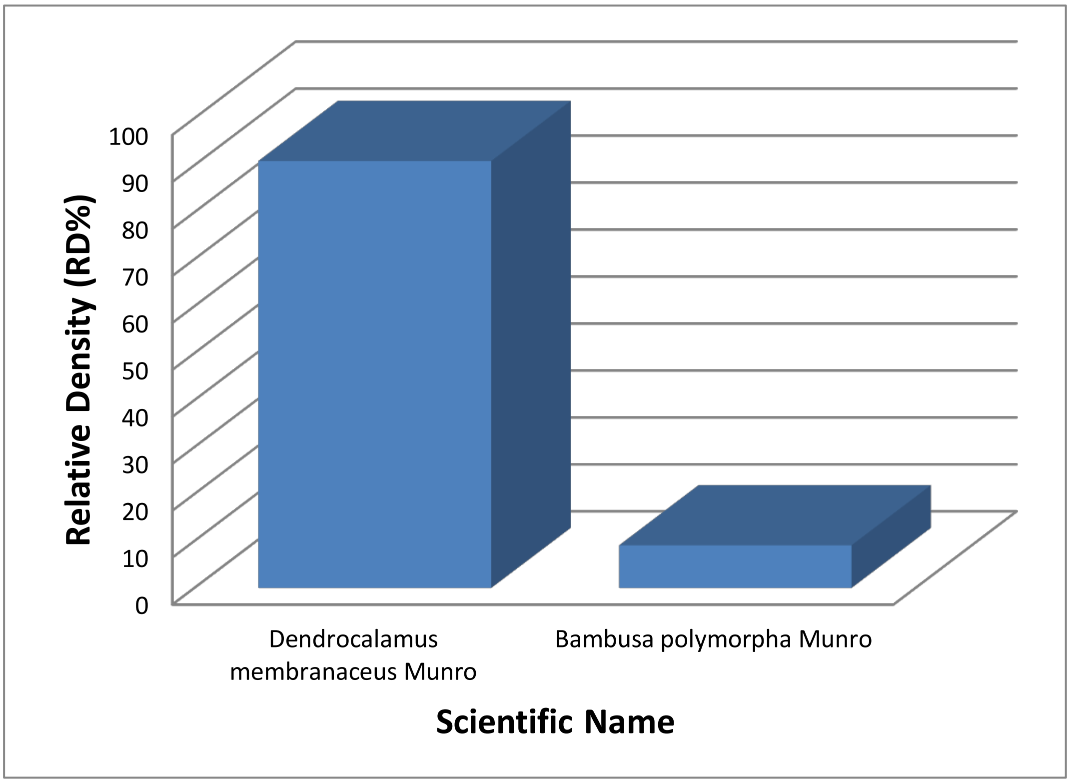
5.8 Bamboo Forest

Bamboo Forest

Table A11: Bamboo Species Population

No.	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha(%)
1	*Bambusa polymorpha* Munro	8	16	**3.33**
2	*Dendrocalamus membranaceus* Munro	232	464	**96.67**
	Total	**240**	**480**	**100.00**

Table A12: Relative density



No.	Scientific Name	Density (D)	Relative Density (R.D.%)
1	*Dendrocalamus membranaceus* Munro	23.20	97.58
2	*Bambusa polymorpha* Munro	0.80	2.42

Table A13: Species distribution

No.	Scientific Name	Frequency (F)	Relative Frequency (R.F.%)
1	*Dendrocalamus membranaceus* Munro	1	90.91
2	*Bambusa polymorpha* Munro	0.1	9.09

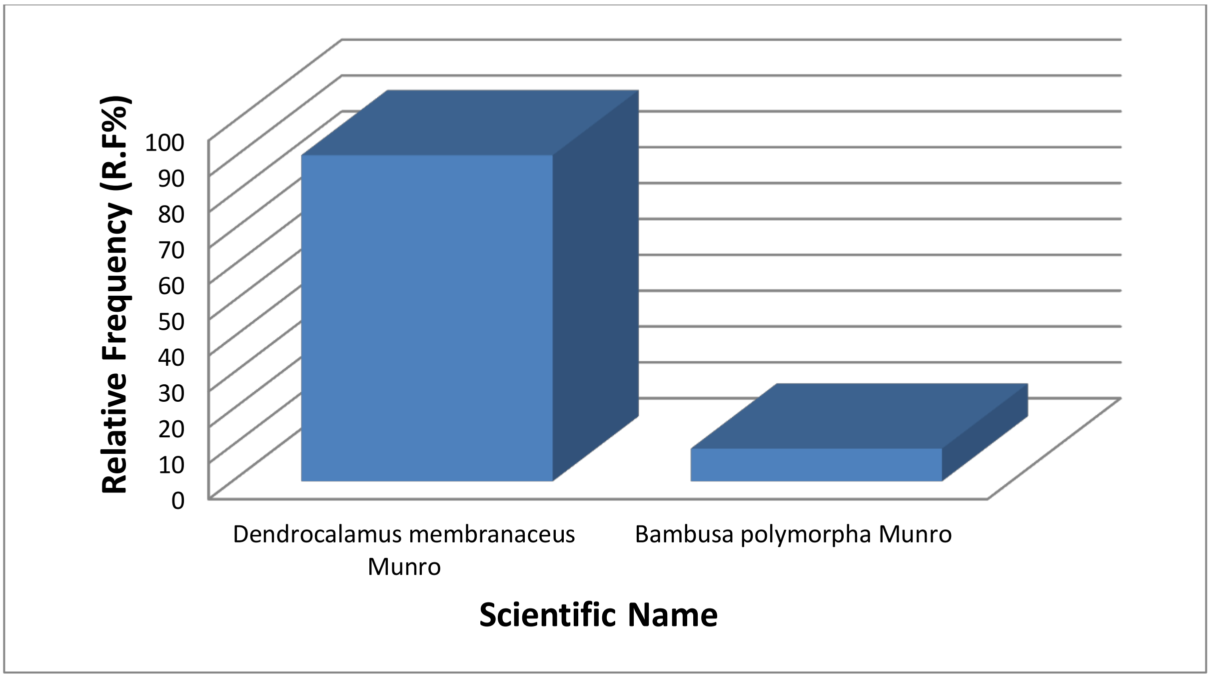


Table A14: Species List of Bamboo

No	Scientific Name	Common Name	Family Name
1	*Bambusa polymorpha* Munro	Kya-thaung-wa	Poaceae
2	*Dendrocalamus membranaceus* Munro	Hmyin-wa	Poaceae

Appendix 4

Scoping Phase Meeting Minutes

Appendix 4 – Scoping Meeting Minutes

Record of Meeting Minute

Basic Details	
Project Title	EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	5.2.2018
Time	09:30 to 11:30 hrs
Venue	Administrative office, Thayet Township
Number of Participants	102
Agenda	1. Opening of Public Consultation meeting 2. Introduction speech by Township Administrator 3. Introduction to PTTEP SA personnel 4. Introductory speech by MOGE representative U Myo Min Soe 5. Showing PTTEP Myanmar Asset Video 6. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA 7. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 8. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins 9. Question and Answer 10. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Aung Win Tin (Hand-Dug well owner) • He is working in the hand dug petroleum operations. He wished to be successful for MOGE-3 project like as Zawtika project and thanks to PTTEP SA for not disturbing hand dug wells operations. There are 7 village tracts in Thayet Township. He would like to know PTTEP SA can endorse official permit for new hand dug wells operations.	Discussion by PTTEP SA • Most of the hand dug wells are producing from about 300 – 1200 ft and the prospect of PTTEP SA is at about 9000 – 15000 ft. Due to the different prospects, PTTEP SA will not disturb hand dug wells operations. PTTEP SA is also an operator company and operating under permission of Myanmar Investment Committee and Myanma Oil and Gas Enterprise. So, PTTEP SA has no authority for endorsement.
2	U Aung Gyi (Media) • How will waste generated from exploration drilling operations be managed to avoid any impacts on the environment and local communities?	Discussion by PTTEP SA • Waste including food residue, paper box and plastic are collected and temporarily stored in specified area within the project area and then disposed to CDC sites or the site specified by the government. • There will be drilled cutting generated and those will be stored at temporary storage container within project area. After drilling finished, a third-party waste management company will conduct treatment according to international standards until the waste can be disposed as natural condition or no further

		impacts on the environment and human beings.
3	U Ko Ko Naing i. How much percentage of profit will our government receive concerning with this project? What about PTTEP? ii. Will land compensation be provided to land owner not having evidence form such as Land Registration Form No (7)? iii. What is the compensation price for buying/renting an acre land?	Discussion by PTTEP SA i. There is a Production Share Agreement between PTTEP SA and MOGE. As a Signature Bonus, Myanmar government will have USD $5-10millions. In addition royalty fees 12.5% of upon oil and gas production will be given to the national level. And then, for example, if 10,000 barrels of oil and gas can be produced, 60% is for MOGE and 40% for PTTEP SA. The higher production of oil and gas, the more the country get profit. ii. When well site locations are identified, land compensation committee will be founded with local authority, MOGE and PTTEP SA personnel after MOGE approval. Then the committee will handle land buying/renting cases for well sites, access roads and project area according to the land compensation procedure.
4	U Myint Phay • In my experience, in 1976, there was a well kick accident in 'Lat Pan To' test well, Pauk as a consequence approximately 1,000 barrels of oil contanimated to nearby areas. i. Can there be such an accident from this project and how PTTEP SA will be managed and prevented? How about rig move plan of PTTEP SA and if heavy equipment need to pass over the bridges, the strength of the bridge to consider and permission to seek from bridge administration department	Discussion by PTTEP SA i. Before drilling operation start, engineering design must be prepared by PTTEP SA, for example, designating drilling depth and types of equipment. The proposed engineering design has been reviewed and optimized together with MOGE with experienced experts of third-party Company and PTTEP SA. During drilling, the formation pressure is controlled by mud weight according to the geological formation and BOP is also prepared in ready position to prevent blowout.,. In addition an emergency response plan will be prepared and personnel will be trained to prevent accidents. ii. PTTEP SA conducted road and bridge survey. As there is a weight limitation on each bridge, drilling rigs must be dismantled into parts till to reach the limited weight of road and bridges. PTTEP SA will take permission from the Roads and Bridges Administration Department before rig move
5	U Aung Min Tin • I would like to ask for temporary hand-dug well operation licenses to work in PTTEP SA's project areas in which the project operations will not run.	Discussion by PTTEP SA • Myanmar Investment Committee MIC has authorized PTTEP SA to do operation in this Block MOGE-3. Yearly procedures and finance mechanisms concerned with this block project must be submitted to MOGE. MOGE is the regulatory authority for any permission, so any applications even for PTTEP SA must be submitted to MOGE for approval.
6	Deputy Staff Officer of Environment Conservation Department i. A budget for implementation stage of EMP must be included in EIA report in compliance with EIA Procedures Section-63(h). ii. Which Magway regional CSR programs or other CSR programs will	Discussion by PTTEP SA • According to the EIA Procedures Section-63(h), EMP must be prepared. This meeting is first public consultation meeting. Baseline survey for example; air, water and soil samples will be taken. In this meeting, project information and potential impacts will be

	PTTEP SA undertaking? iii. According to the EIA Procedures Section-64(i), when and how will public consultation and disclosure take place?	discussed in brief. In April or May 2018, we will conduct next public consultation meeting and will be presented the results of baseline survey, impacts and mitigation measures in detail. Those information will be included in EMP chapter of EIA report. Currently, scoping report has not been submitted yet. This is just the initial public consultation meeting. • PTTEP SA will use our own budget for CSR program.
7	Staff Officer of Forest Department • If the well is to be drilled in the forest area, an approval letter is required from Union Minister, Ministry of Natural Resources and Environmental Conservation (MONREC) according to the forest law 12 (a).	• Information was noted by PTTEP SA
	Daw Aye Aye Maw (Regional Hluttaw Representative) • We are pleased to meet with PTTEP SA, the relevant departments and the public. As a parliament representative I would like to make the following comments. As PTTEP SA will drill 4 wells in our township, PTTEP SA should construct the access roads in order to ensure good transportation for local people. Concerning the employment opportunities, trucks/cars from local business (or) labours in Thayet Township should be used as priority.	• Information was noted by PTTEP SA
	U Win Ko Ko (Director, ECD, Magway) • PTTEP Company held a meeting with Magway Chief Minister at the regional government office before this consultation meeting. There is one comment from Chief Minister to consult with CSOs, relevant departments and local people. There is one misunderstand case from one company with community in Magway concerning with operation and compensation process due to weak in communication/consultation process. There should also be minimal impact when the project implemented. In order to mitigate impacts, the EMP is necessary and should include CSR activities for local development. This EIA report must be submitted to ECD. The proposed company will conduct the operation activities based on this report. So, I would like to say that local people no need to worry that PTTEP SA is implementing the project in accordance with the international standards. Land compensation will be conducted with the	• Information was noted by PTTEP SA

	cooperation of the project owners and township administrator.	
8	U Zaw Lin (local people) • Can PTTEP SA provide some support when we apply for hand dug well license?	Discussion by PTTEP SA • PTTEP SA now planning to conduct exploration drilling in block MOGE-3 with the permission of MOGE. We have no authority to give permits or support for hand dug operations and license.

Photo Session

Record of Meeting Minute

Basic Details	
Project Title	EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	5.2.2018
Time	14:00 to 16:00 hrs
Venue	Monastery, Padauk Pin Village
Attended Villages	Kyauk-O, Nga Hlaing Chon Ywar Gyi, Nga Hlaing Chon Ywar Lay, Padaukpin, Sakangyi, Taung Baw, Myauk Baw, Yay Ban Nyay
Number of Participants	167
Agenda	1. Opening of Public Consultation meeting 2. Introduction speech by Township Administrator 3. Introduction to PTTEP SA personnel 4. Introductory speech by MOGE representative U Myo Min Soe 5. Showing PTTEP Myanmar Asset Video 6. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA 7. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 8. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins 9. Question and Answer 10. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	Daw Yin Kyi, (Pa Dauk Pin' Village head of National League Democracy) • The main economy of this village is hand dug operations since 1972. In the exploration drilling operations of the project, local workers would like to be employed without assumption as unskilled workers. Land compensation rate should be provided efficiently.	Discussion by PTTEP SA A committee that will handle land buying/renting cases for well sites, roads and project area will be organized. An official letter concerned with establishment of committee has been submitted to MOGE. Committee members are from relevant government departments, Settlement and Land Records Department, Agricultural Department and Administrative Departments in 'Thayet' district and township.
2	U Kyaw Win Sein (the previous village administrator of 'Pa Dauk Pin' village) • How many acre will be require for one wellsite? • How much compensation for one acre and how long will the land lease period?	Discussion by PTTEP SA There will be four exploration wells in different places. About 10-11 acres will be required for each well. Currently, well site locations are not confirmed yet but these locations will be identified very soon. As mentioned above, committee that will handle land buying/renting cases for well sites, roads and project area will be organized along with permission of MOGE and they will decide for the compensation rate. Land compensation price concerned with previous seismic survey was much higher than local price. So, don't be concerned about this case. Discussion by U Win Ko Ko (Director of Environmental Conservation Department of Magway Region) ECD is a new department under Ministry of Natural Resources and Environmental Conservation. One of responsibilities of ECD department is to hold awareness programs on environmental conservation in schools,

		villages and industrial sector. Another one is to investigate and tackle environmental problems that cause negative impacts on environment and then to monitor EMP. Environmental Management Plan (EMP) will include waste management plans to get safe environment and CSR (Corporate Social Responsibilities) programs such as health and education support. Similarly, it is found that EMP report for this project will be prepared in compliance with relevant laws. It will also include CSR programs for local development and waste management plans for safety. Daw Aye Yu Maw, the Magway regional Hluttaw representative, discussed about job opportunities for local people and road access in project meeting conducted in township administrative office today morning. This EMP report will be submitted to central office through my ECD department and then to union minister office. So, I would like to say all of you not be concerned too much.
3	U Than Naing (100 householder of Pauk Pin village) • The land compensation for seismic survey was provided to land owner not having legal evidence such as Land Registration Form (7). Will it be the same for exploration drilling stage?	Discussion by PTTEP SA Land owners with evidence may have more chance to get compensation but main decisions will be taken by Township Administrators and Settlement and Land Records Department. Village leaders must keep in touch with Township Administrator. For access to roads to the identified well sites, big trees and houses will be avoided but agricultural lands will be chosen. If well sites locations are identified, this issue will be addressed together with land owners and relevant departments.

Photo Session

Record of Meeting Minute

Basic Details	
Project Title	EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	6.2.2018
Time	14:00 to 16:00 hrs
Venue	Monastery, Baw Village
Attended Villages	Tazigauk East, Tazigauk West, Talokpin, Monatkon, Tat, Baw South, Baw North, Inle, Paukphyu, Sanmagyi, Oakpon
Number of Participants	214
Agenda	11. Opening of Public Consultation meeting 12. Introduction to PTTEP SA personnel 13. Introductory speech by MOGE representative U Myo Min Soe 14. Showing PTTEP Myanmar Asset Video 15. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA 16. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 17. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins 18. Question and Answer 19. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	• As there may be loss and damage of agricultural lands caused by the project, it is important that land compensation be provided to land owners as soon as possible without any delay.	Discussion by PTTEP SA • For agricultural lands, our Nay Pyi Taw team addressing landownership/renting cases will submit official letter about project area to Township Administer. Through permission of township administer, a committee including Settlement and Land Records Department, Agricultural Department, village administers, village elders and township administers will be established to handle land cases and conduct site investigations for reliable information about land price and crop price. These prices will be declared with an official letter by Township Administrative Office. Land buying/renting cases will be conducted and addressed together with all responsible people in order to reach acceptable agreements.
2	U Aung Kyaw Lin (Baw Villager) • Will land compensation be provided to land owner having no evidence form such as Land Registration Form No (7)?	Discussion by • According to the decision and recommendation of village administer and village elders, land compensation committee will be decided to provide compensation to the land owner without having approval form such as Land Registration Form No (7). But there must be no dispute about landownership among villagers.
3	U Khin Soe (local people) • Although our villagers currently not have land registration forms, one day Settlement and Land Records Department will grant us land registration forms.	• Comment noted and No response provided
4	U Aung Han (Village Administrator of Samagyi Village)	Discussion by PTTEP SA • In selection of roads, the access roads have been

	• The area proposed for roads for the project is within the planned new houses construction area of our villagers. This area is also near with the monastery. It is now ready for construction of new houses but PTTEP SA access road construction hasn't been started yet. I would like to know more detailed information on the planned road construction area.	chosen to avoid household damage and try to pass from agricultural lands. I will check whether the chosen road/path will pass through the above-mentioned area and provide more detailed information to you.

Photo Session

Record of Meeting Minute

Basic Details	
Project Title	EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	7.2.2018
Time	14:00 to 16:00 hrs
Venue	Monastery, Ohn Mon Taw Village
Attended Villages	Sanle, Ngabetkya, Ohnmundaw, Banbyin, Ywathit, Pegadin, Shanywarkyaw, Yemyet, Zidaw, Ahlatle, Ohnedegyi, Patmakhan
Number of Participants	272
Agenda	11. Opening of Public Consultation meeting 12. Introduction to PTTEP SA personnel 13. Introductory speech by MOGE representative U Myo Min Soe 14. Showing PTTEP Myanmar Asset Video 15. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA 16. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 17. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins 18. Question and Answer 19. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Myint Shwe, (Village Elders of 'Sanle' Village) • This project is warmly welcomed. I would like to suggest that there should be good communication between land owners, village leaders and company to avoid misunderstanding and problems about land compensation. Please do not sell or cut trees without permission of land owners.	Response by PTTEP SA Thank for your information

Photo Session

Record of Meeting Minute

Basic Details	
Project Title	EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	8.2.2018
Time	13:30 to 15:30 hrs
Venue	Monastery, Parput Village
Attended Villages	Ton, Parput, Paukuga
Number of Participants	59
Agenda	20. Opening of Public Consultation meeting 21. Introduction to PTTEP SA personnel 22. Introductory speech by MOGE representative U Myo Min Soe 23. Showing PTTEP Myanmar Asset Video 24. Presentation about company by U Khin Maung Gyi, advisor of PTTEP SA 25. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 26. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins 27. Question and Answer 28. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	Village leader of Ton Village • How waste management will be performed for this project? Based on the presentation, will waste be kept in big container? How will waste be disposed near religious sites?	Discussion by PTTEP SA A modern waste grinding machine will be set up for daily grinding of domestic waste such as food waste. In conformity with international standard, other domestic waste as well as plastic cups and bottles will be compacted by using compact machine till 5ft^3 volume of waste. After that, these wastes will be kept temporarily in a specified project area or container. Finally, waste will be disposed to the site specified by the government. There will be drilled cutting generated from drilling operations. These will be stored at temporary storage pit within project area. After drilling stage, our third-party waste management company will conduct treatment of these wastes till waste can be disposed according to standards to ensure that there are no impacts on environment and human beings.
2	U Tin Ngwe (Ton Villager) • According to your presentation, will PTTEP SA will drill in Natmi area or near by 3 villages that invited for this Public Consultation? We warmly welcome economic production of hydrocarbon in our villages.	Discussion by PTTEP SA PTTEP SA gave the name as Natmi according to Natmi Geological Structure and not based on Natmi village. Therefore we will drill nearby Ton, Paput and Paukuga villages.
3	U Thein Tun (Ton Villager) • How PTTEP SA will arrange for religious land and compensation for farmland?	Discussion by PTTEP SA Religious sites will be excluded. For agricultural lands, our Nay Pyi Taw team is addressing landownership/renting cases. We will submit official letter about project area to Township Administer. Through permission of township administer, a committee including Settlement and Land Records Department, Agricultural Department, village administers, village elders and township administers will

		be established to handle land cases and conduct site investigations for reliable information about land price and crop price. These prices will be declared with an official letter by Township Administrative Office. And then, using proper calculation methods, land buying/renting cases will be conducted and addressed together with all respondent and responsible people in order to reach acceptable agreements.
4	U Tin Shwe (Pauk Oo Kar Villager) • Will land compensation plan be provided to land owner having no approval form such as Land Registration Form No (7)?	Discussion by PTTEP SA According to the decision and recommendation of village administer and village elders, land compensation committee will be decided and provided compensation to the land owner without having the approval form such as Land Registration Form No (7). But there must be no dispute about landownership among villagers.

Photo Session

Appendix 5

EIA Phase Meeting Minutes

Appendix 5 – EIA Phase Meeting Minutes

Record of Meeting Minute for 2nd PC Meeting

Basic Details	
Project Title	2nd Public Consultation EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	24th April, 2018 (Tuesday)
Time	9:00 am to 11:00 am
Venue	Township Administrative Hall
Number of Participants	119
Agenda	1. Opening of Public Consultation meeting 2. Opening speech by District Administrator 3. Introduction to PTTEP SA personnel 4. Introductory speech by MOGE representative U Myo Min Soe 5. Presentation about company by Dr Khun Hline Myint, PTTEP SA 6. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 7. Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins (IEM) 8. Question and Answer 9. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	Member of City Development Committee of Thayet • I specially thanks for detail explanation about the environmental performances. However, it is more important to check and balance. Who will check and monitor these activities? Are there any third parties for monitoring and checking?	Answered by Daw Zar Chi Saint, Environmental Engineer (PTTEP SA) PTTEP SA have to report these activities to the Environmental Conservation Department (ECD) (Nay Pyi Taw). ECD will assign Magway ECD to check these performances if necessary. PTTEP SA will care monitoring and submit monitoring report to ECD every six months. We also have a plan to invite local authorities to our project areas to see our operation activities.
2	U Aung Gyi (Reporter) • How will the company responsible for public health at the project surrounding area?	Answered by Daw Zar Chi Saint, Environmental Engineer (PTTEP SA) In terms of local community's health, PTTEP SA will conduct medical checkup for workers before employment and set up health clinic on site. PTTEP SA provides mobile clinic (health care) service as CSR programs in collaboration with the Township Health Department. Answered by U Phone Thet Khaing, Communication officer of PTTEP SA

		PTTEP SA have planned to providemobile clinic service in 13 villages and already finished two villages This week will be in Nga bat kya village. For other villages, PTTEP SA have intended to continue this program by negotiating with the authorities of Public Heath of Thayet Township.
3	U KO KO Naing • I would like to suggest about the employment, it is needed to assign the local workers with special contract. And I would also like to say thanks PTTEP SA for consideration of our comments and suggestions concerning with Land compensation which doesn't have Form-7. How much will pay compensation for lands?	Answered by MOGE representative, U Myo Minn Soe (Manager of MOGE) In term of land use, we will do 2 year contract for proposed drilling area. The regional government organizes a land compensation committee including local authority and community, MOGE, PTTEP SA personnel, land record department and hluttaw representatives. They will conduct ground check and will be compensated by the decision of this committee. Answered by U Nay Lin (District Administrator) I here would like to add some points; the local community, Hluttaw representatives and local authorities are included in the compensation committee. Only this committee will do ground check and set what prices should be for what kinds of land. Then, compensation will be paid with the reasonable prices. Therefore, this case is directly concerned with the compensation committee. In doing so, I would like to explain about the nature of this joint project. According to this MOGE joint investment, the company totally invested in advance. If the project is successful, our country will pay the invested capital including the total cost of land compensation, seismic acquisition and exploration drilling etc. After that, they will receive profit sharing. Therefore, public is needed to understand this kind of situation. You will get the reasonable price for your land. We will push them and pay pressure on them to be a reasonable price. However it needs to not be over priced.

Photo Session

Introduction speech by U Nay Lin, (District Administrator)	Introductory speech by MOGE representative U Myo Min Soe
Presentation about company by U Khun Hline Myint (PTTEP SA)	Presentation about Drilling operation by U Wunna Win (Drilling Engineer)
Presentation about Environmental Impact Assessment (EIA) by U Khun Setthar (EQM) and Mr. Dylan Jenkins (IEM)	Question and Answers Question by a Member of city development committee of Thayet

U Ko KoNaing (local community)	Answered by U Nay Lin (District Administrator)

Record of Meeting Minute for 2nd PC Meeting

Basic Details	
Project Title	2nd Public Consultation EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	24th April, 2018 (Tuesday)
Time	2:00 pm to 4:00 pm
Venue	Baw Monastery
Number of Participants	229
Agenda	10. Opening of Public Consultation meeting 11. Introduction to PTTEP SA personnel 12. Introductory speech by MOGE representative U Myo Min Soe 13. Presentation about the project by U Khun Hline Myint, geologist of PTTEP SA 14. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 15. Presentation about Environmental Impact Assessment (EIA) by U Khun Set Thar (EQM) and Mr. Dylan Jenkins (IEM) 16. Question and Answer 17. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Khin Soe (village administrator of Baw village) • I here would like to request to villagers that try to ask the questions and suggestions. I just came back from the Thayet public consultation this morning that was made by PTTEP SA. I will share my experiences in morning meeting and District administrator's answers to all of us in the meeting. The District administrator said that concerning compensation, he also discussed about those cases in the other meeting. PTTEP	Information has been noted by PTTEP SA

	SA will also pay Land compensation which doesn't have Form-7/ legal document according to the decisions of land compensation committee. The Local community, Hluttaw representatives and local authorities are included in the compensation committee. This committee will do ground check and set the compensation rate for the various kinds of land. Then, compensation will be paid by the decision of the committee with the reasonable prices. If the project is successful, our country need to pay back the total cost of land compensation, seismic acquisition and exploration drilling etc to the company. After that, they will receive profit sharing. He also gave one example concerning compensation; the land compensation price was a little higher in the Kanma township. This may be in order to get more for local people and not to affect the local community by this land compensation. Eventually, the land rate was 860 lakhs per acre. This cost will be paid to our country later. Therefore, the public needs to understand this kind of situation. You will get the reasonable price for your land. We will push them and put pressure on them to set a reasonable price. However, the price should not be a bit overpriced than the market price.	

Photo Session

Introductory speech by MOGE representative U Myo Min Soe

Presentation about the project by Dr. Khun Hlaing Myint, geologist of PTTEP SA

Presentation about Drilling operation by U Wunna Win, Drilling Engineer

Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar (EQM) and Mr. Dylan Jenkins (IEM)

Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar

Question and Answer
U Khin Soe, village administrator of Baw village.

Record of Meeting Minute for 2nd PC Meeting

Basic Details	
Project Title	2nd Public Consultation EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	25th April,2018 (Wednesday)
Time	9:00 am
Venue	Ohnmuntaw Monastery
Number of Participants	232
Agenda	18. Opening of Public Consultation meeting 19. Introduction to PTTEP SA personnel 20. Introductory speech by MOGE representative U Myo Min Soe 21. Presentation about the project by Dr. Khun Hlaing Myint, geologist of PTTEP SA 22. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 23. Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar (EQM) and Mr. Dylan Jenkins (IEM) 24. Question and Answer 25. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Kyaw Win (Local people) • Which villages will the project drill? • Have you determined the exact location to be drilled?	Answered by Dr. Khun Hlaing Myint (PTTEP SA) Now, we are conducting survey together with Land Record Department. We confirmed four locations to be drilled for this project those are Ngabattkya, Moe Natt Kone, Padaukpin and Sakhanggyi villages. However we haven't finalized the exact coordinate yet where we will drill
2	Ko Wai Lin (Local People) • I'd like to ask the former case. During seismic survey period, our seasonal crop plantations damaged because surveyors passed our field. But they compensated only for the place of the shot hole locations, even though the crew told us that compensation team will pay for the damage crop as well. Please, discuss and how PTTEP SA will manage about the same kind of issue for this drilling project?	Answered by Dr. Khun Hlaing Myint (PTTEP SA) We measured and compensated with the participation of Land Record Department, village heads and community leaders for all compensational issues during Seismic period. We will note down this issue and inform land acquisition committee for their consideration for this drilling project.

Photo Session

Introductory speech by MOGE representative U Myo Min Soe

Presentation about the project by Dr. Khun Hlaing Myint, geologist of PTTEP SA

Presentation about Drilling operation by U Wunna Win, Drilling Engineer

Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar (EQM) and Mr. Dylan Jenkins (IEM)

Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar

Question and Answer (U Kyaw Win)

 Question and Answer (Ko Wai Lin)	 Closing public consultation

Record of Meeting Minute for 2nd PC Meeting

Basic Details	
Project Title	2nd Public Consultation EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	26th April, 2018 (Thursday)
Time	9:00 am to 11:00 am
Venue	Padaukpin Monastery
Number of Participants	212
Agenda	26. Opening of Public Consultation meeting 27. Introduction to PTTEP SA personnel 28. Introductory speech by MOGE representative U Myo Min Soe 29. Presentation about the project by U Khun Hline Myint, geologist of PTTEP SA 30. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 31. Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar (EQM) and Mr. Dylan Jenkins (IEM) 32. Question and Answer 33. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Sein Thaung (villager) • According to the presentation, qualified workers will be employed in the project. But most of local villagers are not graduated and our education is just primary and middle school. Anyway, I would like request to use local workers if the project starts.. In conclusion, I would like to say thanks for coming and implementing your project in our remote area.	Answered by Dr. Khun Hline Myint (PTTEP SA) Sure, PTTEP SA have plan to employ local workers as first priority for certain type of work but some foreigners and national experts will be included in the project implementation. I will report to my higher level concerning with your suggestions.. Thank you.
2	Daw Yin Kyi (village president of National League for Democracy) • Since 1972, our Paduakpin village have been depended on oil that is our careers and livelihoods. So, I am also happy and thank you for coming and drilling in our region. But some villagers are conducting self-employed drilling around the project areas. How will the company arrange official permit for us concerning with self-employed drilling in the Block?	Answered by U Khun Hline Myint (PTTEP SA) What I'd like to say is our drilling won't affect local self-employed drilling because the depth that we will drill is over 10,000 ft. Honestly, we won't disturb hand dug wells operation but PTTEP SA has no authority for endorsement.. Villagres have to request permission from Ministry of Electricity and Energy (MOEE) via Magway Regional Government office if the villagers want to continue their operation. Answered by U Thet Naing Win (Geologist from MOGE). I here would like to make another point; only MOEE can decide the permit for self-employed drilling and this is not related with the company. You can apply local drilling permit through the

		regional government. Then, regional government will report to MOEE in order to confirm whether the proposed drilling is free from the MOGE block or not. Then, MOEE will assign to us to check After that, we have to summit our recommendation on the proposed area to MOEE.
3	U Kyaw Khin (village administrator of Nga Lein Chyone) • The explanation today is about the present situation of project. What I would like to know is about the percentages of the CSR programs if the drilling project is successful. Although natural resources were explored and extracted, only the company got the profit and the public remained here originally. That is why I asked about future target/plan for social sector, economy, education etcIf possible, please explain about how many percentages from the profit of PTTEP SA will use for local's development? If not possible, please report our suggestions to higher levels of PTTEP SA.	Answered by U Phone Thet Khaing, (Communication officer from MOGE) For MOGE-3 Project, PTTEP SA have two phases; exploration phase and production phase. Present is exploration phase that is totally invested and no profit, CSR for this phase will be less than the production phase. If we succeed, we will do more CSR than this present situation. However, PTTEP SA conduct CSR or local development program from the periods of seismic survey since 2015 to date. I would like to conclude; PTTEP SA already support disaster, health, culture, sport activities and education sectors and we also have many plans in various sector of CSR programs in the future.
4	U Than Zaw (Hand Dug Well Worker, Padauk pin village) • I would like to know about that how will PTTEP SA manage for the hand dug-wells that are existed in your proposed drilling areas or block?	Answered by Khun Hline Myint (PTTEP SA) We won't affect hand dug-wells operations. We will avoid the local hand dug-wells as possible as we can. We are currently conducting ground survey with land record department in order not to disturb local hand dug-wells.
5	U Kyaw Win Sein (Driver from Padauk Pin Villag). • As I am a driver, I will talk about the driving concerning with company. When operation is started, the traffic will increase. Moreover, our village school is existed on the road. So, I would like to request to construct three stop lines or slow-down in front of the school to control the speed of car for their safety.	Answered by Khun Hline Myint (PTTEP SA) We note down your suggestion and I will report to my seniors of company. Moreover, we also have our own SSHE (Safety, Security, Health, Environment) policy and procedure and we apply this for our operation. However, if our drivers drive with over-speed, please let us know or complain to PTTEP SA representative on site.

Photo Session

Introductory speech by MOGE representative U Myo Min Soe

Presentation about the project by U Khun Hline Myint, geologist of PTTEP SA

Presentation about Drilling operation by U Wunna Win, Drilling Engineer

Presentation about Environmental Impact Assessment (EIA) by U Khun Set thar (EQM) and Mr. Dylan Jenkins (IEM)

Daw Yin Kyi, village president of National League for Democracy (NLD).

U Kyaw Khin, village administrator of Nga lein chyone

U Than Zaw, Padauk pin village	U Kyaw Win Sein, Driver from padauk pin village

Record of Meeting Minute for 2nd PC Meeting

Basic Details	
Project Title	2nd Public Consultation EIA Study of Exploration Drilling Campaign in Onshore Block MOGE-3
Date	26th April, 2018 (Thursday)
Time	2:00PM- 4:00PM
Venue	ParPut Monastery
Number of Participants	60
Agenda	34. Opening of Public Consultation meeting 35. Introduction to PTTEP SA personnel 36. Introductory speech by MOGE representative U Myo Min Soe 37. Presentation about the project by U Khun Hline Myint, geologist of PTTEP SA 38. Presentation about Drilling operation by U Wunna Win, Drilling Engineer 39. Presentation about Environmental Impact Assessment (EIA) by U Khun Set Thar (EQM) and Mr. Dylan Jenkins (IEM) 40. Question and Answer 41. Closing of Public Consultation meeting

Question & Answer Session

No.	Questions, Concerns and Recommendation	Clarification
1	U Kyaw Naing Oo (Ton Village Administrator) • What is the width of the access road? The reason I ask is that our road is very narrow so the vehicles of the company may face traffic difficulties due to the road conditions of our village.	Answered by U Htun Aung Kyaw, Project Engineer in cooperation of MOGE and PTTEPSA. The access road to the well site would have approximately 30 feet width according to our survey. Answered by Tin Wai Yan Oo (Junior Engineer, PTTEPSA) I would like to add information about the road. The actual width of the road is about 5 meters (15 feet). Considering the width of road shoulder and drainage, the total width is about 7 meters (21 feet).
	U Kyaw Naing Oo (Ton Village Administrator) • As the proposed width of the road would be 15 feet and there is an ancient pagoda at the adjacent side of the road, the additional access road around the village will be more suitable than the existing road in the village.	Answered by U Htun Aung Kyaw (Project Engineer in cooperation of MOGE and PTTEP SA) We will choose the most suitable roads, if we cannot upgrade the existing road, we will construct new access road. Discussed by Dr. Khun Hlaing Myint (Geologist of PTTEP SA) Thanks for your discussion. Before we do the road

		construction, we will take permission from landowners, and local authorities. After they confirmed and allow us to do, the road construction process will be started.

Photo Session

 Introductory speech by MOGE representative U Myo Min Soe	 Presentation about the project by U Khun Hline Myint, geologist of PTTEP SA
 Presentation about Drilling operation by U Wunna Win, Drilling Engineer	 Presentation about Environmental Impact Assessment (EIA) by U Khun Set Thar (EQM) and Mr. Dylan Jenkins (IEM)
 Presentation about Environmental Impact Assessment (EIA) by U Khun Set Thar	 Question and Answer (U Kyaw Naing Oo)