MYANDAWEI
INDUSTRIAL ESTATE
COMPANY LIMITED

Initial Environmental Examination (IEE)

on

Pa Yain Byu Reservoir
Small Water Reservoir Project
in Dawei District, the Republic of the Union of Myanmar

Final Report

Proposed by

PHISUT TECHNOLOGY CO.,LTD.

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ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပြည်ထောင်စုဝန်ကြီးရုံး

စာအမှတ် (သစ်တော)၃(၂)/၁၆(ခ)(၁၈၃၅ /၂၀၁၈)
ရက်စွဲ ။ ။ ၂၀၁၈ ခုနှစ် ၊ မေလ ၂၉ ရက်

သို့

ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ

အကြောင်းအရာ။ **ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်းတွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ပယင်းဖြူရေလှောင်တမံနှင့်စပ်လျဉ်းသည့် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအစီရင်ခံစာ(IEE)အပေါ် သဘောထားမှတ်ချက်ပြန်ကြားခြင်း**

ရည်ညွှန်းချက် ။ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ၁၅- ၅- ၂၀၁၈ ရက်စွဲပါစာအမှတ်၊ ထဝ-၁၆/ DSEZ/ ၂၀၁၈ (၁၃၄)

၁။ ထားဝယ်အထူးစီပွားရေးဇုန် ကနဦးစီမံကိန်းလုပ်ငန်းများ၏ ၂၀၁၅ ခုနှစ်၊ ဒီဇင်ဘာလ အတွင်း အီတာလျံ-ထိုင်းကုမ္ပဏီမှ တင်ပြခဲ့သည့် သဘာဝပတ်ဝန်းကျင်ဆန်းစစ်မှု အစီရင်ခံစာ (၁၀)ခုအနက်(၈)ခုကို အတည်ပြုပေးခဲ့ပြီး အတည်ပြုရန်ကျန်ရှိသည့် စီမံကိန်း(၂)ခုဖြစ်သော ၂-လမ်းသွားကားလမ်း(ESIA)နှင့် ပယင်းဖြူရေလှောင်တမံစီမံကိန်းအတွက် (IEE) အစီရင်ခံစာများအား အမြန်ဆုံးအတည်ပြုပေးနိုင်ရေး စီစဉ်ဆောင်ရွက်ပေးနိုင်ပါရန် ရည်ညွှန်းစာဖြင့် တင်ပြလာပါသည်။

၂။ အဆိုပါကိစ္စနှင့်ပတ်သက်၍ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနအနေဖြင့် Myandawei Industrial Estate Co.,Ltd(MEI) မှ ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်းတွင် ကနဦးစက်မှုလုပ်ငန်းနယ်မြေ တည်ဆောက်ခြင်း၊ စက်မှုနယ်မြေအသုံးပြုမှုနှင့် စက်မှုမြို့တော်၏ ရေသုံးစွဲမှုကိုပံ့ပိုးပေးနိုင်ရန်အတွက် ရေပေးဝေရေးကို အထောက်အကူပြုစေမည့် ပယင်းဖြူရေလှောင်တမံစီမံကိန်း၏ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း(IEE) အစီရင်ခံစာသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် ၃၆ ပ၊ အချက်များနှင့် ကိုက်ညီမှုရှိကြောင်း စိစစ်တွေ့ရှိရသဖြင့် ပြန်လည်တင်ပြလာသည့် အစီရင်ခံစာကို အတည်ပြုပါကြောင်းနှင့် စီမံကိန်းကို အကောင်အထည်ဖော် ဆောင်ရွက်ရာတွင် အောက်ဖော်ပြပါ အချက်များကို အလေးထားလိုက်နာဆောင်ရွက်ရန် လိုအပ်ပါကြောင်း သဘောထားမှတ်ချက်ပြန်ကြားအပ်ပါသည်-

(က) အပြီးသတ် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် ဖော်ပြထားသော ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ ဥပဒေ၊နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများ၊

မြန်မာနိုင်ငံ၏ တည်ဆဲဥပဒေများ၊ အပြည်ပြည်ဆိုင်ရာ သဘောတူညီချက်များ၊ အပြည်ပြည်ဆိုင်ရာ ပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ စံသတ်မှတ်ချက်များ၊ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ညွှန်ကြားချက်များ/ စည်းမျဉ်းစည်းကမ်းများနှင့် ဆက်လက်ထုတ်ပြန်မည့် သက်ဆိုင်ရာ လုပ်ထုံးလုပ်နည်းများကို လိုက်နာဆောင်ရွက်ရန်၊

(ခ) ကုမ္ပဏီမှ လိုက်နာမည်ဖြစ်ကြောင်း ကတိကဝတ်ဇယားတွင် ဖော်ပြထားသည့် အာရှဖွံ့ဖြိုးရေးဘဏ်၏ Environmental Safeguards(2009) ပါဖော်ပြထားသော အဆိုပြုစီမံကိန်းနှင့်သက်ဆိုင်သည့် ဘေးကင်းလုံခြုံရေးဆိုင်ရာ အစီအမံများကို လိုက်နာဆောင်ရွက်ရန်၊

(ဂ) အစီရင်ခံစာ၏ အခန်း (၂-ခ) နှင့် ဇယား (၂.၆-ခ) ပါသတ်မှတ်ချက်အတိုင်းသာ ရေလှောင်တမံကို တည်ဆောက်ရန်၊

(ဃ) ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေးများနှင့်စပ်လျဉ်း၍. အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များနှင့် အစီရင်ခံစာအခန်း (၃.၅-ခ) နှင့် (၃.၅-၂) ပါလိုက်နာမည်ဖြစ်ကြောင်း ဖော်ပြထားသည့် သတ်မှတ်စံချိန်စံညွှန်းများနှင့်အညီ လိုက်နာဆောင်ရွက်ရန်၊

(င) စီမံကိန်းကြောင့်ထိခိုက်ခံရနိုင်သည့် ဒေသခံများ(Project Affected Households -PAHs)အတွက် ဝင်ငွေပြည်လည်ထူထောင်ပေးရေးစီမံချက် (Income Restoration Programme-IRP) ပါဝင်သည့် ပြန်လည်နေရာချထားရေး လုပ်ငန်းစီမံချက် (Resettlement Work Plan-RWP) ကို စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့်သူသည်ရေးထိုးထားသည့် သဘောတူညီချက် (Conession Agreement) နှင့်အညီ အကောင်အထည်ဖော်ဆောင်ရွက်ရန်နှင့် အခန်း(၈)ပါ Compensation Plan ကို ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ကြီးကြပ်မှုဖြင့် ဆောင်ရွက်ရန်၊

(စ) အပြီးသတ် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် မီးဘေးလုံခြုံရေး၊ ရေကြီးခြင်း၊ ငလျင်လှုပ်ခြင်း စသည့် သဘာဝဘေးအန္တရာယ်များကျရောက်ပါက အရေးပေါ်တုန့်ပြန်ဆောင်ရွက်မည့် အစီအစဉ်များနှင့်ပတ်သက်၍ အသေးစိတ် ရေးဆွဲဖော်ပြထားခြင်း မရှိသည့်အတွက် အဆိုပါကိစ္စရပ်များ မတော်တဆဖြစ်ပေါ်လာပါက ဖြေရှင်းနိုင်ရေးအတွက် Emergency Response Plan ကို စီမံကိန်းလုပ်ငန်းများ စတင်လည်ပတ်ခြင်းမပြုမီ ရေးဆွဲပြင်ဆင်ထားရန်၊

(ဆ) စီမံကိန်း အကောင်အထည်ဖော် ဆောင်ရွက်မည့်သူသည် ဒေသခံများ၏ အဓိက လိုအပ်ချက်ဖြစ်သည့် ရေရရှိရေး၊ ဒေသခံများအတွက် လမ်း၊ လျှပ်စစ်မီး၊ ပြည်သူ့

ကျန်းမာရေးစောင့်ရှောက်မှု စသည့် အခြေခံအဆောက်အဦး လိုအပ်ချက်များနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆောင်ရွက်ချက်စသည့် လုပ်ငန်းများပါဝင်သည့် Community Support Programme များကို ဒေသခံများနှင့်ညှိနှိုင်း၍ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ကြီးကြပ်မှုဖြင့် အကောင်အထည်ဖော်ဆောင်ရွက်ရန်နှင့် အဆိုပါဆောင်ရွက်ချက်ရလဒ်များကို စောင့်ကြပ်ကြည့်ရှုခြင်း အစီရင်ခံစာ (Monitoring Report) တွင် ထည့်သွင်းဖော်ပြ၍ လုပ်ငန်းလည်ပတ်သည့်ကာလနှင့် ပိတ်သိမ်းမည့်ကာလတို့အတွင်း ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြသွားရန်၊

(ဇ) စီမံကိန်းအကောင်အထည်ဖော် ဆောင်ရွက်မည့်သူသည် စီမံကိန်း၏ ကနဦး ပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် ပါဝင်သည့် လိုက်နာရန် ကတိကဝတ်များအတိုင်းလိုက်နာဆောင်ရွက်သွားရမည့်အပြင် တမံဆောက်လုပ်ရေးကာလ၊ လုပ်ငန်းလည်ပတ်စဉ်ကာလနှင့် လုပ်ငန်းပိတ်သိမ်းမည့် ကာလများအတွင်း ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် လူမှုရေးထိခိုက်နိုင်မှုအခြေအနေများကို စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးခြင်း၊ သက်ဆိုင်ရာဌာနများသို့ အစီရင်ခံတင်ပြခြင်းတို့ကို မပျက်မကွက် ဆောင်ရွက်သွားရမည့်အပြင် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်သူနှင့် ပြည်သူလူထုအကြား ပွင့်လင်းမြင်သာမှုရှိစေရေးအတွက် ပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ ကိစ္စရပ်များ ဆောင်ရွက်ရာတွင် စဉ်ဆက်မပြတ် ဆွေးနွေးညှိနှိုင်းမှုများ ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မှုရလဒ်များကို စောင့်ကြပ်ကြည့်ရှုသည့် အစီရင်ခံစာတွင် ထည့်သွင်း၍ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြသွားရန်၊

(ဈ) Monitoring Program (section 6.2.1) နှင့် Table (6.2-2) အား ထိရောက်စွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရန်နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) တွင် ဖော်ပြထားသော အခန်း (၉) စောင့်ကြပ်ကြည့်ရှုခြင်းနှင့်အညီ ဆောင်ရွက်ရန်။

၁၄/၅/၁၈

ပြည်ထောင်စုဝန်ကြီး(ကိုယ်စား)
(ဝင်းဇော် ၊ ဒုတိယအမြဲတမ်းအတွင်းဝန်)

မိတ္တူကို
ညွှန်ကြားရေးမှူးချုပ်
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

[Translation]

State Emblem

Government of the Republic of the Union of Myanmar
Ministry of Natural Resources & Environmental Conservation
Union Minister Office

Doc. No. : (Forest)3(2)/16(B) (1845/2018)
Date : 29 May 2018

To : Dawei Special Economic Zone Management Committee

Subject : **Comments & Recommendations upon Initial Environmental Examination(IEE) of Pa Yain Byu Reservoir Project to be carried out in Dawei Special Economic Zone**

Reference: Document No. HtaWa-16/DSEZ/2018(134) dated 15/05/2018 of Dawei Special Economic Zone (DSEZ) Management Committee

1. Regarding the natural environment survey reports submitted by Italian-Thai Development Public Company Limited, the ministry has approved eight Environmental Impact Assessment Reports from a total of ten. According to the referenced document, DSEZ requested the ministry's approval for the remaining 2 survey reports: Two-lane Road Project (ESIA) and Pa Yain Byu Reservoir Project (IEE).
2. The ministry has found that: the initial industrial estate establishment inside Dawei Special Economic Zone and water supply to the industrial estate from Pa Yain Byu Reservoir Project, to be developed by Myandawei Industrial Estate Co., Ltd. (MEI), and its related Initial Environmental Examination report met clause 36 of the environmental impact assessment procedures. Therefore, the Ministry of Natural Resources & Environmental Conservation hereby affirms that the ministry has approved the mentioned IEE report with guidelines for related parties to practice as per the following.
   a. To abide by the environmental reservation law-act-procedure described in the final report of Initial Environmental Examination, Myanmar's law in force, international

law & agreements, international environmental & social standards, existing and future instructions & rules of the Dawei Special Economic Zone Management Committee.

b. To act accordingly with safety plans for the proposed project committed by the company which is mentioned in the Asian Development Bank's Environmental Safeguards (2009).

c. To construct the Reservoir according to the specifications stated in the Survey Report Section 2-1 and Table 2.6-1.

d. To follow National Environmental Qualities (Emission) Instructions and Specifications of Survey Report Section (3.5-1) and Section (3.5-2) with matters related to the Environmental Qualities.

e. In accordance with the Concession Agreement, the developer is required to conduct "Resettlement Work Plan – RWP" including "Income Restoration Programme – IRP" for "Project Affected Housholds – PAHs", and to carry out "Compensation Plan" described in Section 8 under the guidance of Dawei Special Economic Zone Management Committee.

f. There was no emergency action plan for natural disasters such as fire hazard, flood & earthquake, etc., drawn out in detail inside the final report of Initial Environmental Examination. So the developer is required to compile an "Emergency Response Plan" for this undesired situation and make it ready before the project begins operation.

g. Under the control of Dawei Special Economic Zone Management Committee and with talks & negotiations with local residents, the project developer is required to conduct the "Community Support Programme" to develop the infrastructure & safety measures for servicing the needs of local residents, including municipal water

supply, road, electricity, public health care, etc. and to prepare a "Monitoring Report" stating the conducted works during operation period and closing period and to report to Dawei Special Economic Zone Management Committee and this ministry.

h. The Project Developer must not only act in accordance with its commitment stated in project Initial Enviromental Examination Report, but must also monitor environment conservation and social impact, and report to the related departments and organizations regularly. In addition, the developer must continuously carry out discussions & negotiations with the people concerning social & environmental issues to create transparency between the two sides and to compile and prepare their conducted works in the form of a monitoring report and submit to Dawei Special Economic Zone Management Committee and this ministry.

i. The developer must strictly & effectively carry out the actions as mentioned in the "Monitoring Programme" stated in Section 6.2.1 & Table 6.2-2 and to act in compliance with "Section (9) – Monitoring" stated in the Environmental Impact Assessment Procedure (2015).

[Signature]

(On behalf of) Union Minister

(Win Zaw, Deputy Permanent Secretary)

Copy to :

Director General

Environmental Conservation Department

PA YAIN BYU RESERVOIR, SMALL WATER RESERVOIR PROJECT

PROJECT KEY COMMITMENTS

Chapter	Commitment
CHAPTER 2 DESCRIPTIONS OF THE PROJECT	
Section 2.1: Project Description	MIE will construct Pa Yain Byu Reservoir which the storage volume is about 7.7 MCM.
Section 2.2: Location	The Pa Yain Byu Reservoir is located on the right bank of the Dawei River in the DSEZ boundary.
Section 2.6: Technical Descriptions of the Project	The Project will design and construct all buildings and structures to blend in with the surrounding environment.
CHAPTER 3 POLICY AND LEGAL FRAMEWORK	
Section 3.1: Regional Environmental & Social Safeguards	MIE will follow: -Environmental Safeguards (2009) -Involuntary Resettlement Safeguards (2009) -Indigenous Peoples Safeguards (2009)
Section 3.2: Environmental & Social Policy Framework in Myanmar	MIE will follow: -Environmental Conservation Law (ECL 2012) -Environmental Conservation Rules (ECR 2014) -Environmental Impact Assessment Procedure (2015) -Laws on Protection and Preservation of Antique Objects and Buildings (2015) -Land acquisition and Resettlement Procedures -Farmland Laws (2012) -Legal framework related to Occupational Health & Safety
Section 3.3: Other Environmental Related Legislation	MIE will consider to other statutory policies, laws and regulations in Myanmar that related to environmental issues: • Finance & Revenue -The Myanmar Insurance Law, 1993 - The State Law and Order Restoration Council (The Law amending the financial institutions of Myanmar Law, 1994) • Forestry -The Protection of Wild Life and Wild Plants and Conversation on Natural Areas Law, 1994 -The Forest Law, 1992 • Health -The National Food Law, 1997 -The Traditional Drug Law, 1996 -The Prevention and Control of Communicable -Diseases Law, 1995 -The National Drug Law, 1992 -The Union of Myanmar Public Health Law, 1972 • Hotels & Tourism -The Myanmar Hotel and Tourism Law, 1993 • Industrial -The Private Industrial Enterprise Law, 1990 -The Factorial Act, 1951 -The Oilfield (Workers and Welfare) Act, 1951 -The Petroleum Act, 1934 -The Oilfield Act, 1918 • Livestock & Fisheries -The Animal Health and Development Law, 1993

	-The Freshwater Fisheries Law, 1992 -The Myanmar Marine Fisheries Law, 1990 (The Law Amending the Myanmar Marine Fisheries Law, 1993) -The Law Relating to Aquaculture, 1989 -The Law Relating to the Fishing Right of Foreign Fishing Vessels, 1989 (The Law Amending the Law Relating to the Fishing Rights of Foreign Fishing Vessels, 1993 • Mining -The Myanmar Gemstone Law, 1995 -The Myanmar Pearl Law, 1995 -The Myanmar Mines Law, 1994 -The Salt Enterprise Law, 1992 -The Land Acquisition (Mines) Act, 1885 • Science & Technology -The Science and Technology Development Law, 1994 • Transportation -The Highways Law, 2000 -The Motor Vehicles Law, 1964 (The Law Amending the Motor Vehicles Law of 1964 enacted in 1989) -The Myanmar Aircraft Act, 1934 -The Island Steam Vessels Act, 1917 -The Ports Act, 1908 -The Defile Traffic Act, 1905 -The Yangon Port Act, 1905 -The Canal Act, 1905 -The Obstruction in Fairways Act, 1881 • Electricity -The State Law and Order Restoration Council (The Law Amending the Electricity Law, 1990) • Air Quality -National Environmental Quality (Emission) Guidelines (2015)
Section 3.5.1: Ambient Air Quality Standard	MIE will comply with National Environmental Quality (Emission) Guidelines, Myanmar (2015) and International Quality Standard. -Notifications of National Environmental Board No.10, 24, 28, 33, and 36, Ministry of Natural Resources and Environment, Thailand -National Ambient Air Quality Standard (TCVN5973:2005), Ministry of Science and Technology in Vietnam -Environmental, Health, and Safety Guidelines, General EHS Guidelines, IFC, 2007 -National Air Quality Standard in Japan (CircularNo.25, 1973, originally), Ministry of Environment, Japan
Section 3.5.2: Noise Level Standard	MIE will comply with National Environmental Quality (Emission) Guidelines, Myanmar (2015) and International Quality Standard. -Noise Standard in Indonesia (KEP-48/MENLH/11/1996) -Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)
Section 3.5.3: Water Quality Standard	MIE will comply with National Environmental Quality (Emission) Guidelines, Myanmar (2015) and International Quality Standard.
CHAPTER 5 POTENTIAL IMPACTS AND MITIGATION MEASURES	
Section 5.2: Mitigation and Enhancement Measures	MIE will comply the mitigation measures of Pre-construction phase as follows: -Land acquisition
	MIE will comply the mitigation measures of Construction phase as follows:

	-Employment opportunity to local people -Enhancement of technical skill -Air and noise pollution -Water Quality -Landscape and land use -Forest area/vegetation -Wildlife -Land acquisition -Social, cultural and religious practices -Gender -Archaeological sites -Occupation health and safety
	MIE will comply the mitigation measures of Operation phase as follows: -Flood protection -Tourism and recreation
CHAPTER 6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)	
Section 6.2.1.2: Monitoring Indicators	MIE will comply with National Environmental Quality (Emission) Guidelines, Myanmar (2015) and International Quality Standard as follows: -Air and Noise Quality -Water quality -Landscape and Land Use -Economic Development and Social and Cultural Resources
Section 6.2.1.3: Monitoring Mechanism	-MIE will develop the Monitoring Procedures in both Construction and Operation Phase that ensure all mitigation measures and monitoring requirements specified in the report through Environmental Monitoring Plan (EMP) -MIE will develop in-built monitoring for environmental improvement and mitigate undesirable environmental changes
Section 6.2.2: Grievance Redress Mechanism	-MIE will set up Grievance Redress Mechanism to ensure that all views of the people are adequately reviewed and suitably incorporated in implementation process.
Section 6.2.3: Reporting and Documentation	-MIE will follow Environmental Impact Assessment Procedure (2015), the Monitoring Report will be prepared and submitted to ECD.
CHAPTER 7 PUBLIC INVOLVEMENT, CUMULATIVE IMPACT AND INITIAL RISK ASSESSMENT	
Section 7.1: Public Involvement	The Project will support the Community Participatory Committee (CPC) to disclose the information related to the Project activities.
CHAPTER 8 COMPENSATION PLAN	
Section 8.1: Compensation Plan	-MIE will comply with international practice and guidelines, such as those stipulated by the World Bank. -MIE will appoint Independent Relocation Expert who perform census, asset assessment, and market survey, prepare entitlement matrix, stakeholders engagement and provide consultation to the Compensation and Relocation Committee (CRC)
CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS	
Section 9.2: Recommendations	MIE will comply with related task as follows: -Working closely with local authorities to comply with environmental and social legislation in consultation with the affected people; -Support the socio-economic development of the Dawei District and the Tanintharyi Region; -Ensuring that releases pollutions on environment not exceed the Myanmar national environmental standards;

	-Periodically monitoring and reporting must comply with local, regional, national and law and regulations; -Treatment and elimination to reduce environment and social impacts.

To publicly disclose the IEE. The Revised draft Final Report has been disclosed to public via the Project proponent's website, already. The link is

http://www.daweiindustrialestate.com/download.php?cid=110&cname=EIA%20Report

In the future, the Project proponent will prescribe the web link address with reference to clause 65 of EIA Procedure 2015 in the Final Report, consequently

Final Report
Initial Environmental Examination on Pa Yain Byu Reservoir for the Small Water Reservoir Project

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ABBREVIATIONS

ADB	Asian Development Bank
APs	Affected Persons
BGs	Building Groups
BOD	Biochemical Oxygen Demand
CC	Compensation Committee
CDMA	Code Division Multiple Access
CFC	Compensation Fixation Committee
CL	Central Lowland
COD	Chemical Oxygen Demand
CSR	Social Corporate Responsibility
DDC	Dawei Development Company District Development Committee
DSEZ	Dawei Special Economic Zone
EH	Eastern Highland
EIA	Environmental Impact Assessment
EIE	Early Industries Estate
EMP	Environmental Management Plan
EMS	Environmental Management Section
EMU	Environmental Management Unit
EPA	Environment Protection Act
EPR	Environmental Protection Regulations
FD	Forestry Department
GoN	Government of Nepal
IEE	Initial Environmental Examination
ISC	Implementation Support Consultant
ITD	Italian Thai Development
LWL	Lower Water Level
MCM	Million Cubic Meters
MEC	Myanmar Earthquake Committee
MMI	Modified Mercalli Intensity
MOI	Ministry of Industry
MOU	Memorandum of Understanding
MOAI	Ministry of Agriculture and Irrigation
MSL	Mean Sea Level
NWL	Normal High Water Level
PM	Project Manager
PPE	Personal Protective Equipment
RRC	Relocation and Resettlement Committee
RRU	Relocation and Resettlement Unit
RU	Relocation Unit

ABBREVIATIONS (CONT'D)

SD	Site Director
SPT	Standard Penetration Test
SWB	Supporting Working Body
VDC	Village Development Committee
WFB	Western Fold Belt

ပယင်းဖြူရေလှောင်တမံစီမံကိန်း၏ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု(IEE) ဆိုင်ရာ စီမံအုပ်ချုပ်မှုအနှစ်ချုပ်အစီရင်ခံစာ

ပယင်းဖြူရေလှောင်တမံစီမံကိန်း၏ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု(IEE) ဆိုင်ရာ စီမံအုပ်ချုပ်မှုအနှစ်ချုပ်အစီရင်ခံစာ

1. နိဒါန်း

1.1 စီမံကိန်းနောက်ခံသမိုင်း

ပြည်ထောင်စုမြန်မာနိုင်ငံတော်အစိုးရနှင့် ထိုင်းဘုရင့်နိုင်ငံတော်အစိုးရတို့သည် တနင်္သာရီတိုင်း၊ ထားဝယ်ခရိုင်၌ ထားဝယ်ရေနက်ဆိပ်ကမ်း၊ စက်မှုဇုန် နှင့် စကြံ ဆက်ကြောင်း ဖွံ့ဖြိုးရေး စီမံကိန်း၌ ပူးပေါင်းလုပ်ဆောင်သွားကြရန်အတွက် 2008 ခုနှစ်၊ ဧမေလ 19 ရက်နေ့တွင် နှစ်နိုင်ငံနားလည်မှုစာချွန်လွှာ (MOU) ကို လက်မှတ်ရေးထိုးခဲ့ကြပါသည်။

နားလည်မှုစာချွန်လွှာ အရ ဖော်ဆောင်မည့် ဤဒေသမစီမံကိန်းတွင်းရှိ စက်မှုဇုန် အိမ်ယာအစုအဖွဲ့နှင့် လူနေထိုင်ရာ ရပ်ကွက်တို့၌ သုံးစွဲရန် အတွက် ကြီးမားသည့်ရေအရင်းအမြစ် ထောက်ပံ့မှု လိုအပ်ချက် ရှိနေပါသည်။ စီမံကိန်းကြီး တစ်ရပ်လုံးအတွက် ရေသုံးစွဲမှု လိုအပ်ချက်ကို ကလုတ်ထာဆည်နှင့် ရေလှောင်တမံကို တည်ဆောက်၍ ဖြည့်ဆည်းရန် စီစဉ်ထားပြီး၊ ၎င်းကို ထားဝယ် အထူးစီးပွားရေးဇုန် (DSEZ) တစ်ခုလုံး၏ ရေထောက်ပံ့မှုရင်းမြစ်အဖြစ် ရည်ရွယ်ထားပါသည်။ ထိုင်းနိုင်ငံတွင်းရှိ စက်မှုဇုန် များစွာ၏ ရေသုံးစွဲသည့် အချက်အလက်ကို ကိုးကား၍ ယခုလို တွက်ချက် ခန့်မှန်းထားခြင်း ဖြစ်ပါသည်။

ဤပယင်းဖြူရေလှောင်တမံ စီမံကိန်းကိုမူ ရှေးဦးအဆင့် စက်မှုလုပ်ငန်း တည်ဆောက်မှုနှင့် စက်မှုလုပ်ငန်းအသုံးအတွက် ရေထောက်ပံ့ပေးနိုင်ရန် ရည်ရွယ်လျက် အဆိုပြု တင်ပြထားခြင်း ဖြစ်ပါသည်။

ပယင်းဖြူရေလှောင်တမံစီမံကိန်း၏ တည်နေရာသည် ထားဝယ်စက်မှုဇုန်စီမံကိန်း၏ ကနဦးလုပ်ငန်းဖော်ဆောင်မှုအဆင့်ရှိ အစပိုင်း လုပ်ငန်းတည်ဆောက်မှုနှင့် လုပ်ငန်းသုံးအတွက် တည်ငြိမ်လုံလောက်သည့် ရေအား ပံ့ပိုးပေးနိုင်ရန်အတွက် ရေလုံလောက်စွာစီးဝင် သိုလှောင်နိုင်သည့် အနေအထားပေါ်မူတည်ပြီး၊ ဖွံ့ဖြိုးတိုးတက်မှုအတွက် သင့်လျော်သည့်နေရာနှင့် ဖြစ်နိုင်သည့် ရေအရင်းအမြစ် ၏ရလဒ်ကို အခြေခံထားသည့် နေရာဖြစ်ပါသည်။

1.2 လေ့လာဆန်းစစ်မှု၏ ရည်ရွယ်ချက်နှင့် လုပ်ငန်းနယ်ပယ်

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) လေ့လာချက်၏ အဓိက ရည်ရွယ်ချက်မှာ စီမံကိန်းဇရိယာ အတွင်းရှိ ရုပ်ပိုင်းဆိုင်ရာ၊ ဂေဟဗေဒပိုင်းဆိုင်ရာ၊ စီးပွားရေးဖွံ့ဖြိုးမှုပိုင်းဆိုင်ရာ နှင့် လူမှုရေးပိုင်းနှင့် ယဉ်ကျေးမှုပိုင်းဆိုင်ရာ ရင်းမြစ်များအပေါ် ထိခိုက် နိုင်မည့် သက်ရောက်မှုများကို သတ်မှတ် ဖော်ထုတ်နိုင်ရန် ဖြစ်သည်။ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ၏ အသေးစိတ် ရည်ရွယ်ချက်များ၌ ဖော်ပါအချက်များ ပါဝင်ပါသည်။

- အဆိုပြုထားသည့် လုပ်ငန်းစဉ်များ ဖော်ဆောင်မှုမှ စီမံကိန်းဇရိယာ၏ ဇီဝ-ရူပပိုင်းဆိုင်ရာ၊ လူမှု-စီးပွားပိုင်း ဆိုင်ရာ နှင့် ယဉ်ကျေးမှုရင်းမြစ်တို့အပေါ် သက်ရောက်နိုင်သည့် အဓိကအကြောင်းအချက်များကို သတ်မှတ်ဖော်ထုတ်ရန်။
- ဆိုးရွားသည့် ထိခိုက်သက်ရောက်မှုများကို ရှောင်ရှားနိုင်စေမည့်၊ သို့မဟုတ် အနည်းဆုံးဖြစ်စေမည့် ပတ်ဝန်းကျင် စီမံကြီးကြပ်မှု စီမံကိန်းနှင့် ပေါင်းစပ်လျက် သင့်တော်သည့် ကုစားမှုနှင့် စောင့်ကြည့်စစ်ဆေးမှု ဆိုင်ရာ အစီအစဉ်များကို အဆိုပြု တင်ပြရန်။
- ပယင်းဖြူရေလှောင်ကန်စီမံကိန်းအတွက် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ဖြင့် လုံလောက် ပြည့်စုံကြောင်း စိတ်ချသေချာစေရန်။

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ကို တစ်ဆင့်ခံ သတင်းအချက်အလက်များ အပေါ် အခြေခံ လုပ်ဆောင်ထားခြင်း ဖြစ်ပြီး၊ လိုအပ်သည့် နေရာများ၌ ကွင်းဆင်း၍ မြေပြင်အချက်အလက်များကို ထပ်မံကောက်ယူ၍ ဖြည့်ဆည်းထားပါသည်။ ကွင်းဆင်း လေ့လာမှုများအား ရေပြင်ဂေဟဗေဒစနစ်၊ ဓမြေပြင်ဂေဟဗေဒစနစ်နှင့် မြေအသုံးချမှု နေရာများ၌ လုပ်ဆောင်ထားပါသည်။ အဆိုပါ လေ့လာမှုနှင့် တစ်ချိန်တည်းမှာပင် ပြုလုပ်သော လူမှုဗေဒဆိုင်ရာ လေ့လာမှုများနှင့် ပေါင်းစည်း လေ့လာထားပါသည်။ လူမှုအဖွဲ့အစည်း၏ သဘောထားကို သိရှိ၍ ဖြစ်နိုင်သည့် ဖွံ့ဖြိုးရေးလုပ်ငန်းများဖော်ဆောင်နိုင်ရန်အတွက် ကနဦး ပတ်ဝန်းကျင် ဆန်းစစ်မှု (IEE) ၏ အစိတ်အပိုင်းတစ်ရပ်အဖြစ် လူထုနှင့် ကျယ်ပြန့်စွာ တွေ့ဆုံဆွေးနွေးမှုများကိုလည်း ပြုလုပ်ခဲ့ပါသည်။

1.3 ဆီလျော်ကိုက်ညီမှု

ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) နှင့် စပ်ဆိုင်ရာ လုပ်ရှားဆောင်ရွက်မှုများ ဖြစ်သော - ပတ်ဝန်းကျင်နှင့် လူမှုရေးပိုင်းဆိုင်ရာ အချက်အလက် ကောက်ယူခြင်း၊ ထိခိုက်သက်ရောက်မှုအားဇယ်လာဆန်းစစ်ခြင်း၊ ခန့်မှန်းခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်၊ အဆိုပြု ကုစားသက်သာစေခြင်း၊ စီမံကြီးကြပ်မှု ဆိုင်ရာအစီအစဉ် နှင့် လုပ်ငန်းအားအကောင်အထည်ဖော်ဆောင်ခြင်း တို့အား မြန်မာ့ ပတ်ဝန်းကျင် စည်းမျဉ်းဥပဒေတို့နှင့် အညီ ဖြစ်စေရန်အတွက် စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသည့် ပြည်သူများအပါအဝင် ဒေသဆိုင်ရာ အစိုးရဌာနအာဏာပိုင်အဖွဲတို့ ထံမှ အကြံဉာဏ်များ ဆွေးနွေးရယူ ဆောင်ရွက်ခဲ့ပါသည်။

2. စီမံကိန်းဖော်ညွှန်းချက်

2.1 စီမံကိန်းအမျိုးအစား

ဤစီမံကိန်းသည် သဘာဝ ပစ္စည်းများ အားအသုံးပြု တည်ဆောက်ထားသည့် အသေးစား ရေထိန်း ရေလှောင်တာတမံ ဖြစ်သည်။ ရေလှောင်ကန်၏ တာဘောင်ကို 15.50 မီတာ အမြင့်၊ 120.50 မီတာ အရှည်၊ 6 မီတာထုအကျယ်ရှိ ဖိသိပ်မြေသား ကျောက်စရစ် တို့ဖြင့် ဖွဲ့စည်း၍ တည်ဆောက်ထားပြီး၊ ရေသိုလှောင်နိုင်မှု စွမ်းအားမှာ 8.54 သန်း ကုဗမီတာ ဖြစ်သည်။

2.2 စီမံကိန်းအမျိုးအစား

အာရှဖွံ့ဖြိုးရေးဘဏ် (ADB) ၏ ပတ်ဝန်းကျင်ပိုင်းဆိုင်ရာ အမျိုးအစားခွဲခြားမှုအရ ဤစီမံကိန်းကို အမျိုးအစား ခ (B) အဖြစ် သတ်မှတ်သည်။ ဆိုလိုသည်မှာ စီမံကိန်းသည် သဘာဝပတ်ဝန်းကျင်အပေါ် ထိခိုက်သက်ရောက်မှုအနည်းငယ် ဖြစ်စေနိုင်သော်လည်း၊ ထိခိုက်သက်ရောက်နိုင်သည့် အတိုင်းအတာမှာ ဘောင်အကန့်အသတ်တစ်ခုအတွင်းသာ ရှိသည်ဟု အကဲဖြတ်ထားသည်။ သို့ဖြစ်သောကြောင့်၊ ဤ လုပ်ငန်းစီမံကိန်းအမျိုးအစားအတွက် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ပြုလုပ်သွားရန် လိုအပ်ခြင်း ဖြစ်ပါသည်။

2.3 စီမံကိန်းလိုအပ်ချက်

စီမံကိန်း၏ အဓိက ရည်မှန်းချက်ပန်းတိုင်မှာ အစောပိုင်းအဆင့် စက်မှုလုပ်ငန်း တည်ဆောက်ရေး၊ စက်မှုလုပ်ငန်းနှင့် မြို့နယ်သုံးအတွက် စက်မှုရေပေးဝေရေးကို ထောက်ပံ့ပေးနိုင်ရန် ဖြစ်သည်။

2.4 စီမံကိန်းတည်နေရာ

စီမံကိန်းသည် တောင် 2 လုံး ကြားမှနေ၍ အနောက်မှ အရှေ့သို့ ဖြတ်သန်းစီးဆင်းသော ချောင်းငယ်တစ်ခုရှိသည့် ထားဝယ်အထူးစီးပွားရေးဇုန် (DSEZ) အတွင်းရှိ ထားဝယ်မြစ်၏ ညာဖက်ကမ်းပါး ပေါ်၌ တည်ရှိပါသည်။ ဆည်ရေလှောင်ကန် လုပ်ငန်းတည်နေရာသည် မြောက်လတ္တီကျူ 14° 19′ 49.18″ နှင့် အရှေ့လောင်ဂျီကျူ 98° 10′ 16.11″ ၌ တည်ရှိပြီး၊ ဆည်၏ မိုးရေခံရပ်ဝန်းဧရိယာမှာ 7.14 စတုရန်းကီလိုမီတာ ဖြစ်ပါသည်။

2.5 စီမံကိန်းဖော်ဆောင်ရန် အဆိုပြုအချိန်ကာလ

လုပ်ငန်းတည်နေရာကို ရွေးစမ်းလေ့လာမှုနှင့် လုပ်ငန်းတည်နေရာပြင်ဆင်မှုကို 2012 ခုနှစ် ဇန်နဝါရီလတွင် စတင်ခဲ့ပါသည်။ ဆောက်လုပ်ရေး အကြို လုပ်ငန်းများအား 2013 ခုနှစ် ဖေဖော်ဝါရီလ၌ စတင်ခဲ့ပြီး၊ 2016 ခုနှစ် မေလတွင် စီမံကိန်းကို အပြီးသတ်ခဲ့ပါသည်။ ပထမဦးဆုံး ရေထိန်း သိုလှောင်မှုကို 2014 ခုနှစ် မေလတွင် စတင်ခဲ့သည်။ စီမံကိန်း၏ ပထမလုပ်ငန်းအဆင့် ပြီးဆုံးချိန်တွင် ရေလှောင်တမံမှနေ၍ ရေများကို ရေပြုပြင်ရေးစက်ရုံသို့ ပေးပို့နိုင်ခဲ့ပါသည်။

2.6 စီမံကိန်း အားရှင်းလင်းဖော်ပြရန်

စီမံကိန်း၌ အောက်ပါ တည်ဆောက်မှုဆိုင်ရာ အစိတ်အပိုင်းများ ပါဝင်သည်။ **(ဇယား 2.6-1)**

(ဇယား 2.6-1) ပယင်းပြူရေကန်စီမံကိန်း အင်္ဂါရုပ်များ

စာရင်း	ယူနစ်	အသေးစိတ်
1. တာတမံအင်္ဂါရုပ်		
- အမျိုးအစား		ဖိသိပ်မြေသားကျောက်စရစ်
- တာထိပ်အမြင့်	မီတာ (ပျမ်းမျှပင်လယ်ရေမျက်နှာပြင်အထက်)	+23.50
- လက်ခံနိုင်သည့် အမြင့်ဆုံးရေမှတ်	မီတာ (ပျမ်းမျှပင်လယ်ရေမျက်နှာပြင်အထက်)	+22.80
- ပုံမှန် အမြင့်ဆုံးရေမှတ်	မီတာ (ပျမ်းမျှပင်လယ်ရေမျက်နှာပြင်အထက်)	+22.00
- ဆည်ကြမ်းပြင်အမြင့်	မီတာ (ပျမ်းမျှပင်လယ်ရေမျက်နှာပြင်အထက်)	+6.00
- အမြင့်ဆုံးတာဘောင်ထိပ်	မီတာ	17.50
- တာဘောင်ထိပ်အလျား	မီတာ	120.50
- တာဘောင်ထိပ်အကျယ်	မီတာ	6.0
- တာဘောင်ထိပ်အမြင့်	မီတာ	15.50
- တာအတွင်းဖက်မျက်နှာပြင်အစောင်းဒီဂရီ	-	1 အချိုး 2.5
- တာအပြင်ဖက်မျက်နှာပြင်အစောင်းဒီဂရီ	-	1 အချိုး 2.0
2. ရေထိန်းကန်		
- အမြင့်ဆုံး သိုလှောင်နိုင်မှု	ကုဗမီတာသန်း	8.54
- (ထိန်းချုပ်နိုင်သည့်) ရေရှင် သိုလှောင်နိုင်မှု	ကုဗမီတာသန်း	8.23
- (လက်ကျန်) ရေသေ သိုလှောင်နိုင်မှု	ကုဗမီတာသန်း	0.31
3. ရေလွှဲပေါက်		
- တည်နေရာ	-	ညာဖက်တာရိုးစွန်းအနားရှိ ရေထိန်းကန်ဝယ်
- အမျိုးအစား	-	လွပ်လပ်စွာစီးထွက်စေသည့်ရေလွှဲပေါက်
- အတိုင်းအတာ (အကျယ် x အမြင့်)	-	25.00 x 2.00
- ရေလွှဲပေါက်အောက်ကြမ်းပြင်အမြင့်	မီတာ (ပျမ်းမျှပင်လယ်ရေမျက်နှာပြင်အထက်)	+ 22.00
- သတ်မှတ် ရေလွှဲထုတ်နိုင်မှုစွမ်းအား (Tr 1,000)	ကုဗမီတာ/စက္ကန့်	104
- ရေလွှဲလမ်းအောက်ခြေအကျယ်	မီတာ	25.00
- စွမ်းအင်ဖြေလျှော့မှုအမျိုးအစား	-	လေကားထစ်ရေလွှဲလမ်း
4. ရေစုပ် ပန့် ဝ စတေရှင့်		
- တည်နေရာ	-	1. WTP မြောက်ဖက်ရှိ ကန်တွင်း
	-	2. WTP အရှေ့ဖက်ရှိ ရေဝင်မြောင်း
- အမျိုးအစား	-	ရေဖေါ်ဖောင်အမျိုးအစား
- ရေတွန်းပို့/စုပ်ယူနိုင်မှုစွမ်းအား	ကုဗမီတာ/ရက်	36,000
- စုပ်ယူ/တွန်းတင်နိုင်သည့်အမြင့်	မီတာ	18.00
5. ရေပြန်ပြင်မှု		
- တည်နေရာ	-	ရေလွှဲပေါက်တောင်ဖက်ရှိ တောင်ကုန်းထိပ်
- အမျိုးအစား	-	ပုံမှန်သမားရိုးကျနည်းလမ်း
- စွမ်းအား	ကုဗမီတာ/ရက်	36,000

2.7 စီမံကိန်းတည်နေရာအတွက် အခြားရွေးချယ်ရန်များ

ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်၊ စိုက်ပျိုးရေးနှင့် ဆည်မြောင်းဝန်ကြီးဌာနမှ ထုတ်ပြန်သည့် ပြည်ထောင်စုမြန်မာနိုင်ငံ စာအမှတ် 4/220 (က) (5) (8) (1171/2013) ပါ ထားဝယ်အထူးစီးပွားရေးဇုန်(DSEZ)၏ စက်မှုလုပ်ငန်း၊ လူနေရပ်ကွက်နှင့် စက်မှုဇုန်များ ထံသို့ ရေရေးပို့ထောက်ပံ့နိုင်ရန်အတွက် ထားဝယ်အထူးစီးပွားရေးဇုန်(DSEZ) နယ်မြေအတွင်း နှင့် အနီးအနား ပတ်ဝန်းကျင်ရှိ ရေအရင်းအမြစ်အား စူးစမ်းရှာဖွေသည့် ရလဒ်ကို အစီရင်ခံတင်ပြရန် တောင်းဆိုချက်အရ ရေအရင်းအမြစ်ကို လေ့လာ စူးစမ်းမှုများ ပြုခဲ့ပါသည်။

တနင်္သာရီတိုင်း၊ ထားဝယ်ခရိုင်ရှိ ဆည်မြောင်းဌာန၏ လက်ထောက် ညွှန်ကြားရေးမှူးမှ ပြုစုခဲ့သော စူးစမ်းလေ့လာ တွေ့ရှိချက် အစီရင်ခံစာတွင် အခြားဖွေးချယ်နိုင်သည့် စီမံကိန်းနေရာအဖြစ် ရေဖြူခရိုင်တွင် 4 နေရာနှင့် ထားဝယ်ခရိုင်တွင် 3 နေရာကို တင်ပြခဲ့ပါသည်။

အီတာလျံ-ထိုင်းဖွံ့ဖြိုးရေးအများပိုင်ကုမ္ပဏီ (ITD) မှ ဟိန်းဇဲရေလှောင်တမံ၊ ကရောမရေလှောင်တမံ၊ ရလိုင်းရေလှောင်တမံ၊ ကလုတ်ထာရေလှောင်တမံ၊ ဇကနီရေလှောင်တမံ၊ ပယင်းဖြူရေလှောင်တမံ၊ ဒွေးတောနှင့်အိမ်ရှည် ရေလှောင်တမံ၊ အရှေ့နှင့် အနောက် ဝက်ချောင်းရေလှောင်တမံ စသဖြင့် ရေဖြူမြို့နယ်တွင်းနှင့် စပ်ဆိုင်ရာ ထားဝယ်အထူးစီးပွားရေးဇုန်(DSEZ) ဝန်းကျင်ရှိ ဖြစ်နိုင်သည့် စီမံကိန်းနေရာများ အားလုံးကို စူးစမ်းရှာဖွေ ဖော်လာခဲ့ပါသည်။ ထို့အပြင်၊ ဆည်မြောင်းဌာနမှ အဆိုပြုထားသော အခြားဖွေးချယ်နိုင်သည့် စီမံကိန်း 4 နေရာကိုလည်း ကုမ္ပဏီဖက်မှ ထည့်သွင်းစဉ်းစား လေ့လာခဲ့ပါသည်။

လေ့လာတွေ့ရှိချက်များအရ ထားဝယ်အထူးစီးပွားရေးဇုန်(DSEZ) ရေဖြန့် ဖြူးပေးဝေမှုအတွက် ဆည်မြောင်းဌာနမှ အဆိုပြုထားသော အခြားဖွေးချယ်နိုင်သည့် စီမံကိန်း 4 နေရာမှာ စီမံကိန်းအတွက် ဖြစ်နိုင်ဖွယ် သင့်တော်သည့် နေရာမဟုတ်ပါ။ ၎င်းနေရာများတွင် လစဉ် ရေပြတ်တောက်မှုကို နိဝင်ဘာလမှ မေလအထိ ကာလတစ်လျှောက်လုံး မကြာခဏ ကြုံတွေ့ရလေ့ ရှိပြီး၊ ရေထိန်း သိုလှောင် နိုင်မှု မရှိသကဲ့သို့ ၊ ဒေသတွင်း စီးဝင်သည့် ရေပမာဏမှာလည်း နည်းပါးပါသည်။ ထို့အပြင်၊ အဆိုပြုထားသည့် ရေလှောင် တမံ 4 နေရာ အတွက် တည်ဆောက်မှုလုပ်ငန်းများ လုပ်ရာ၌ EIE ရောင်းချနိုင်မှုဇရိယာကို ကျယ်ပြန့်စွာ ဆုံးရှုံးမှုများ ဖြစ်ပေါ် စေနိုင်၍၊ မိုးရေနတ်မြောင်းဒီဇိုင်း ပုံစံထုတ်ခြင်းနှင့် EIE အဆင့် လုပ်ငန်းစီမံချက်များကိုပါ ထိခိုက်ခြင်းများ ရှိနိုင်ပါသည်။

အထက်ပါ အကြောင်းအချက်များအရ ပယင်းဖြူ ရေလှောင်တမံ စီမံကိန်းနေရာသည် စူးစမ်းလေ့လာမှု ပြုခဲ့သော အခြား ဖွေးချယ်ရန် စီမံကိန်းနေရာများထက်ပိုမို၍ ရေထောက်ပံ့မှု ပြုပေးနိုင်သည့် ဖြစ်နိုင်ဖွယ် သင့်တော်သည့်နေရာ ဖြစ်ကြောင်း စီစစ် သုံးသပ်ပါသည်။

3. ပတ်ဝန်းကျင်နှင့် ဆိုင်သည့် ရှင်းလင်းဖော်ပြချက်

3.1 ရုပ်ပိုင်းဆိုင်ရာရင်းမြစ်

ထားဝယ်ခရိုင်သည် မုတ်သုန်အပူပိုင်းရာသီဥတု ရှိပြီး၊ စက်တင်ဘာလမှ ဇူလိုင်အကြားတွင် ခြောက်သွေ့ရာသီနှင့် မေလလယ်မှ အောက်တိုဘာလအကြား မိုးရာသီ ဟူ၍ ထင်ရှားသည့် ဥတုရာသီကာလ နှစ်မျိုး ရှိပါသည်။ ဇူလိုင်လနှင့် သြဂုတ်လ နှစ်လပေါင်း မိုးရေရိုန်သည် ထိုဒေသ၏ တစ်နှစ်ပတ်လုံး ရွာသွန်းမိုးရေရိုန်၏ 50% အထက်တွင် ရှိကြောင်း ယေဘုယျအားဖြင့် တွေ့ရှိရပါသည်။

ထားဝယ်မိုးလေဝသစခန်းမှ ကောက်ယူရရှိခဲ့သော လွန်ခဲ့သော နှစ် 20 အတွင်း (1989-2010) မှတ်တမ်းများအရ နှစ်စဉ် ရွာသွန်းမြဲမိုးရေရိုန်မှာ 5,459 မီလီမီတာ ဖြစ်ပြီး၊ ပျမ်းမျှ အနိမ့်ဆုံးအပူရိန်မှာ ဇန်နဝါရီလအတွင်း 14˚C နှင့် ပျမ်းမျှ အမြင့်ဆုံး အပူရိန်မှာ ဧပြီလအတွင်း 37˚C ဖြစ်ပါသည်။

ထားဝယ်၌ တိုက်ခတ်မြဲလေမှာ အနောက်တောင်မုတ်သုံလေနှင့် အရှေ့မြောက်မုတ်သုံလေတို့ဖြစ်၍ လေတိုက်နှုန်းမှာ ရေမိုင် 20 နှင့် ရေမိုင် 14 အသီးသီး ရှိပါသည်။

အဆိုပြု စီမံကိန်းနေရာရှိ ရေအရည်အသွေးမှာ ကြည်လင်မှု ရှိ၍၊ ပယင်းဖြူ ရေလှောင်ကန်စီမံကိန်း၏ ဒေသဘူမိဗေဒ ဆိုင်ရာ အနေအထားကို ကျောက်ချပ်လွှာ၊ နန်းကျောက်လွှာ၊ အနည်ကျကျောက်၊ ကွာတာနာရီအနယ်လွှာ၊ မြေငြုတ်အန္တရာယ်ရှိဇုန် ဟူ၍ ထပ်ပြီး ပိုင်းခြားနိုင်ပါသည်။ စီမံကိန်းတည်နေရာသည် အတော်အသင့် မဆိုးရွားသော ဇုန် II အတွင်း၌ တည်ရှိပါသည်။

3.2 ဂေဟဗေဒဆိုင်ရာရင်းမြစ်

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အရ စီမံကိန်းဇရိယာ အတွင်းရှိ ရေပြင်နှင့် မြေပြင် ဇီဝပိုင်းဆိုင်ရာသည် လူသားတို့၏ လုပ်ရပ်များကြောင့် ပြင်းထန်စွာ ဖျက်ဆီးခြင်းခံနေရပြီး၊ ဇီဝမျိုးကွဲစုံလင်များပြားမှု ထိခိုက် ယိုယွင်းသည့်နေရာအဖြစ်သို့ ရောက်ရှိ နေပါသည်။ ပယင်းဖြူစီမံကိန်းဇရိယာအတွင်း ကြီးစိုးနေသော ငါးမျိုးစိတ်မှာ ငါးရောင်နှင့် ငါးရောင်ထောပတ်တို့ ဖြစ်သည်။ စပါးအုံးနှင့် မြွေဟောက်တို့ကို စီမံကိန်းဇရိယာအတွင်း ပင်မမြွေမျိုးစိတ်အဖြစ် တွေ့ရှိရပြီး၊ ၎င်းတို့သည် စီမံကိန်းဇရိယာတွင်းရှိ အဓိက

တောရိုင်းတိရိစ္ဆာန်များလည်း ဖြစ်သည်။ စီမံကိန်းဒေသသည် ဇီဝမျိုးကွဲများ ကြွယ်ဝသည့် / ကာကွယ်မှု ပြုထားသည့်ဒေသ သို့မဟုတ် ကြားခံဇုန်ဧရိယာအတွင်း တည်ရှိနေခြင်းမရှိပါ။

3.3 စီးပွားရေးဖွံ့ဖြိုးမှုပိုင်းဆိုင်ရာ

အဆိုပြု စီမံကိန်း ဖော်ဆောင်မည့် ဒေသရှိ လူအများစုမှာ အစိုးရမှ ပေးဝေဖြန့် ဖြူးသည့် လျှပ်စစ်ကို အကန့်အသတ်နှင့်သာ ရရှိနိုင်သဖြင့်၊ ချက်ပြုတ်မှုအတွက် ထင်းနှင့် အလင်းရောင် ရရှိရန်အတွက် မီးစက်ကို အားကိုးနေရပါသည်။ ဒေသတွင်း ရေသုံးစွဲမှုအတွက် ချောင်းရေနှင့် မြေအောက်ရေကို အဓိကထား၍ သုံးစွဲနေကြရပြီး၊ လမ်းပန်းဆက်သွယ်ရေးပိုင်း၌လည်း ချို့တဲ့ အားနည်းပါသည်။

ဒေသတွင်း မြေသုံးစွဲမှု ပုံစံမှာမူ ကိုင်းမြေ၊ အစိုးရဆီအုန်းခြံမြေ၊ စိုက်ပျိုးရေးမြေ နှင့် သစ်တောမြေ အဖြစ် အမျိုးအစား ခွဲခြားနိုင်ပါသည်။

3.4 လူမှုအဖွဲ့အစည်းနှင့် ယဉ်ကျေးမှုပိုင်းဆိုင်ရာရင်းမြစ်

ထိခိုက်သက်ရောက်ခံ လူမှုအဖွဲ့အစည်းအတွင်း မည်သည့် ကျန်းမာရေးစောင့်ရှောက်ဝန်ဆောင်မှုမှ မရှိပါ။ စီမံကိန်း ဧရိယာ အတွင်း၌ မူလတန်းကျောင်း တစ်ကျောင်းသာ ရှိပါသည်။ ဆက်သွယ်ရေးပိုင်း၌မူ လူအများစု၌ စီဒီအမ်အေ(CDMA) ဖုန်း ရှိကြပါသည်။

စီမံကိန်း၏ ချောင်းအထက်ပိုင်းနှင့် အောက်ပိုင်းဧရိယာများအတွင်း ပင်မ ဒေသခံနှစ်အုပ်စု အခြေချနေထိုင်ကြပါသည်။ ယေဘုယျအားဖြင့် ဒေသခံတို့၏ အဓိကအသက်မွေးဝမ်းကျောင်းမှာ စိုက်ပျိုးရေးလုပ်ငန်း ဖြစ်၍၊ ဥယျာဉ်ခြံမြေလုပ်ငန်းအား လုပ်ကိုင်ခြင်းမရှိသည့် လုပ်သားများမှာ စီးပွားရေးအတွက် ဒုတိယ အရေးကြီးသည့် အုပ်စု ဖြစ်ပါသည်။ ထို့အပြင်၊ ဒေသခံများသည် အိမ်နီးချင်းနိုင်ငံများ၌ လုပ်သားအဖြစ် သွားရောက်လုပ်ကိုင်၍ အသက်မွေးမှုလည်း ပြုကြပါသည်။ ပြည်ပသို့ သွားရောက်အလုပ်လုပ်ရာမှ ရရှိသည့် ဝင်ငွေသည် ဒေသခံတို့၏ သက်ရှင်ဇနထိုင်မှုအတွက် အရေးပါသည့် ဝင်ငွေရလမ်း ဖြစ်ပါသည်။

4. ဖြစ်လာနိုင်သည့် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်သက်ရောက်မှု၊ မြို့ပေါင်းစည်း၍ သက်ရောက်မှု၊ ဖြစ်ပေါ်လာနိုင်သည့် အန္တရာယ်ကို သုံးသပ်ခြင်းနှင့် ထိခိုက်သက်ရောက်မှုများမှ လျော့ပါးသက်သာစေမည့် စီမံချက်များ

4.1 ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်သက်ရောက်မှု

4.1.1 သက်ရောက်မှုအကျိုးကျေးဇူး

ရေလောင်တမံစီမံကိန်းမှ ချက်ချင်း မြင်တွေ့နိုင်မည့် သက်ရောက်မှု အကျိုးကျေးဇူးမှာ ဒေသခံများအတွက် အလုပ်အကိုင်အခွင့်အလမ်းများ နှင့်အတူ ဆောက်လုပ်ရေးလုပ်ငန်း၌ ခန့်ထားလုပ်ကိုင်စေခြင်းကြောင့် လုပ်ငန်း ကျွမ်းကျင်ခြင်း၊ ဒေသခံ လုပ်သားများအတွက် နည်းပညာဗဟုသုတများတိုး၍ မိမိ၏ စွမ်းရည်ကို မြှင့်တင်စေနိုင်မည့် အခွင့်အလမ်းများ အပြင်၊ ဆောက်လုပ်ရေးနှင့် စပ်ဆိုင်သည့် လုပ်ငန်းသုံး ကိရိယာ ပစ္စည်းများအား ရောင်းဝယ်ခြင်း၊ ဝန်ဆောင်မှုများပေးခြင်း များမှလည်း စီးပွားရေးအခွင့်အလမ်းများ တိုးမြှင့် ခံစားရရှိနိုင်ပါမည်။

တည်ဆောက်ရေးလုပ်ငန်းပြီးစီး၍ လုပ်ငန်းလည်ပတ်နေသည့် အဆင့်၌ ပိုမိုကောင်းမွန်သည့် လမ်းတံတားဖြင့် ဆက်သွယ်သွားလာနိုင်ခြင်းကြောင့် မိုးကာလ ရေကြီးရေလျှံမှုကို တားဆီးထိန်းချုပ်နိုင်ခြင်းနှင့်အတူ ခရီးသွားလည်ပတ် အပန်းဖြေခြင်းများကိုပါ ပြုနိုင်ပါမည်။

4.1.2 ထိခိုက်သက်ရောက်မှု ဆိုးကျိုး

တည်ဆောက်ရေးလုပ်ငန်း လုပ်ကိုင်နေသည့် ကာလအတွင်း ရုပ်ပိုင်းဆိုင်ရာ ထိခိုက်သက်ရောက်မှု ဆိုးကျိုးများအဖြစ် ဒေသ၏ မြေမျက်နှာသွင်ပြင်နှင့် မြေအသုံးချမှု ပြောင်းလဲသွားခြင်း၊ ဖုန်နှင့် လေ၊ ရေ များ ညစ်ညမ်းနိုင်ပါသည်။ ထို့အတူပင်၊ တည်ဆောက်ရေးကာလအတွင်း ဂဟဗေဒဆိုင်ရာ သက်ရောက်မှုများအဖြစ် မြေပြင်ရင်းမြစ်များ၊ ဥပမာ သစ်ပင်ဝယ်နှင့် တိရိစ္ဆာန်များ ယိုယွင်းပျက်စီးနိုင်ပါသည်။ တည်ဆောက်ရေးကာလ အတွင်း

လူမှုရေးပိုင်းနှင့် ယဉ်ကျေးမှုပိုင်းဆိုင်ရာ ရင်းမြစ်များအား သက်ရောက်မှုများအဖြစ် 252 ဧကအကျယ် ပကောဖွန်းဆီအုန်းခြံ နှင့် ဧက 500 အကျယ်ရှိ စိုက်ပျိုးမြေနေရာများကို ဆုံးရှုံးသွားပါမည်။ တည်ဆောက်ရေး ကာလအတွင်းတွင် ကျန်းမာရေးနှင့် ဘေးကင်း လုံခြုံရေးဆိုင်ရာ အနှောင့်အယှက် အပါအဝင် တစ်ချို့သော ပုဂ္ဂိုလကပိုင်းဆိုင်ရာ ဖြစ်တည် ပိုင်ဆိုင်မှုများကို ထိခိုက်သက်ရောက်မှု ဖြစ်စေနိုင်ပါသည်။

လုပ်ငန်းလည်ပတ်နေစဉ် ကာလအတွင်း ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်ထိခိုက်မှုများကို အနည်းဆုံး ဖြစ်စေရန် အတွက် စီမံချက်အချို့ကို ထည့်သွင်း စဉ်းစားထားပါသည်။ သို့စေကာမူ စီမံကိန်း ထိခိုက်သက်ရောက်နိုင်မှု၏ ပြင်းထန်မှုပမာဏပေါ် အခြေခံ၍သာ ဖြစ်ပေါ်လာနိုင်သည့် အန္တရာယ်ကို လေ့လာသုံးသပ် ထားရခြင်း ဖြစ်၍၊ ပေါင်းစည်းသက်ရောက်မှု အကျိုးနှင့် စပ်လျဉ်း၍မူ ပယင်းဖြူစီမံကိန်း ကိုယ်တိုင်နှင့် ထားဝယ် အထူးစီးပွားရေးဇုန် (DESZ) ဖွံ့ဖြိုးဖော်ဆောင်မှုများနှင့် ဆက်နွယ်လျက် စဉ်းစား သုံးသပ်သွားရပါမည်။

4.2 ထိခိုက်သက်ရောက်မှုများမှ လျော့ပါးသက်သာစေနိုင်မည့် စီမံချက်များ

အဆိုပြုစီမံကိန်း၏ သက်ရောက်မှုများမှ အကျိုးကျေးဇူးများ ရှိနိုင်သလို ဆိုးကျိုး ဖြစ်စေနိုင်သည်လည်း ရှိသည်။ သက်ရောက်မှု အကျိုးကျေးဇူးကို အမြင့်ဆုံး ရရှိစေနိုင်၍ ထိခိုက်မှုများမှ လျော့ပါး သက်သာစေမည့် စီမံချက်ကို ထိရောက်စွာ ချမှတ် လုပ်ဆောင်သွားခြင်းဖြင့် စီမံကိန်း၏ အကျိုးကျေးဇူးများကို အကောင်းဆုံး ရရှိနိုင်မည်ဖြစ်ကာ၊ ဆိုးကျိုးများကို ရှောင်ရှား/အနည်းဆုံး ဖြစ်စေနိုင်ရန် ချိန်ညှိ လုပ်ဆောင်သွားပါမည်။ ထိခိုက်သက်ရောက်မှုအား လေ့လာဆန်းစစ်ခြင်းနှင့် ဖော်ထုတ်သတ်မှတ်ချက်များ အပေါ် အခြေပြုလျက် အမြင့်ဆုံးအကျိုးကျေးဇူး ရရှိစေ၍ ဆိုးကျိုးလျော့ပါးသက်သာစေမည့် စီမံချက်များကို စီမံကိန်း၏ ဆောက်လုပ်ရေး အကြို၊ ဆောက်လုပ်ရေးကာလနှင့် တည်ဆောက်မှု ပြီးစီး၍ လုပ်ငန်း လည်ပတ်နေသည့်အဆင့်များ၌ ပတ်ဝန်းကျင် စီမံကြီးကြပ်မှု အစီအမံ (EMP) ထဲသို့ အသေးစိတ် ထည့်သွင်း ရေးဆွဲသွားပါမည်။

အကြံပြု ထည့်သွင်းရေးဆွဲထားသည့် တည်ဆောက်ရေးကာလအတွင်း ဆိုးကျိုးလျော့ပါးသက်သာစေမည့် စီမံချက်များမှာ ဆောက်လုပ်ရေးအလေ့အထကောင်းနှင့် စပ်ဆိုင်ပါသည်။ ထည့်သွင်းရေးဆွဲထားသည်များမှာ 1) လေထု အရည်အသွေး 2) အသံဆူညံမှု ထိန်းချုပ်ရေး 3) ရေထုအရည်အသွေး 4) သစ်တောနှင့် တောရိုင်းတိရိစ္ဆာန်များ 5) မြေရယူ အသုံးချမှုပုံစံ စသည်တို့ ဖြစ်သည်။ လုပ်ငန်းလည်ပတ်နေသည့် အဆင့်အတွက် ထိခိုက်သက်ရောက်မှုအား လျော့နည်းသက်သာစေမည့် စီမံချက်များမှာ ခရီးသွားလာလည်ပတ်မှုနှင့် အပန်းဖြေနားနေမှု ဆိုင်ရာတို့၌ ဖြစ်သည်။

ပတ်ဝန်းကျင် စီမံကြီးကြပ်မှု စီမံချက် (EMP) ၌ ဖော်ပြထားသည့် ထိခိုက်သက်ရောက်မှုအား လျော့နည်းသက်သာစေမည့် စီမံချက်းကို စီမံကိန်းသက်တမ်း ကာလ တစ်လျှောက်လုံး၌ ကျင့်သုံးဖော်ဆောင်နိုင်စေရန် စီမံကိန်း အဆိုပြုသူမှ အသေအချာ စီစဉ်လုပ်ဆောင်သွားပါမည်။

4.3 စောင့်ကြည့်စစ်ဆေးခြင်းဆိုင်ရာ အစီအစဉ်

စီမံကိန်း အဆိုပြုသူ၏ ပင်မ အခန်းကဏ္ဍနှင့် တာဝန်ခံမှုများမှာ ပတ်ဝန်းကျင်နှင့် လူမှုပိုင်းဆိုင်ရာ ထိခိုက်သက်ရောက်မှုကို စောင့်ကြည့်စစ်ဆေးပြီး လုပ်ငန်းများကို အကောင်အထည်ဖော်ဆောင်သွားခြင်း ဖြစ်ပါသည်။ ပတ်ဝန်းကျင်စောင့်ကြည့်စစ်ဆေးခြင်း အတွက် ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝပိုင်းဆိုင်ရာ၊ လူမှုပိုင်းဆိုင်ရာ၊ ပတ်ဝန်းကျင် စီမံကြီးကြပ်မှုများ၏ အရေးပါသည့် ကဏ္ဍများကို စွမ်းဆောင်ရည်ပြအညွှန်းကိန်း အဖြစ် သတ်မှတ်၍ လုပ်ဆောင်သွားဖေပါမည်။ စွမ်းဆောင်ရည်ပြအညွှန်းကိန်း တစ်ရပ်စီအတွက် ပြည့်စုံသည့် စောင့်ကြည့်စစ်ဆေးခြင်း စီမံချက်ကို စီမံကိန်းအဆင့်အားလုံးအတွက် ရေးဆွဲ အစီအစဉ် ချမှတ်သွားမည် ဖြစ်ပါသည်။ ၎င်းတွင် တိုင်းတာစစ်ဆေးရမည့် ကိန်းရှင်၊ အသုံးပြုရမည့် နည်းလမ်း၊ အချက်အလက် နမူနာ ကောက်ယူရမည့် နေရာ၊ တိုင်းတာမှု ကြိမ်နှုန်း အစိတ်အကဲ့၊ စစ်ဆေးတိုင်းတာမှု အကန့်အသတ်၊ ကြီးကြပ်လမ်းညွှန်မှုနှင့် ဖော်ဆောင်မှုဆိုင်ရာ စရိတ်နှင့် တာဝန် ဝတ္တရားများ ပါဝင်ပါမည်။

5. ပတ်ဝန်းကျင် စီမံကြီးကြပ်မှု စီမံချက်များ

ပတ်ဝန်းကျင်စီမံကြီးကြပ်မှုစီမံချက်သည် အမြင့်ဆုံးအကျိုးကျေးဇူးကို ရရှိစေ၍၊ ဆိုးကျိုးကို အနည်းဆုံး ဖြစ်စေမည့် ထိခိုက်သက်ရောက်မှုအား လျော့နည်းစေမည့် စီမံချက်များကို ဖော်ဆောင်စောင့်ကြည့်စစ်ဆေးရာ၌ အရေးပါသည့် ကဏ္ဍတစ်ရပ် ဖြစ်သည်။ အလားတူပင်၊ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုခြင်းသည် ထိခိုက်သက်ရောက်မှုအားလျော့နည်း သက်သာစေမည့် စီမံချက် ၏ အရည်အသွေးကို မြင့်တင်ပေး၍၊ အကျိုးရှိသည့် သတင်းအချက်အလက်များကိုပါ ရရှိစေပါသည်။ စီမံကိန်း အဆိုပြုသူ မှနေ၍ ဆောက်လုပ်ရေး အကြို၊ ဆောက်လုပ်ရေးကာလနှင့် လုပ်ငန်းလည်ပတ်မှုကာလတစ်လျှောက်

ပတ်ဝန်းကျင် ပိုင်းဆိုင်ရာ တိုးတက်ဖြစ်ထွန်းမှုနှင့် မလိုလားအပ်သည့် ပတ်ဝန်းကျင် ပြောင်းလဲမှုများအား လျော့နည်းသက်သာစေမည့် စောင့်ကြပ်ကြည့်ရှုမှု ဆိုင်ရာကဏ္ဍ၏ အဂိုရပ်များကို ဖွံ့ဖြိုးဖော်ဆောင် ချမှတ်လျက်၊ မိမိ၏ တာဝန်ခံမှုများကို ထပ်ဆင့် ပြဿသွား ပါမည်။

ပတ်ဝန်းကျင်စီမံကြီးကြပ်မှုဆိုင်ရာ အလုပ်ယူနစ်သည် ထိခိုက်မှုအား လျော့နည်းသက်သာစေခြင်းနှင့် စောင့်ကြပ်ကြည့်ရှုခြင်း အစီအမံများကို တာဝန်ခံလျက် ဖော်ဆောင်သွားပါမည်။ ပတ်ဝန်းကျင်စီမံကြီးကြပ်မှုစီမံချက် (EMP) တစ်ရပ်လုံးကို အပြည့်အဝ ဖော်ဆောင်မှုမှာ စီမံကိန်း အဆိုပြုသူ၏ တာဝန်ဝတ္တရား ဖြစ်ပါသည်။ ထိခိုက်မှုအား လျော့နည်းသက်သာစေမည့် စီမံချက် အများစုမှာ စီမံကိန်းမှဒေန၍ ဖြစ်တည်လာမည့် အန္တရာယ် အနှောင့်အယှက်များကို အနည်းဆုံး ဖြစ်စေမည့် သင့်လျော်သော စံချိန်စီမံနည်းလမ်းများ ဖြစ်သည်။ အဆိုပါ စီမံချက်များ ဖော်ဆောင်မှုကို ပံ့မှန်အားဖြင့် လုပ်ငန်းတည်နေရာသို့ ကွင်းဆင်းလေ့လာ ကြည့်ရှုခြင်းဖြင့် စောင့်ကြည့်စစ်ဆေးလေ့ရှိပြီး၊ အချို့သော ကိစ္စများ၌မှ မှတ်တမ်းများကို စစ်ဆေးခြင်းနှင့် အခြားကိစ္စရပ်များပါ ပါဝင်နိုင်ပါသည်။

6. ပတ်ဝန်းကျင်ဆိုင်ရာ ဥပဒေသတ်မှတ်ချက်များ

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ကို အောက်ပါ ပတ်ဝန်းကျင်ဆိုင်ရာ ဥပဒေ များနှင့်အညီ လုပ်ဆောင်ထား ပါသည်။

- ပတ်ဝန်းကျင်စောင့်ရှောက်ရေးစည်းမျဉ်းဥပဒေ 2014
- ပတ်ဝန်းကျင်ထိခိုက်သက်ရောက်မှု ရှုးစမ်းလေ့လာမှုလုပ်ငန်းစဉ် 2015
- ရေးဟောင်းအမွေအနှစ် စောင့်ရှောက်ထိန်းသိမ်း၊ ကာကွယ်ရေး 2015
- ရေးဟောင်းအဆောက်အဦး ကာကွယ်မှုဥပဒေ 2015
- ပတ်ဝန်းကျင်ကာကွယ်မှုအက်ဥပဒေ 1997
- ပတ်ဝန်းကျင်ကာကွယ်မှုစည်းမျဉ်း 1997 (ဇနာဂ်ဆက်တွဲ ထပ်တိုး)
- အမျိုးသား ပတ်ဝန်းကျင်ထိခိုက်သက်ရောက်မှုဆန်းစစ်မှု (EIA) ဆိုင်ရာ လမ်းညွှန်ချက် 1993
- အာရှဖွံ့ဖြိုးရေးဘဏ်၏ လမ်းညွှန်ချက်

ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ကို ဒေသခံအစိုးရအာဏာပိုင်များနှင့် ပြည်သူများနှင့် ကွင်းဆင်း ဆွေးနွေး တွေ့ရှိချက်များအရ မြန်မာနိုင်ငံတော် အစိုးရ၏ တရားဝင် ဥပဒေ လိုအပ်ချက်တို့နှင့် အညီ ပြုစုထားခြင်း ဖြစ်ပါသည်။

စီမံကိန်းကို ဖွံ့ဖြိုးဖော်ဆောင်သူ အနေနှင့် စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်နေချိန် တစ်လျှောက်လုံး၌ သက်ဆိုင်ရာ မူဝါဒ၊ အက်ဥပဒေ၊ စည်းမျဉ်း/သတ်မှတ်ချက်၊ လမ်းညွှန်ချက်နှင့် သဘောတူညီချက် များနှင့်အညီ ပြည့်မီအောင် လုပ်ဆောင်သွားရန် တာဝန် ရှိပါသည်။ အစီရင်ခံစာကို ပြုစုရာ၌ ရေအရင်းအမြစ်ဆိုင်ရာ ဥပဒေသတ်မှတ်ချက်၊ မြေရယူအသုံးချမှုဥပဒေ စသည့် စည်းမျဉ်း အက်ဥပဒေတို့ကို ကိုးကားလျက် ရေးသားပြုစုထားပါသည်။

7. ပြည်သူလူထု၏ ပါဝင်ပတ်သက်မှုနှင့် ဆွေးနွေးညှိနှိုင်းမှုများ

7.1 စီမံကိန်းနှင့် စပ်ဆိုင်ရာ အကျိုးစီးပွားပါဝင်ပတ်သက်သူများကို သတ်မှတ်ဖော်ထုတ်ခြင်း

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အတွင်း စီမံကိန်းနှင့် စပ်ဆိုင်ရာ ပင်မအကျိုးစီးပွား ပါဝင်ပတ်သက်သူများနှင့် အကြိမ်များစွာ စည်းဝေးဆွေးနွေး မေးမြန်းမှုများကို လေ့လာမှုအဖွဲ့ မှဒေန၍ ပြုလုပ်ခဲ့ပါသည်။

ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ၌ ပြည်သူလူထု၏ ပါဝင်ပတ်သက်မှု (PI) ဆိုင်ရာ လှုပ်ရှားဆောင်ရွက်မှုများမှာ

- သတင်းအချက်အလက် ဖော်ထုတ်ဆွေးနွေးခြင်း (ရည်ရွယ်ထားသည့် လှုပ်ရှားဆောင်ရွက်မှု၊ စီမံကိန်း၏ ရည်မှန်းချက် နှင့် ရလဒ် ဆိုင်ရာ သတင်း အချက်အလက်များကို ဖော်ထုတ် အသိပေးခြင်းဖြင့် အဓိပ္ပါယ် ရှိသည့် ဆွေးနွေးမှုများကို စတင်နိုင်ရန်)
- ပဏာမအကြို ဆွေးနွေးတိုင်ပင်ခြင်း (အကျိုးစီးပွားပါဝင်ပတ်သက်သူ နှင့် စီမံကိန်းတို့အကြား နှစ်ဖက် အပြန်အလှန် သတင်းအချက်အလက်၊ အမြင် နှင့် အတွေးအခေါ်များကို ဖလှယ်အသုံးချမှု ပြုသွားရန်)

စီမံကိန်း၏ အကျိုးစီးပွားပါဝင်ပတ်သက်သူများကို သတ်မှတ်ဖော်ထုတ်မှုနှင့် စပ်လျဉ်း၍ လက်တွေ့ချမှတ် ဖော်ဆောင်သည့် အဆင့်၌ ထပ်မံ ခွဲခြမ်းစိတ်ဖြာဆန်းစစ်မှု ပြုသွားမည့် အောက်ပါအချက်တို့ ပါဝင်ပါသည်။

- **အဓိက အကျိုးဝိုးပွားပါဝင်ပတ်သက်သူများ**
  - တာတမံ/ကန် ဇရိယာအတွင်း သို့မဟုတ် အနီးအနား၌ နေထိုင်သူ ဒေသခံများ
  - ရွာသားအစုအဖွဲ့ နှင့် ကျေးရွာကော်မတီအုပ်စု
  - ထိခိုက်သက်ရောက်ခံဒေသရှိ လူမှုပိုင်းနှင့် ယဉ်ကျေးမှုပိုင်းဆိုင်ရာ အရေးကြီး အဆောက်အဦးများကို သုံးစွဲနေသူ
  - ပတ်ဝန်းကျင်နှင့် သစ်တောကာကွယ်စောင့်ရှောက်ရေးတာဝန်ခံ ပြည်နယ်အစိုးရနှင့် ဒေသခံအာဏာပိုင်အဖွဲ့
  - မြေရယူအသုံးချမှုနှင့် နစ်နာကြေးပေးလျော်မှုဆိုင်ရာ တာဝန်ခံ ပြည်နယ်အစိုးရနှင့် ဒေသခံအာဏာပိုင်အဖွဲ့

- **ဆင့်ပွား အကျိုးဝိုးပွားပါဝင်ပတ်သက်သူများ**
  - စီမံကိန်း၏ ထိခိုက်သက်ရောက်ခံ နယ်မြေ သို့မဟုတ် အကြောင်းအချက်ကိစ္စတို့၌ ပါဝင်ပတ်သက်နေသည့် အခြား အစိုးရဌာနဆိုင်ရာ အဖွဲ့အစည်းများ
  - ဒွေကြေးထောက်ပံ့ချေးငှားသူ
  - စီမံကိန်းဇရိယာတွင်း လုပ်ငန်းတာဝန် ဆောင်ရွက်နေသည့် အင်ဂျီအို (NGO) အဖွဲ့အစည်းများ

7.2 ပြုလုပ်ဆောင်ရွက်သည့် ဆွေးနွေးညှိနှိုင်းမှုများနှင့် အသိပေးဖော်ထုတ်မှုများ

ပြည်သူလူထုထံ သတင်းအချက်အလက် အသိပေး ဖော်ထုတ်မှုနှင့် ပြည်သူလူထုအား ရေလျှောင်တမံစုံစမ်းစစ်ဆေးရေး စီမံကိန်း၌ ပါဝင်ပတ်သက်စေသည့် လုပ်ငန်းစဉ်များကို ကွဲပြားခြားနားသော အချိန်ကာလများတစ်လျှောက် အဆက်မပြတ် ပြုလုပ်ခဲ့ပါသည်။ လေ့လာရေး ကာလအတွင်း၌ ဤလုပ်ငန်းစဉ်ကို တိုး၍ အရှိန်မြင့် လုပ်ဆောင်ခဲ့ပါသည်။ စီမံကိန်း၏ လွှမ်းမိုးမှုခံရသည့် အနီးအနားပတ်ဝန်းကျင်အတွင်းရှိ ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝပိုင်းဆိုင်ရာ၊ လူမှုစီးပွားပိုင်းဆိုင်ရာ ရင်းမြစ်တို့ကို သိရှိနိုင်ရန် ကွင်းဆင်း လေ့လာစူးစမ်းမှုများ ပြုခဲ့ပါသည်။ အချက်အလက်များကို ကွင်းဆင်း လေ့လာကောက်ယူရာ၌ လူမှုစီးပွားလေ့လာစူးစမ်းမှု ကိရိယာများကိုပါ ထည့်သွင်း အသုံးချ ခဲ့ပါသည်။ 2012 ခုနှစ် ဇအောက်တိုဘာလ 10 ရက်၊ 2013 ခုနှစ် ဇန်နဝါရီလ 31 ရက်၊ 2013 ခုနှစ် ဇအောက်တိုဘာလ 25 ရက် နှင့် 2015 ခုနှစ် ဇန်နဝါရီလ 19 ရက်နေ့၌ ပြုလုပ်ခဲ့သော ကွင်းဆင်း လေ့လာမှုများ၌ ပြည်သူလူထုအား ပါဝင်ပတ်သက်စေခြင်းများနှင့် စပ်လျဉ်း၍ပါ လုပ်ဆောင်ခဲ့ပါသည်။

ပြည်သူလူထုအား ပါဝင်ပတ်သက်စေသည့် လုပ်ငန်းစဉ်အတွင်း တင်ပြခဲ့သည့် အကြောင်းအချက်များစွာကိုလည်း စီမံကိန်း အဆိုပြုလွှာနှင့် ဖြစ်နိုင်သည့် လျော့နည်းသက်သာစေမည့် စီမံချက်များကို ပြန်လည်ပြင်ဆင်သုံးသပ်ရာ၌ ထိရောက်စွာ အသုံးချ ခဲ့ပါသည်။ သာဓကအားဖြင့်၊ နစ်နာကြေးပေးလျော်မှုဆိုင်ရာလုပ်ငန်းစဉ်၊ နစ်နာကြေးတန်ဖိုး၊ ဒေသခံ ရွာသားများအား ရေပေးဝေထောက်ပံ့ခြင်းနှင့် ၎င်းတို့၏ သက်ရှင်နေထိုင်မှု စသည့် အကြောင်းအချက်များကို ပင်မအချက်များအဖြစ် သက်ဆိုင်ရာ အကျိုးစီးပွားပါဝင်ပတ်သက်သူများက ချပြ ဆွေးနွေးခဲ့ပါသည်။ ပြန်လည်နေရာချထားရေးဌာနမှ အဆိုပါ ဆွေးနွေးသည့် ကိစ္စများကို စစ်ဆေးလျက်၊ စီမံကိန်းအဆိုပြုလွှာ အသေးစိတ်ပြင်ဆင်မှုများအတွက် အားတက်သရော အသုံးချ တင်ပြခဲ့ပါသည်။ ထို့အပြင်၊ အကျိုးစီးပွားပါဝင်ပတ်သက်သူများမှ တင်ပြသည့် ကိစ္စများစွာအတွက် ကနဦး ကုစား သက်သာစေမည့် စီမံချက်များကို သတ်မှတ် စီစဉ်နေပါသည်။ တစ်ချိန်တည်းမှာပင် စီမံကိန်းကို ရှေ့သို့ တိုးတက်ဖော်ဆောင်ရာ၌ သက်ဆိုင်ရာ ကိစ္စရပ်၏ အရေးပါမှုကို ပိုမို တိကျစွာ သတ်မှတ်သွား နိုင်ရန်အတွက် အသေးစိတ်စုံစမ်းစစ်ဆေးမှုများကို ထပ်မံ၍ လုပ်ဆောင်ရန် လိုအပ်ကြောင်းကို အစီရင်ခံစာမှ အလေးထား သိမှတ်ပါသည်။

8. အနှစ်ချုပ်ကောက်ချက်နှင့် အကြံပြုချက်များ

အဆိုပြု စီမံကိန်း၏ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) မှ တွေ့ရှိချက်အရ အဆိုပြု ရေလျှောင်တမံ စီမံကိန်းကို ဖော်ဆောင်ခြင်းကြောင့် ရေရှည်၌ ရရှိလာနိုင်မည့် အကျိုးကျေးဇူးသည် ၎င်း၏သဘာဝအားဖြင့် ကုစားသက်သာမှု/ရှောင်ရှားမှု ပြုပေးသွားမည့် ဆိုးရွားသည့် ထိခိုက်သက်ရောက်မှုအများစုထက် ပို၍ အရေးပါ ပါမည်။ ထို့ကြောင့်၊ အဆိုပါ အဆိုပြု စီမံကိန်းကို အတည်ပြု ခွင့်ပြုချက်ပေးရန်အတွက် ဤကနဦးပတ်ဝန်းကျင် ဆန်းစစ်မှု (IEE) လေ့လာချက်အားဖြင့် လုံလောက်မှု ရှိပါသည်။ ထိခိုက်သက်ရောက်မှုအား လျော့နည်းသက်သာစေခြင်းနှင့် ပတ်ဝန်းကျင်အားစောင့်ကြည့်စစ်ဆေးသည့် စီမံချက်များကို ထည့်သွင်းလျက် ဤစီမံကိန်းကို ဖော်ဆောင်သွားစေရန် အကြံပြုပါသည်။ လူထုအသံကို နားထောင်ခြင်းနှင့် ဒေသခံများနှင့် ဆွေးနွေးတိုင်ပင်သည့် အကြောင်းအရာများကို အများပြည်သူသို့ အသိပေးလျက် စဉ်ဆက်မပြတ် လိုက်နာဖော်ဆောင်သွားခြင်းဖြင့် ဒေသခံများ အနေနှင့် စီမံကိန်းမှနေ၍ ၎င်းတို့အပေါ် ထိခိုက်သက်ရောက်လာမည့် အကျိုးဆက်များကို ရှင်းလင်းစွာ သိနားလည် နိုင်ကာ၊ စံနှုန်းမီ၍ မျှတသည့် နစ်နာကြေး ပေးချေမှုကို လုပ်ဆောင်စေနိုင်ပါမည်။

စီမံကိန်းဖွံ့ဖြိုးဖော်ဆောင်သူ၏ တာဝန်များမှာ အောက်ပါ အချက်များပါဝင်သော စီမံကိန်း တည်ဆောက်လည်ပတ်မှုမှ နေ၍ ပတ်ဝန်းကျင်နှင့် လူမှုပိုင်းဆိုင်ရာ ထိခိုက်သက်ရောက်မှုများကို ကောင်းမွန်စွာ ကြိုးကြပ်စီမံသွားရန် ဖြစ်သည်။

- ထိခိုက်သက်ရောက်ခံ ပြည်သူများနှင့် ဆွေးနွေးတိုင်ပင်၍ ဒေသအာဏာပိုင်အဖွဲ့နှင့် နီးကပ်စွာ ပူးပေါင်းလျက် ပတ်ဝန်းကျင်နှင့် လူမှုပိုင်းဆိုင်ရာ ဥပဒေအချက်များနှင့်အညီ ကိုက်ညီအောင် ဆောင်ရွက်သွားရန်။
- ထားဝယ်ခရိုင်နှင့် တနင်္သာရီတိုင်းဒေသ၏ လူမှုစီးပွား ဖွံ့ဖြိုးတိုးတက်မှုများကို အားပေးထောက်ကူသွားရန်။
- ပတ်ဝန်းကျင် အဆိပ်သင့်ညစ်ညမ်းစေသည့် ထုတ်လွှတ်ပစ္စည်းများကို မြန်မာနိုင်ငံပတ်ဝန်းကျင်စံသတ်မှတ်ချက်ထက် မပိုသည့်တန်ဖိုးဖြစ်ကြောင်း သေချာအောင် ဆောင်ရွက်သွားရန်။
- အခါအားလျော်စွာ ပုံမှန် ပြုလုပ်သည့် စောင့်ကြည့်စစ်ဆေးခြင်းနှင့် အစီရင်ခံချက်များကို နယ်မြေ၊ ဒေသ၊ နိုင်ငံ၏ ဥပဒေ စည်းမျဉ်းတို့နှင့်အညီ ဖြစ်အောင် လုပ်ဆောင်သွားရန်။
- ပတ်ဝန်းကျင်နှင့် လူမှုပိုင်းဆိုင်ရာ ထိခိုက်သက်ရောက်မှုများကို လျော့နည်းကုစားပြုပြင်၊ ဖယ်ရှားပျောက်ပျယ်သွားစေရန်။

9. ကတိကဝတ်

Myandawei Industrial Estate Co., Ltd. သည် အသေးစားရေလှောင်တမံစီမံကိန်း ဖြစ်သည့် ပယင်းဖြူရေလှောင်တမံ ဆိုင်ရာ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အစီရင်ခံစာတွင် ဖော်ပြထားသည့် ကတိဝန်ခံချက်၊ ထိခိုက်မှုအား လျော့နည်းသက်သာစေမည့် ဆောင်ရွက်မှု၊ အစီအစဉ်များနှင့်အညီ အချိန်တိုင်း ပြည့်ပြည့်ဝဝ လိုက်နာ ဆောင်ရွက်သွားပါမည်။

စီမံကိန်းအဆိုပြုသူ အနေနှင့် ပတ်ဝန်းကျင် စီမံကြိုးကြပ်မှု အစီအမံ (EMP)၊ စီမံကိန်း၏ ကတိဝန်ခံချက်နှင့် စည်းမျဉ်းများ အတိုင်း လုပ်ငန်းများကို အပြည့်အဝ ဖော်ဆောင်သွားပါမည်။ စီမံကိန်း၏ လက်အောက်ခံကန်ထရိုက်တာ၊ တစ်ဆင့်ခံ ကန်ထရိုက်တာ တို့ကိုလည်း 2012 ခုနှစ် ပတ်ဝန်းကျင်ဓောင့်ရှောက်ရေးဥပဒေ ၊ 2015 ခုနှစ် ပတ်ဝန်းကျင်ဓောင့်ရှောက်ရေး စည်းမျဉ်းဥပဒေ နှင့် ပတ်ဝန်းကျင်ထိခိုက်သက်ရောက်မှု စူးစမ်းလေ့လာမှုလုပ်ငန်းစဉ် ၊ ကျင့်သုံးနေသည့် ဥပဒေသတ်မှတ်ချက်များ စသည့် သက်ဆိုင်ရာ ဥပဒေများအားလုံး အပါအဝင်၊ ပတ်ဝန်းကျင် စီမံကြိုးကြပ်မှု အစီအမံ (EMP)၊ စီမံကိန်း ကတိဝန်ခံချက် နှင့် စည်းမျဉ်းများ နှင့်အညီ သေချာတိကျစွာ လိုက်နာလုပ်ဆောင်သွားစေရန် စီမံကိန်းအဆိုပြုသူမှ တာဝန်ခံကြိုးကြပ် သွားပါမည်။

စီမံကိန်းအဆိုပြုသူနှင့် Phisut Technology Co., Ltd., တို့သည် ဤနေရာမှနေပြီး အောက်ပါအချက်များတို့ ကို ထပ်ဆင့် အတည်ပြုပါသည်။

(1) ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အစီရင်ခံစာကို အစီရင်ခံစာ ပြုစုနေချိန်တွင် ကျွန်ုပ်တို့၌ ရှိထားသည့် အကောင်းဆုံးသော အသိပဟုသုတများဖြင့် တိကျမှန်ကန်၊ ပြည့်စုံစွာ ပြုစုထားပါသည်။

(2) ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ကို 2015 ခုနှစ် ပတ်ဝန်းကျင်ထိခိုက်သက်ရောက်မှု စူးစမ်းလေ့လာမှု (EIA) လုပ်ငန်းစဉ် သတ်မှတ်ချက်များ အပါအဝင် သက်ဆိုင်ရာ ဥပဒေသတ်မှတ်ချက်များနှင့်အညီ လုပ်ဆောင်ထားပါသည်။

(3) စီမံကိန်းအဆိုပြုသူ အနေဖြင့် ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အစီရင်ခံစာတွင် ဖော်ပြထားသည့် ကတိဝန်ခံချက်၊ ကုစားသက်သာစေမှု ဆောင်ရွက်မှု အစီအစဉ်များ နှင့်အညီ ပြည့်ပြည့်ဝဝ လိုက်နာ ဆောင်ရွက် သွားပါမည်။

Dr. Somchet Thinaphong
Managing Director
Myandawei Industrial Estate Company Limited

EXECUTIVE SUMMARY OF INITIAL ENVIRONMENTAL EXAMINATION OF PA YAIN BYU RESERVOIR PROJECT

EXECUTIVE SUMMARY OF INITIAL ENVIRONMENTAL EXAMINATION OF PA YAIN BYU RESERVOIR PROJECT

1. INTRODUCTION

1.1 PROJECT BACKGROUND

The Government of the Union of Myanmar and the Government of the Kingdom of Thailand signed a Memorandum of Understanding MOU on May 19, 2008, the for collaboration in developing the Dawei Deep Sea Port and Industrial Estate and Corridor Link Development Project in Dawei District, Tanintharyi Region.

With regards to the MOU, this mega project requires high water demand for supporting the consumption of industrial estate, community, and residential areas. For the full phase development, the Ka Loat Htar Dam and Reservoir was planned and and to be developed under the concept of being the water supply resource for the whole Dawei Special Economic Zone (DSEZ), where the water demand forecasting was based on the water consumption history of several industrial estates operated in Thailand.

The Pa Yain Byu Reservoir is proposed for early industries construction and industrial uses.

The location of Pa Yain Byu Reservoir Project resulting from an appropriated location and feasible water source for the development that would provide enough water flow and sufficient reservoir capacity for supporting the sufficient and stable water supply to early industries construction and industrial uses in the initial phase.

1.2 PURPOSE AND SCOPE OF IEE STUDY

The main objective of the IEE study is to identify the impacts of physical, ecological, economic development and social and cultural resources of the project area. The specific objectives of the proposed IEE study include to:

- Identify the major issues that may arise as a result of proposed works on bio-physical, socio-economic and cultural resources of the project area.
- Propose appropriate mitigation and monitoring measures that can be incorporated into an Environmental Management Plan that will avoid or minimize adverse impacts so that residual impacts are reduced to acceptable levels.
- Make sure that IEE is sufficient for the proposed Pa Yain Byu Pond Project

The IEE is based on secondary sources of information which is supplemented as required by field studies to improve the data. Field studies were undertaken in aquatic systems, terrestrial ecology and land use. Data was also carried into the study from the sociological study that was undertaken at the same time. Extensive public consultation was

undertaken as part of the IEE process to determine community attitudes to the possible development.

1.3 COMPLIANCE

All activities related to this IEE such as: environmental and social data collection; impact analysis and prediction process; and proposed mitigation and management measures and implementation have been performed to comply with the Myanmar environmental laws and regulations in consultation with local government authorities including the project affected people.

2. DESCRIPTION OF THE PROJECT

2.1 TYPE OF PROJECT

This project is a small reservoir that makes use of natural material. A weir is a compacted earth fill which consists 15.50 meter of dam high, 120.50 meter of dam length, 6 meters of dam width and storage capacity 8.54 MCM

2.2 CATEGORY OF PROJECT

The project falls into category B of the Asian Development Bank's (ADB's) environmental classification, i.e., the project is assessed to have some potential environmental impacts, but to a limited degree. It therefore requires an IEE.

2.3 NEED FOR PROJECT

The primary goal of the project is to support industrial water supply to serve the consumption of early industries construction, industrial uses and township.

2.4 LOCATION OF PROJECT

The project is located on the right bank of Dawei River in the DSEZ, where having a creek between two small mountains and flows from the west to east. The dam site is located at latitude 14° 19' 49.18" N and longitude 98° 10' 16.11" E covering the catchment area of 7.14 km.^{2}

2.5 PROPOSED SCHEDULE FOR IMPLEMENTATION

Site preparation and site investigation starts in January 2012, pre-construction works begin in February 2013 and the Completion of the Project is in May 2016. The first impoundment is on May 2014. The project reservoir can deliver water to the water treatment plants when the initial phase has operated.

2.6 DESCRIPTION OF THE PROJECT

The project will consist of the following components (**Table 2.6-1**)

Table 2.6-1 Pa Yain Byu Pond Project Feature

Item	*Units*	*Description*
1. Weir Feature		
- Type		Compacted Earth Filled
- Crest Elevation	m MSL.	+23.50
- High Water Level	m MSL.	+22.80
- Normal High Water Level	m MSL.	+22.00
- Bed Level	m MSL.	+6.00
- Maximum Height	m	17.50
- Crest Length	m	120.50
- Crest Width	m	6.0
- Crest High	m	15.50
- U/S Face Slope	-	1:2.5
- D/S Face Slope	-	1:2.0
2. Storage Pond		
- Max Storage	MCM	8.54
- Active Storage	MCM	8.23
- Dead Storage	MCM	0.31
3. Spillway		
- Location	-	Saddle Near Right Abutment
- Type	-	Free Flow Discharge Channel
- Dimensions (Width x Height)	-	25.00x2.00
- Sill Elevation	m MSL.	+22.00
- Design Flood Capacity (Tr 1,000)	cms	104
- Width of Chute	m	25.00
- Energy Dissipater Type	-	Stepped Chute
4. Pump Station		
- Location	-	1. In Pond North of WTP
	-	2. Intake Channel East of WTP
- Type	-	Floating Raft
- Pumping Capacity	Cu.m./day	36,000
- Pumping Head	m.	18.00
5. Water Treatment Plant		
- Location	-	Top of Hill South of Spillway
- Type	-	Conventional
- Capacity	Cu.m./day	36,000

2.7 Alternative Project Location

With reference of Union of Myanmar's letter number 4/220 (ka) (5) (8) (1171/2013) issued by Ministry of Agriculture and Irrigation Department, the Republic of the Union of Myanmar, to report the results of investigation the water resources in DSEZ Area and surrounding area to implement the water supply raw water for water demand of Industries Estate, residential area and DSEZ.

The study and observation report was conducted by Deputy Director of Irrigation Department, Dawei Province, Tanintharyi Region, which provided 4 alternative sites in Yebyu Township and 3 sites in Dawei Township.

ITD had studied and investigated all alternative site locations around Yebyu Township and correlative area in DSEZ, for example Heize Reservoir, Karoma Reservoir, Yalai Reservoir, Ka Loat Htar Reservoir, Ekani Reservoir, Pa Yain Byu Reservoir, Dwe Taw and Ai Shey Reservoir and East and West Wet Chaung Reservoir, etc. Besides, we had studied and considered 4 alternatives that are proposed by Irrigation department.

The 4 alternative reservoirs proposed by Irrigation department for DSEZ Water supply Project have not suitable and feasible site location to supply the water demand for DSEZ. The numbers of monthly shortages occur from November to May with no water storage and have less local inflow. The investment cost of raw water delivery system is costly and not functional. In addition, the construction of 4 proposed reservoirs create the extensive loss of the EIE sellable area, affect to storm drainage design and EIE Phasing development plan

According the above, The Pa Yain Byu Reservoir site has been considered the feasible and suitable water resource more than the alternative site locations had explored and had studied.

3. DESCRIPTION OF ENVIRONMENT

3.1 PHYSICAL RESOURCES

Dawei province has a monsoon tropical climate showing two marks seasons: the dry season from September to April and the rainy season from mid of May to October. Most often, July and August together account for more than 50% of the total annual rainfall.

The average annual rainfall in Dawei station (1989-2010) has been around 5,459 mm and over the twenty last years, the mean highest and lowest temperature was 14°C in January and 37°C in April.

In Dawei, the prevailing winds are SW-monsoon and NE-monsoon were 20 knots and 14 knots, respectively.

Water quality in the proposed project is observe to be clear and local geology of Pa Yain Byu Pond Project can be subdivided into stratigraphy unit, shale, siltstone, quaternary sediment and the seismic hazard zone, the project is located in the moderate zone II.

3.2 ECOLOGICAL RESOURCES

The IEE investigation revealed that the terrestrial and aquatic biology in the project area have been heavily disturbed by human activities and became a degraded biodiversity. The dominant species of fish reported in the Pa Yain Byu Project are catfish and butter catfish. Main snake species found in the project area are pythons and cobras which were reported as key wild animals in the project area.The project does not situate within any protected/rich biodiversity or buffer zone areas.

3.3 ECONOMIC DEVELOPMENT

For the proposed project, due to limited public electricity service, most people rely on firewood for cooking and generator for lighting. At the same time, the stream and groundwater are the primary sources of domestic water supply and the road composition was poor.

Land use pattern of area through have been classified into cultivated land, Government Oil Palm Plantation, agriculture land and forest land.

3.4 SOCIAL AND CULTURAL RESOURCES

There is no healthcare facility in all the affected communities and only one primary school located in the project area. Regarding communication, mostly have a CDMA set connection.

There are two main communities in the upstream and downstream area of the project. In general, the primary occupation of the local people is based on agriculture while non-farm labor is the second one but play key role for the economy. In addition, people are carrying out other economic activities by working as labor to several neighboring countries. Earning of people working abroad play significant role in the livelihood income of the people.

4. POTENTIAL ENVIRONMENTAL IMPACTS, CUMULATIVE IMPACTS, RISK ASSESSMENT AND MITIGATION MEASURES

4.1 ENVIRONMENTAL IMPACTS

4.1.1 Beneficial Impacts

The immediate beneficial impacts from reservoir development are apparent in the construction phase where there will be a number of employment opportunities for the local people with capacity building through construction employment skills, technical know-how to the local workers and increase the economic activities from trading of equipment, material and services relating to construction works.

During operation phase, the improved road access will bring control and flood protection in rainy season and create some recreation activities and tourism.

4.1.2 Adverse Impacts

The physical adverse impacts during construction will be due to change in landscape and land use and air, dust and water pollution. Similarly, ecological impacts during construction will be the impact to some degraded terrestrial resources such as small trees and animals. Social and cultural resources impacts during construction will be the loss of 252 acre of Pagaw Zoon oil palm plantation and approximately 500 acre of agriculture land. Some private properties will be impacted including disturbance by construction activities to health and safety during construction phase.

To minimize the adverse impacts on environmental during operation phase with some mitigation measures have to be included and considered. However, risk assessment was analyze for the project in magnitude of the impacts and the cumulative impacts will be related to Pa yain Byu Project itself and DSEZ development.

4.2 MITIGATION MEASURES

Impacts from the proposed project can be both beneficial as well as adverse. An effective implementation of benefit maximization measures and adverse impacts mitigation measures would be optimized the benefits expected from the project and avoid/minimize the adverse impact from the project. Based on the impact assessment and identification, beneficial augmentation and adverse impact mitigation measures are detailed in the EMP in pre-construction, construction and operation phase.

Many of the mitigation measures suggested during the construction phase of the Project are associated with good construction practices. Examples are including: 1) air quality, 2) noise control, 3) water quality, 4) forest and wildlife, and 5) land acquisition. Mitigation measure for the operation phase is about tourism and recreation.

The Project Proponent will ensure that the mitigation measures stated in the EMP are implemented throughout the life span of the Project.

4.3 MONITORING PROGRAMME

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

5. ENVIRONMENTAL MANAGEMENT PLAN

Environmental management plan is an important tool to ensure the implementation and monitoring of mitigation measures for minimizing adverse impacts and maximizing the beneficial impacts. Similarly, environmental monitoring generates useful information and improves the quality of implementation of mitigation measures. The proponent will development monitoring mechanism to show its additional commitment for environmental improvement and mitigate undesirable environmental changes, if any during pre-construction, construction and operation phase.

The Environmental Management Unit will be responsible for the implementation of mitigation measures and of the monitoring plan. Overall implementation of the EMP is an obligation of the Project Proponent. Most of the mitigation measures are fairly standard methods of minimizing disturbance from the project. Monitoring of such measures

normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

6. ENVIRONMENTAL LEGISLATION

The IEE was conducted to comply with the following environmental legislations;

- Environmental Conservation Rule, 2014
- Procedure of Environmental Impact Assessment, 2015
- Antique Safeguarding and Prevention, 2015
- Prevention Law of Antique Buildings, 2015
- The Environment Protection Act, 1997
- Environment Protection Rules, 1997 (With Amendment)
- National EIA Guidelines, 1993
- Asian Development Bank Guidelines

This IEE was prepared in accordance with the legal requirements by the Government of Myanmar, based on field investigations in consultation with local government authorities and people.

The project developers will be responsible for fulfilling the provisions of all relevant policies, acts, rules/regulations, guidelines and conventions while implementing the project. The regulation and acts related to water resource regulation, Land Acquisition Act, etc., were referred while preparing the report.

7. PUBLIC CONSULTATION AND PARTICIPATION

7.1 STAKEHOLDERS IDENTIFICATION OF THE PROJECT

During the course of IEE process, the study team has carried out several meetings, discussions and interviews with key stakeholders.

The IEE Public Involvement (PI) activities included:

- Information Dissemination (disclosure of information about the intended activity, project objectives and their outcomes in order to enable meaningful discussions);
- Preliminary Consultation (using two-way flow of information, views and ideas between stakeholders and the Project).

Identification of project stakeholders will be analyzed more in the implementation stage, these may include:

- ***Primary stakeholders:***
  - Residents who live and work within or near to the dikes/pond areas;
  - Communities and villager Committees;
  - Users of socially and culturally important buildings in affected areas;
  - State and local authorities responsible for the protection and conservation of environmental and forestry;

- State and local authorities responsible in land acquisition and compensation.

- ***Secondary stakeholders:***
  - Other government institutions whose remit includes areas or issues affected by the project;
  - The financial lenders;
  - Non-governmental organization working in the project area.

7.2 Consultation and Disclosure conducted

Information disclosure and public involvement with the people of the reservoir investigation project have been continuing in different period. This process was intensified during the studies. Surveys were carried out in order to investigate physical, biological and socio-economic resources falling within the immediate area of influence of the project. The data collection was including of socio-economic survey tools in the field. The Public involvement was conducted during the field surveys on 10th October 2012, 31st January 2013, 25th October 2013 and 19th January 2015.

Many of the issues raised during the public involvement process were actively used to refine the project proposal and potential mitigation measures. For example, an issue related to compensation process, compensation price, supply water to the local villager and likelihood was raised by stakeholders as a significant issue. This issue was later investigated and actively addressed by the relocation department in refining the project proposal. In addition, the report noted that while initial mitigation measures were identified for many of the issues raised by stakeholders, further detailed investigation would be required to more precisely determine the significance of issues should the project move forward.

8. CONCLUTION AND RECOMMENDATIONS

The IEE study of the proposed project reveals that the benefit from implementation of the proposed reservoir project are more significant with long term in nature against the adverse impacts most of which could be mitigated or avoided. Therefore, this IEE is sufficient for approval of the proposed project. This project is recommended for implementation with incorporation of mitigation measures and environmental monitoring plan. Public hearing and consultation with local people should be disclosed and continually carried out so as to enable the local people to clearly understand the project impacts on them for that standard and fair compensation can be performed.

The Project Developer commitment is to well manage environmental and social impacts by project construction and operation, which include:

- Working closely with local authorities to comply with environmental and social legislation in consultation with the affected people;

- Support the socio-economic development of the Dawei District and the Tanintharyi Region;
- Ensuring that releases pollutions on environment not exceed the Myanmar national environmental standards;
- Periodically monitoring and reporting must comply with local, regional, national and law and regulations;
- Treatment and elimination to reduce environment and social impacts.

9. COMMITMENT

Myandawei Industrial Estate Co., Ltd., will at all times comply fully with the commitments, mitigation measures, and plans that have been presented in IEE Report on Pa Yain Byu Reservoir, Small Water Reservoir Project.

The Project Proponent shall 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, including the Environmental Conservation Law (2012), Environmental Conservation Rules and Environmental Impact Assessment Procedure (2015), as well as the EMP, Project commitments and conditions.

The Project Proponent and Phisut Technilogy Co.,Ltd hereby confirm that:

(1) The IEE Report is accurate, consolidated and complete to the best of our knowledge, at the time of preparing this Report;
(2) The IEE has been conducted in accordance with relevant laws, including the EIA Procedure (2015).
(3) The Project Proponent will fully follow the commitments, mitigation measures and plans set out in this IEE Report.

Dr. Somchet Thinaphong
Managing Director
Myandawei Industrial Estate Company Limited

Chapter 1

INTRODUCTION

CHAPTER 1
INTRODUCTION

1.1 Project Background

On May 19, 2008, the Government of the Union of Myanmar and the Government of the Kingdom of Thailand signed a Memorandum of Understanding (MOU) for collaboration in developing the Dawei Deep Sea Port and Industrial Estate and Corridor Link Development Project in Dawei District, Tanintharyi Region. At its greenfield stage and under the Special Economic Zone Law, Dawei Development Company Limited (DDC) has been established in Myanmar to implement the Dawei Project. Dawei Project has been planned as a large fully-integrated industrial zone with a sustainable industrial complex and fully-supported infrastructure & utilities. The Dawei Project consists the development of the Dawei Deep Sea Port, Industrial Estate, Roadlink to Thailand, Rail Link, Electricity, Telecommunication and Water Supply and Waste Water.

According to the above, this mega project would require high water demand for supporting the consumption of industrial estate, community, and residential areas. As a result, the Ka Loat Htar Dam and Reservoir was planned and to be developed under the concept of being the water supply resource for the full-scheme Dawei Special Economic Zone (DSEZ) , which the water demand forecasting is based on the water consumption history of several industrial estates operated in Thailand.

The proposed of Pa Yain Byu Pond and associated water distribution network is to be supported early industries construction and industrial uses for the initial phase of project development.

Following this concept, the location of Pa Yain Byu reservoir Project resulting from an appropriated location and feasible water source for the development that would provide enough water flow and sufficient reservoir capacity for supporting the sufficient and stable water supply to early industries construction and industrial uses. (**Figure 1.1-1**)

1.2 Purpose of Study

Key objective of the IEE Study is to identify project implementation impacts and mitigation plans for physical, biological and socio-economic aspects of the project area complying applicable national laws/regulations including Myanmar National Environmental Impact Assessment.

Specific objectives are:

- To identify potential direct, indirect, cumulative and induced environmental impacts on and risks to physical, ecological, economic development and social and cultural resources and determine their significance and scope,
- To examine alternatives to the project location, design, technology, and components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks.
- To prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment. The EMP will include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.

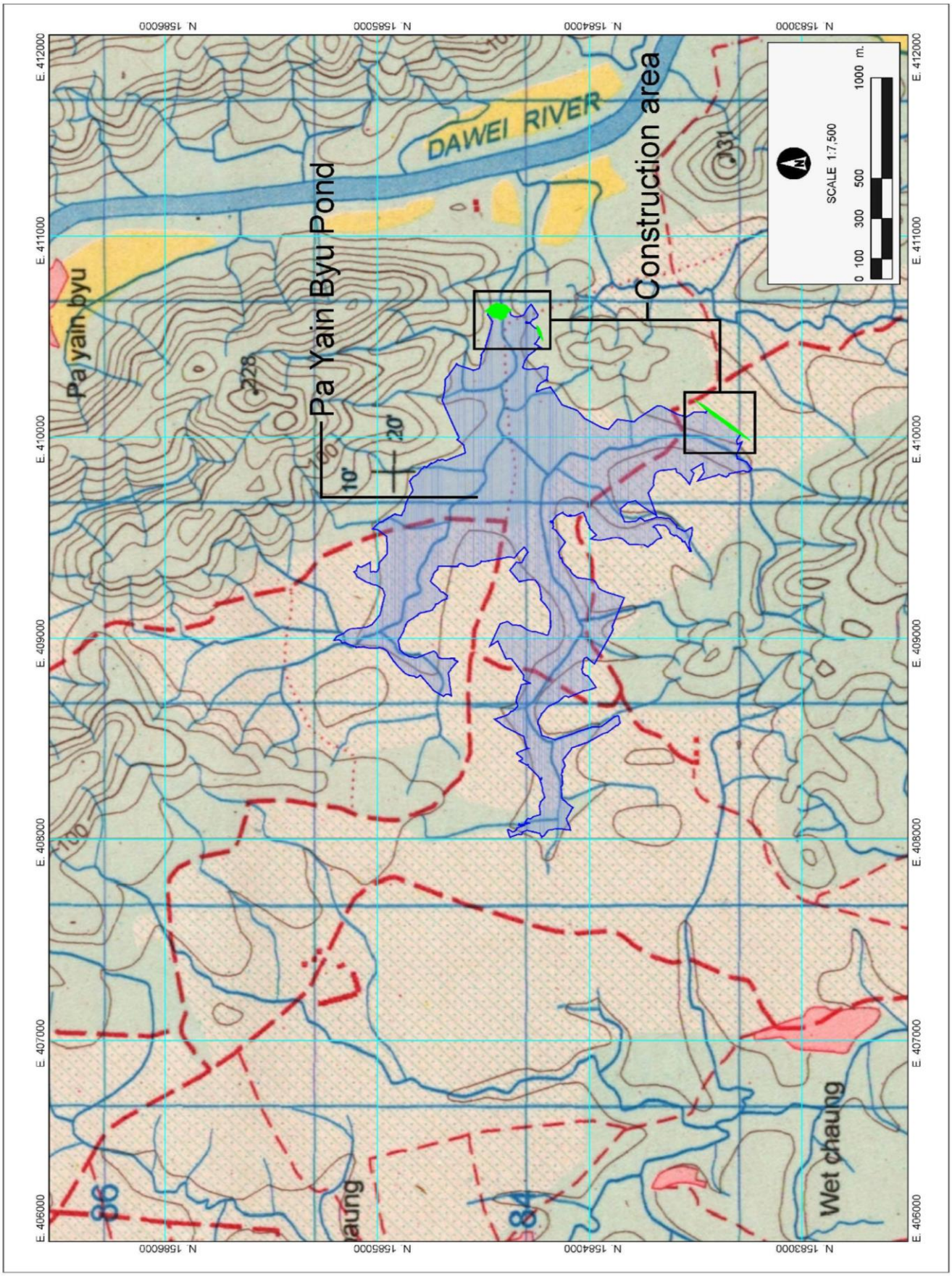

Figure 1.1-1 Potential Target Site

1.3 Extent of the IEE study

The Pa Yain Byu project implementation needs to comply with the policies of Myanmar requiring that impacts of the development projects have to be identified at the beginning and mitigation measures be incorporated in the project to reduce those impacts to acceptable levels. This is generally done through the process of environmental impact assessment. The Consultant has addressed environmental aspects by furnishing information on physical, ecological, economic development and social/cultural resources.

1.4 Summary of Pa Yain Byu Project

The Pa Yain Byu Project located on the right bank of Dawei River It has a catchment area of 7.14 km^2. The normal high water level is +22.00 m MSL and reservoir capacity is 8.54 MCM and active reservoir capacity is 8.23 MCM/year is discharged to construction phase of initial industries estate and surrounding area. This amount would be sufficient and stable water use.

The crest elevation of main dike is +23.50 m MSL, which the dam height is 15.50 m above the river bed with the crest length of 120.50 m and crest width of 6 m.

The spillway is located on saddle near right abutment with the chute width of 25.00 m and dimensions (width x height) of 25.00 m x 2.00 m. In addition, the water treatment plant is located on top of hill, which situated in the south of spillway consisting of pump station and associated pipelines.

This project area would affect the agriculture area and forest. The Oata Yan Village and Pa Yain Byu Village where requiring fair compensation to them.

1.5 Study Zone

Since, the project generates several types of impacts affected on various components of the environment in different parts of project area and also in different period of project life, thus the study area would have to be identified in such a way that will cover all possible affected area. Therefore, upstream, downstream and construction zones were finally selected and covered in the IEE study. **Figure 1.5-1** shows the IEE study zones.

- Upstream Impacted Zone – an area within the project where the storage reservoir will impact to agricultural and forest lands;
- Downstream Impacted Zone – an area from the Pa Yain Byu main weir to the Dawei River (the Pa Yain Byu creek drains here);
- Construction Impacted Zone – the areas selected for the construction of main weir and a saddle dike.

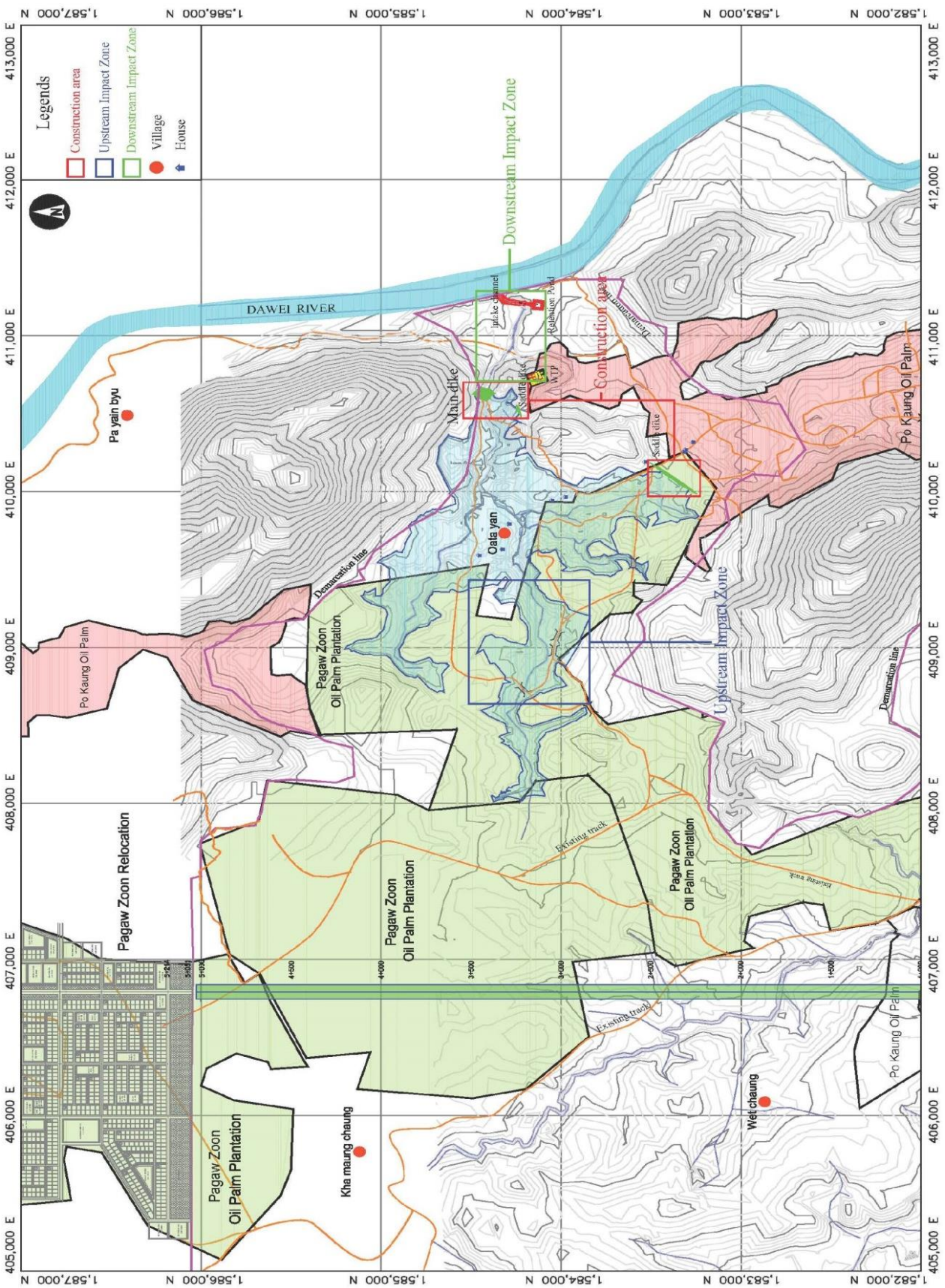

Figure 1.5 -1 IEE Study Zones

1.6 Methodology and Work Plan

The methods employed in the preparation of IEE include the followings:

- Collection and initial review of literature on the concerned subjects;
- Field surveys to gather fresh data at sites including consultation with key stakeholders at the township and at the potential affected villages;
- Review and analysis of information and preparation of report.

The IEE will be performed based on work plan consisting of three steps, which include:

- Step 1: IEE literature reviews;
- Step 2: Field survey at project sites, data collection and consultation with the local leaders and affected land owners;
- Step 3: Preliminary E&S impact assessment and mitigation plans formulation.

Diagram 1.6-1 below shows tasks and activities with timeline for the study of IEE for the Pa Yain Byu Project.

Diagram 1.6-1: IEE Work Plan, Schedule & Deliverables Milestone

Tasks & Activities		1st Month				2nd Month				3rd Month				4st Month			
Step 1: ESNIA literature reviews																	
Task 101	Literature reviews																
Task 102	Prepare survey tools																
Task 103	Inception reporting																
Step 2: Field survey at project sites, data collection and consulted with township and villages																	
Task 201	Field surveys/ consultation																
Task 202	Progress reporting																
Step 3: Preliminary E&S impact assessment and mitigation plans formulation																	
Task 301	Data entry & analysis																
Task 302	E&S impact assessment & mitigation plan formulation																
Task 303	Drafting the IEE																
Deliverables Milestone (DM)																	
DM 101	Inception Report																
DM 102	Progress Report																
DM 103	IEE Report																

1.6.1 Step 1 - Environmental and Social (E&S) Literature Reviews

The Step 1 spent the first four weeks with three main activities:

- *Task 101* – Literature Reviews & Preliminary Environmental Baseline Study - preparation of bio-physical environment in the project area included in the Inception Report;
- *Task 102* - Preparation of survey tools by IEE teams - preparation of E&S questionnaires forms for data collection;
- *Task 103* – Preparation of Inception Report.

1.6.2 Step 2 - Field Survey at Project Sites and Consultation with District/Village Authorities

The timeframe of Step 2 was spent the whole 2nd month that mainly for field surveys, data collection and consultation with district and potential affected villages.

- *Task 201* – Field survey at the project sites including Upstream Impacted Zone , Downstream Impacted Zone and Construction Impacted Zone
- *Task 202* - Preparation of Progress Report.

1.6.3 Step 3 - Preliminary E&S Impact Assessment and Mitigation Plan Formulation

For IEE Step 3, it spent about two months starting in the 3rd month.

- *Task 301* – Data entry and analysis from field surveys;
- *Task 302* – Prediction of E&S potential impacts and formulation of initial EMP plan;
- *Task 303* - Drafting the IEE report.

1.7 Project Developer and IEE Consultants

- MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED (MIE) is the project developer. MIE can be contacted at address below:

Myandawei Industrial Estate Company Limited

Address: 6th Floor, Salomon Business Centre,
223/A, U Wisara Road, Bahan Township, Yangon,
The Republic of the Union of Myanmar
Contact person: Mr. Thanarat Bhollaarj
Tel: + 6691-783-8181
Email: Thanarat@itd.co.th

- PHISUT TECHNOLOGY CO.,LTD is the IEE consultant. The Phisut Technology can be contacted at the following address:

Phisut Technology Co., Ltd

Address: The Pann Building, 5th Floor,
125 Khlong Lam Chiak Road,
Nawamin, Bueng Kum, Bangkok 10230, Thailand,
Contact person: Mr. Songkrit Sappakit
Tel : + 66-2943 9619-20
Fax : + 66-2943 9621

Phisut Technology has license to conduct EIA/IEE from the Government of Thailand. Consultant's profile is provided in Appendix A.

1.8 The IEE Team

The Phisut team selected for this Project possess the relevant expertise and experience to undertake this IEE. The deails of the specialist team are presented on **Table 1.8-1** and **Appendix C.**

Table 1.8-1 List of the specialist

No	Name of staff	Responsibility
1	Dr Montri Suwanmontri	Environment Expert & Team Leader
2	Dr.Yupa Chithong	Hydrology Specialist
3	Ms.Sasithorn Songprakon	Land Use Specialist/Project coordinate
4	Assist.Prof.Dr.Phongchate Pichitkul	Water Quality and Ecology Specialist
5	Ms.Pasinee Songkunatham	Forestry Specialist
6	Ms. Nuanwan Sakdadach	Socio-Economic Specialist
7	Mrs.Monlak Nontakaew	Editor

1.9 Terminology

The following environmental and social terminologies are used in the IEE report:

Aspect	*Description*
Baseline	*A description of the biophysical and socio-economic state of the environment at a given time, prior to development of a particular project.*
Biodiversity	*Diversity within and among flora and fauna in an environment.*
Buffer zone	*An area surrounding land that is directly affected by the Project (i.e. inundation and construction areas), where Project impacts will be felt.*
Construction Area	*Includes an additional area that may potentially be alienated (i.e. lost access and /or rendered effectively unsuitable for agricultural or other purposes) during the construction phase, as well as the Construction Footprint, Construction Buffer Zone and Access Road ROW.*
Contamination	*Pollution.*
Conservation	*The preservation of natural resources for use by future generations.*
Consultation	*A process of communication with those potentially affected by a project, policy, plan or program.*
Culvert	*A drain or channel crossing under a road, sidewalk, etc.; sewer; conduit.*
Cumulative effects	*Changes to the environment that are caused by an action in combination with other past, present and future actions.*
Decibel (dB)	*Describes the sound pressure level of a noise source. It is a logarithmic scale referenced to the threshold of hearing.*
Disturbed	*Not in natural state.*
Endangered species	*An animal or plant in danger of extinction.*
Environment	*The combination of elements whose complex inter-relationships make up the settings, surroundings and conditions of life of the individual and society as they are or are felt.*
Environmental Flow	*The minimum water required based on the need to maintain the downstream ecosystem.*
Ecology	*A branch of science dealing with the interrelationships of organisms and their environment.*
Ecosystem	*An interconnected and symbiotic grouping of microorganisms, fungi, plants and animals.*

Aspect	*Description*
Fauna	*The total animal population in a given area.*
Flora	*The total vegetation assemblage in a given area.*
Filter fences	*Temporary sediment control used on construction sites to protect nearby water bodies. Usually consists of a piece of synthetic filter fabric stretched between a series of wooden or metal posts along a contour line.*
Footprint	*This is the total area expected to be physically disturbed as a result of the development of the Project.*
Groundwater	*Water found beneath the Earth's surface.*
Habitat	*The home of a plant or animal.*
Hydrology	*The science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and atmosphere.*
Impact	*The consequence of an action or activity on the human or natural environment. Impacts may be positive, negative or neutral.*
Irreversible	*A result whereby once occurred cannot be changed or reverted to its prior state.*
Issue	*A question or concern regarding an environmental impact, consequence or effect.*
Magnitude	*The size or degree of a predicted impact.*
Mitigation	*Prescribed actions taken to prevent, avoid, reduce or minimize the impacts, or potential adverse effects, of a project.*
Monitoring	*A combination of observation and measurement to assess the environmental and social performance of a project and its compliance with the IEE/EMP, or other approval and regulatory conditions.*
Normal Water Level (NWL)	*The water level of the storage pond under nominal operating conditions.*
NTFP	*Non timber forest products.*
pH	*A measure of concentration of hydrogen ions (grams of atom/L) used to represent the alkalinity or acidity of a solution. Measured on a logarithmic scale.*

Aspect	*Description*
PM_{10}	*Particulate matter less than 10 microns in diameter.*
The Project	*The Pa Yain Byu Reservoir Project.*
Project Area	*The entire area affected by the Pa Yain Byu Reservoir and all potentially affected zones.*
Project Footprint	*Areas directly affected by the Project.*
Protected Area	*A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.*
Rehabilitation	*The process by which lands disturbed as a result of construction activity are rehabilitated back to a beneficial land use. The activity includes the removal of construction buildings, equipment, machinery and other physical remnants of construction (e.g. concrete batching plants) and contouring, covering and re-vegetation of borrow areas, spoil disposal areas and other disturbed areas.*
Riparian	*The terrestrial region around a body of water or along a river bank.*
Risk	*The likelihood of occurrence of an adverse project effect.*
Runoff	*Precipitation falling on the ground that is not absorbed and eventually reaches rivers, lakes or other water bodies.*
Sediment	*Solid material that has settled down from a state of suspension in a liquid. More generally, solid fragmental material transported and deposited by wind, water or ice, chemically participated from solution, or secreted by organisms, and that forms in layer in loose unconsolidated form.*
Significance	*The relative importance of an issue or impact to society.*
Spillway	*A passageway through which surplus water escapes from a reservoir or lake, etc.*
Stakeholder	*Someone who has an interest in the outcome of a project, or a decision affecting them.*
Storage pond	*An artificial water body created and used for water storage for development activities in the DSEZ initial stage.*
Watershed	*The entire region or area where water flows into a river.*

Chapter 2

PROJECT DESCRIPTIONS

CHAPTER 2
PROJECT DESCRIPTIONS

2.1 Type of Project

The main project consists of main dike, water treatment plant and distribution network. The main dike has a catchment area of 7.14 km^2 with the height of 15.5 meters (m) and the length of 120.50 m. The total storage capacity of the pond is 8.54 million cubic meters (MCM). The nearest neighboring villages are distance far from Project site is of 5 Kilometers.

2.2 Category of Project

The environmental assessment classification depends on the significant of environmental impacts. Each proposed project is scrutinized as to its type, location, the sensitivity, scale, nature, and magnitude of its potential environmental impacts, and availability of cost-effective mitigation measures. According to ADB Safeguard Policy Statement, development projects are classified into three environmental categories which are A, B, and C of the following;

Category A: Projects are categorized as "A" if they would have significant adverse environmental impacts. Thus, an EIA is required to address significant impacts.

Category B: Projects are categorized as "B" if they would have some adverse environmental impacts, but of lesser degree or significance than those of category "A" projects. An initial environmental examination (IEE) is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

Category C: Projects are categorized as "C" if they are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.

The Pa Yain Byu Project was initially screened and classified as an Environmental Category B project which requires an Initial Environmental Examination (IEE) *because of Pa Yain Byu Reservoir area and location;*

- *Located in the unproductive palm oil plantation*
- *No household and land acquisition use inside the reservoir area ad damsite*
- *Not in or near sensitive and valuable ecosystem*
- *The cultural heritage e.g., historical sites has not situated inside the project*
- *Less compensate for adverse impact or relocation or any displacement of people*

Also the storage area of Pa Yain Byu is of 1.57 Square Kilometers and storage volume 7.7 MCM. So that the size of reservoir is limited to classification and less impact to local environment.

2.3 Need for Project

The project aims to support industrial water supply serving as water consumption for early industries construction and industrial uses in the initial phase of the DESZ development.

2.4 Location

Pa Yain Byu, a small creek, is located on the right bank of the Dawei River in the DSEZ boundary located between two small mountains and flows from the west to the east. The main dike site is located at latitude 14° 19’ 49.18” N and longitude 98° 10’ 16.11” E covering the catchment area of 7.14 sq. km. The nearest neighboring villages are distance far from Project site is of 5 Kilometers.as shown in **Figure 2.4-1**

2.5 Project Schedule

Site preparation and site investigation starts in January 2012, pre-construction works begin in February 2013 and the Completion of the Project is in May 2016. The first impoundment is on May 2014. The project reservoir can deliver water to the water treatment plants when the initial phase has operated.

2.6 Technical Descriptions of the Project

The main technical features of the Pa Yain Byu Reservoir Project are provided **Table 2.6-1 and Figure 2.6-1.** Map showing pond location and its catchment area is provided in **Figure 2.4-1.**

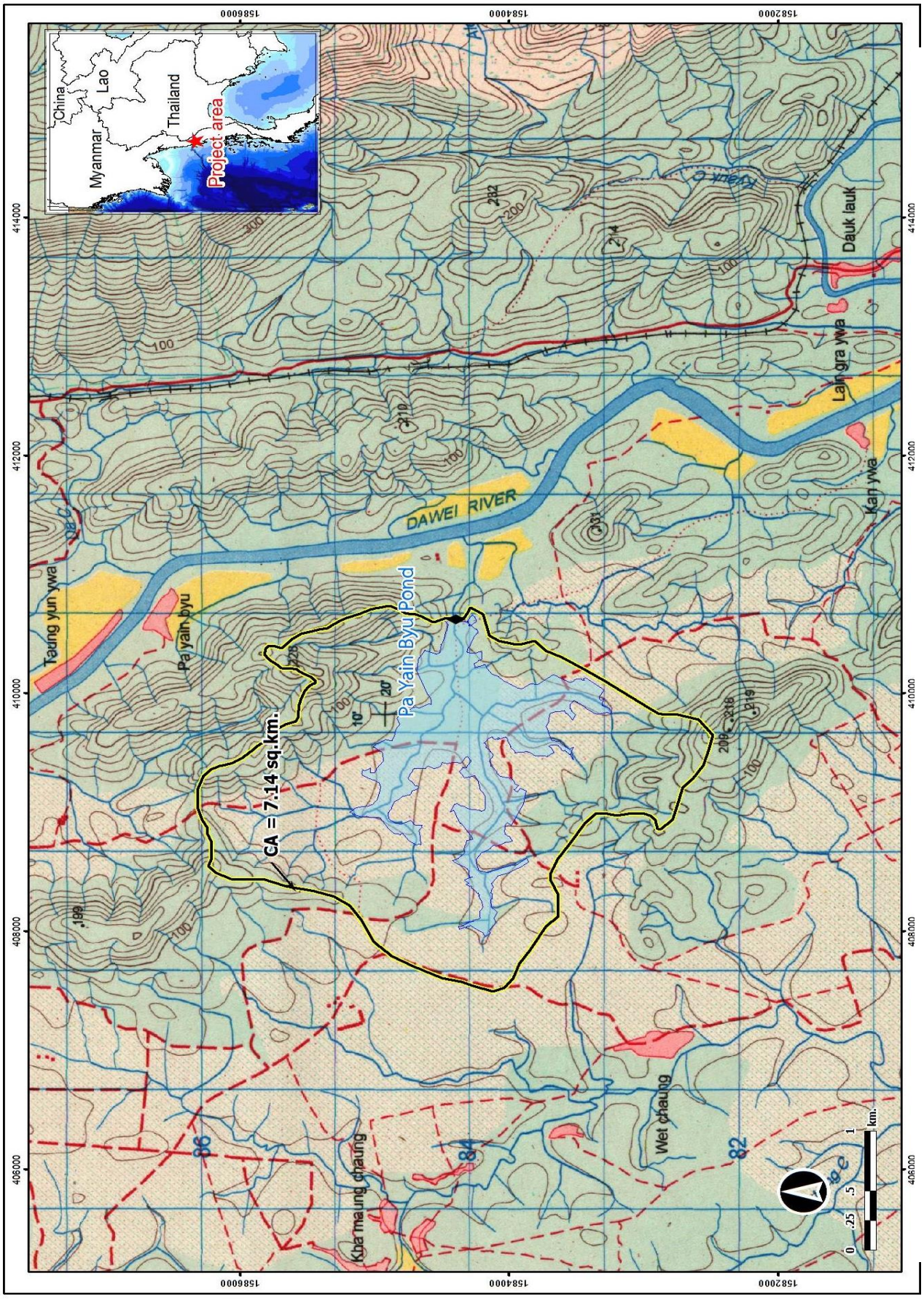

Figure 2.4-1 The Location of Pa Yain Byu Project

Table 2.6-1 Pa Yain Byu Pond Project Feature

Item	Units	Description
1. Weir Feature		
- Type		Compacted Earth Filled
- Crest Elevation	m MSL.	+23.50
- High Water Level	m MSL.	+22.80
- Normal High Water Level	m MSL.	+22.00
- Bed Level	m MSL.	+6.00
- Maximum Height	m	17.50
- Crest Length	m	120.50
- Crest Width	m	6.0
- Crest High	m	15.50
- U/S Face Slope	-	1:2.5
- D/S Face Slope	-	1:2.0
2. Storage Pond		
- Max Storage	MCM	8.54
- Active Storage	MCM	8.23
- Dead Storage	MCM	0.31
3. Spillway		
- Location	-	Saddle Near Right Abutment
- Type	-	Free Flow Discharge Channel
- Dimensions (Width x Height)	-	25.00x2.00
- Sill Elevation	m MSL.	+22.00
- Design Flood Capacity (Tr 1,000)	cms	104
- Width of Chute	m	25.00
- Energy Dissipater Type	-	Stepped Chute
4. Pump Station		
- Location	-	1. In Pond North of WTP
	-	2. Intake Channel East of WTP
- Type	-	Floating Raft
- Pumping Capacity	Cu.m./day	36,000
- Pumping Head	m.	18.00
5. Water Treatment Plant		
- Location	-	Top of Hill South of Spillway
- Type	-	Conventional
- Capacity	Cu.m./day	36,000

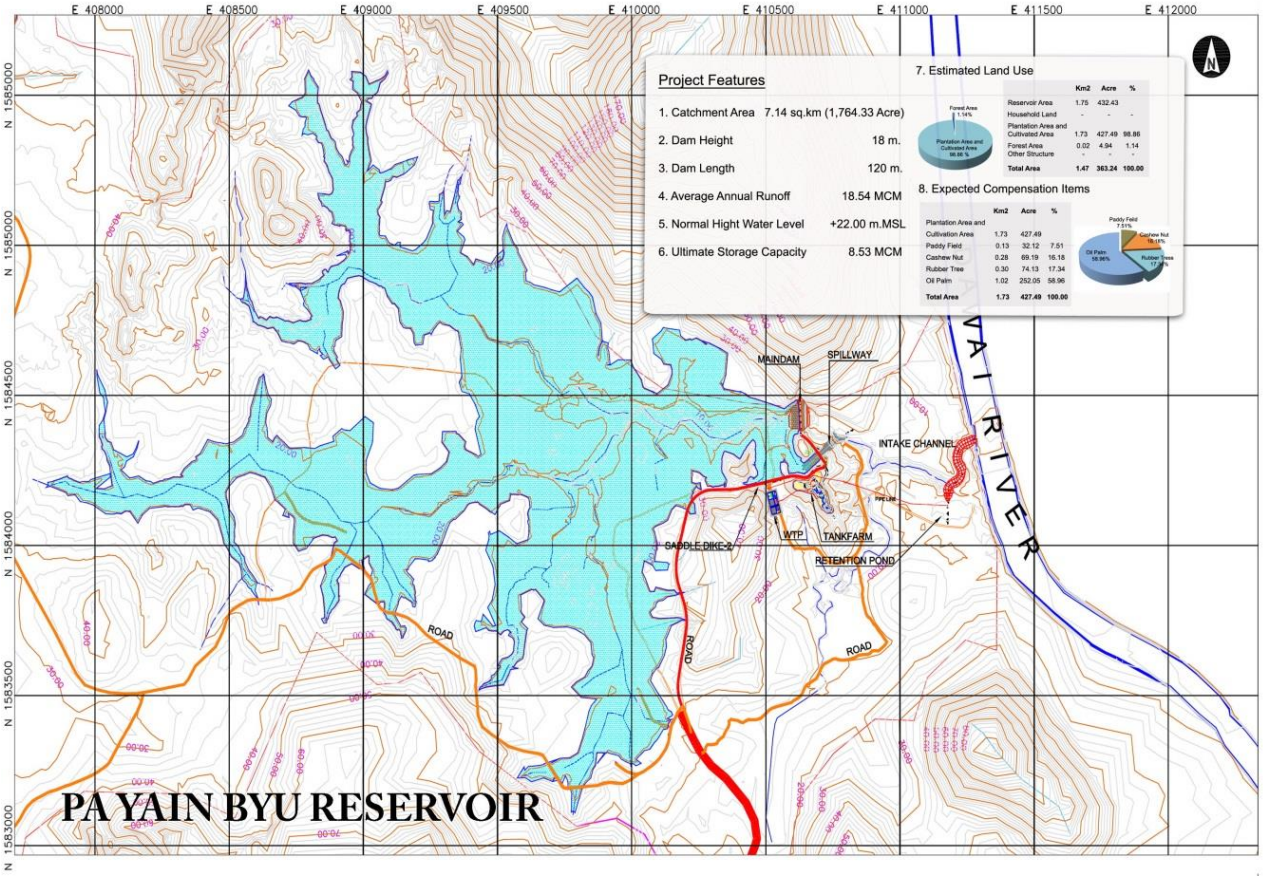

Figure 2.6-1 The Component of Pa Yain Byu Project

2.7 Alternative Project Location

With reference of Union of Myanmar's letter number 4/220 (ka) (5) (8) (1171/2013) issued by Ministry of Agriculture and Irrigation Department, the Republic of the Union of Myanmar, to report the results of investigation the water resources in DSEZ Area and surrounding area to implement the water supply raw water for water demand of Industries Estate, residential area and DSEZ.

The study and observation report was conducted by Deputy Director of Irrigation Department, Dawei Province, Tanintharyi Region, which provided 4 alternative sites in Yebyu Township and 3 sites in Dawei Township.

ITD had studied and investigated all alternative site locations around Yebyu Township and correlative area in DSEZ, for example Heize Reservoir, Karoma Reservoir, Yalai Reservoir, Ka Loat Htar Reservoir, Ekani Reservoir, Pa Yain Byu Reservoir, Dwe Taw and Ai Shey Reservoir and East and West Wet Chaung Reservoir, etc. Besides, we had studied and considered 4 alternatives that are proposed by Irrigation department.

We have to clarify and report the results of study which had submitted the clarification of water resources observation report that is feasible, suitable, economical, or not. As describes on following;

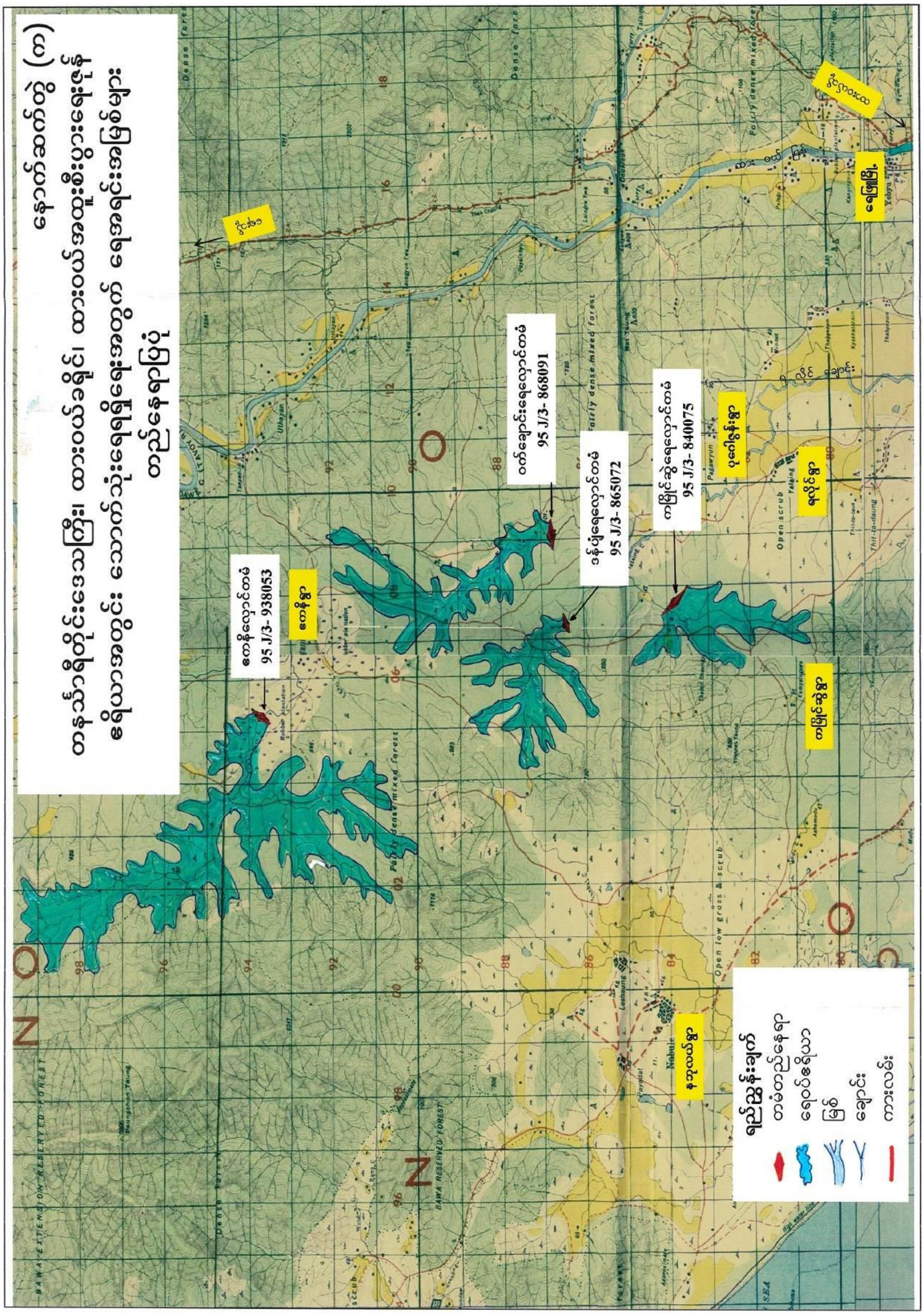

Figure 2.7-1 The study of alternative water resources from Irrigation Department

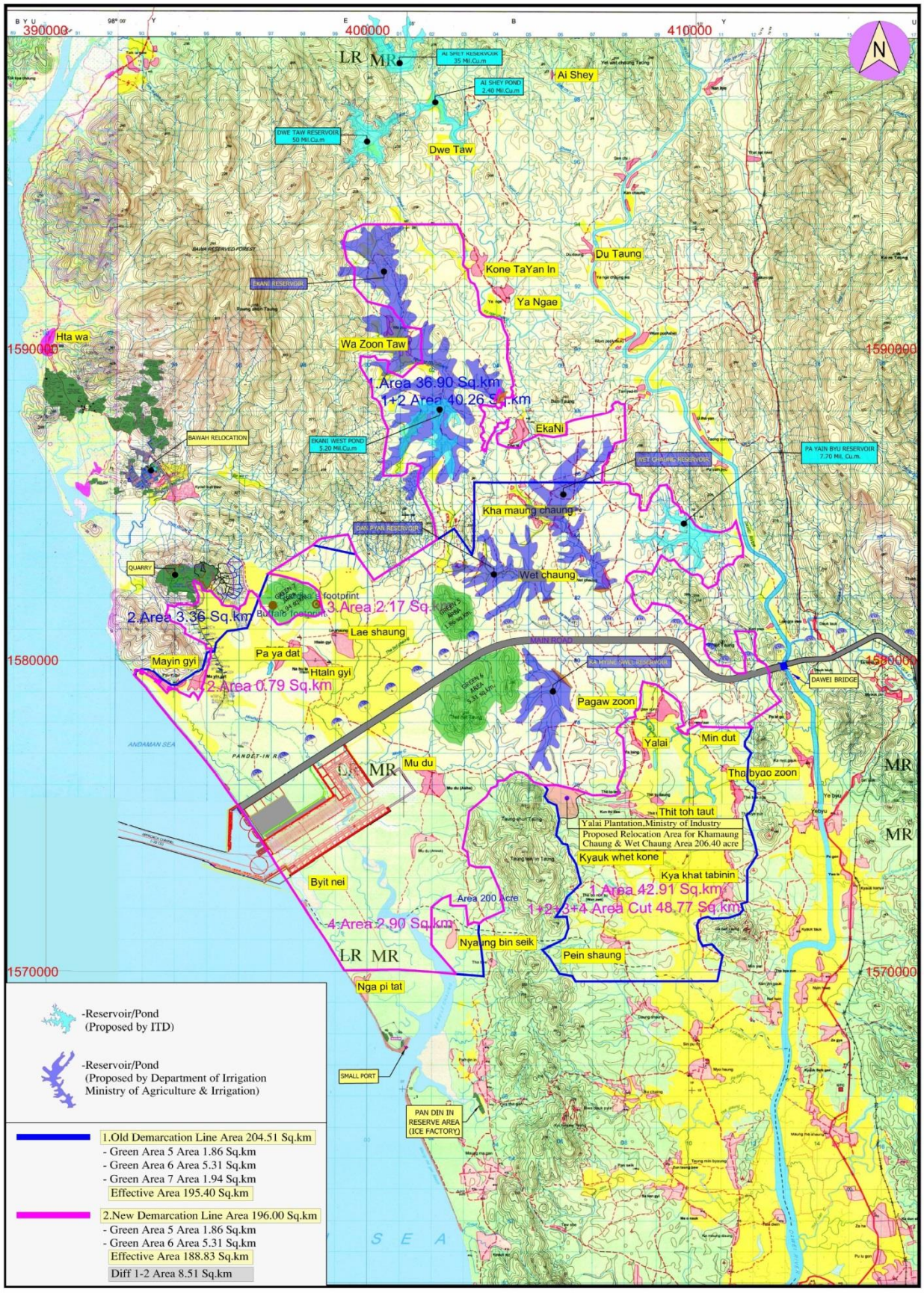

Figure 2.7-2 The Alternative sites inside DSEZ demarcation

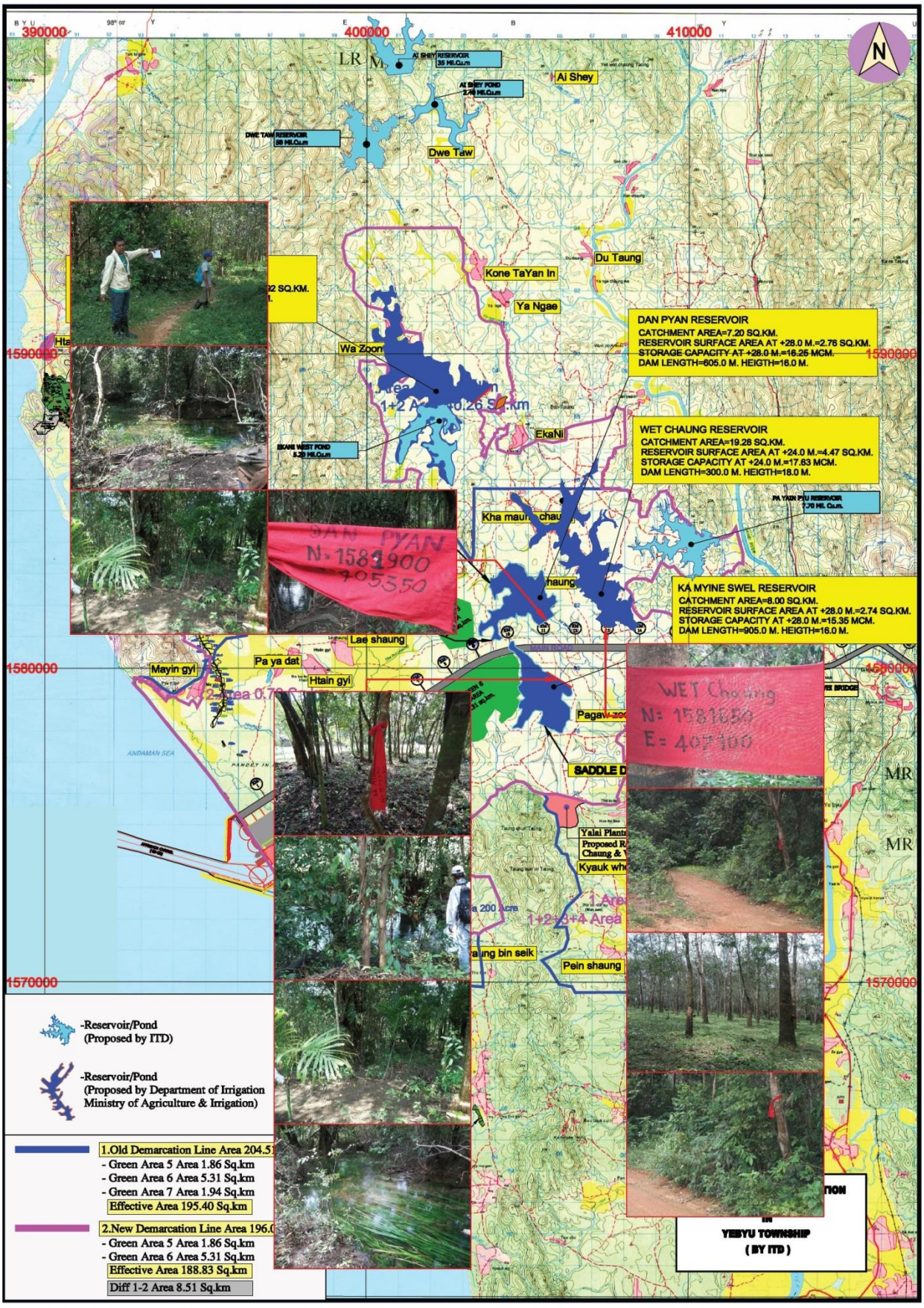

Figure 2.7-3 Existing Site Condition Investigation

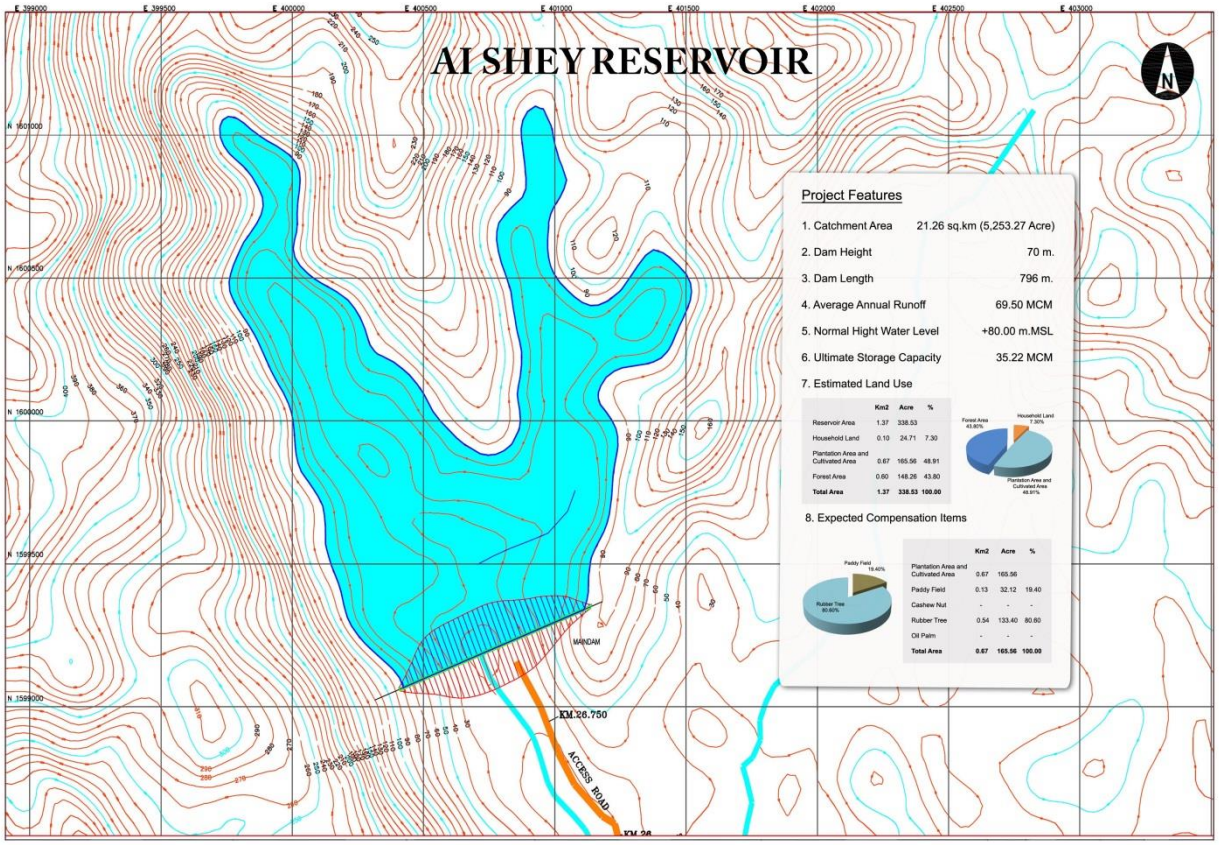

Figure 2.7-4 Feature of Ai Shey Reservoir

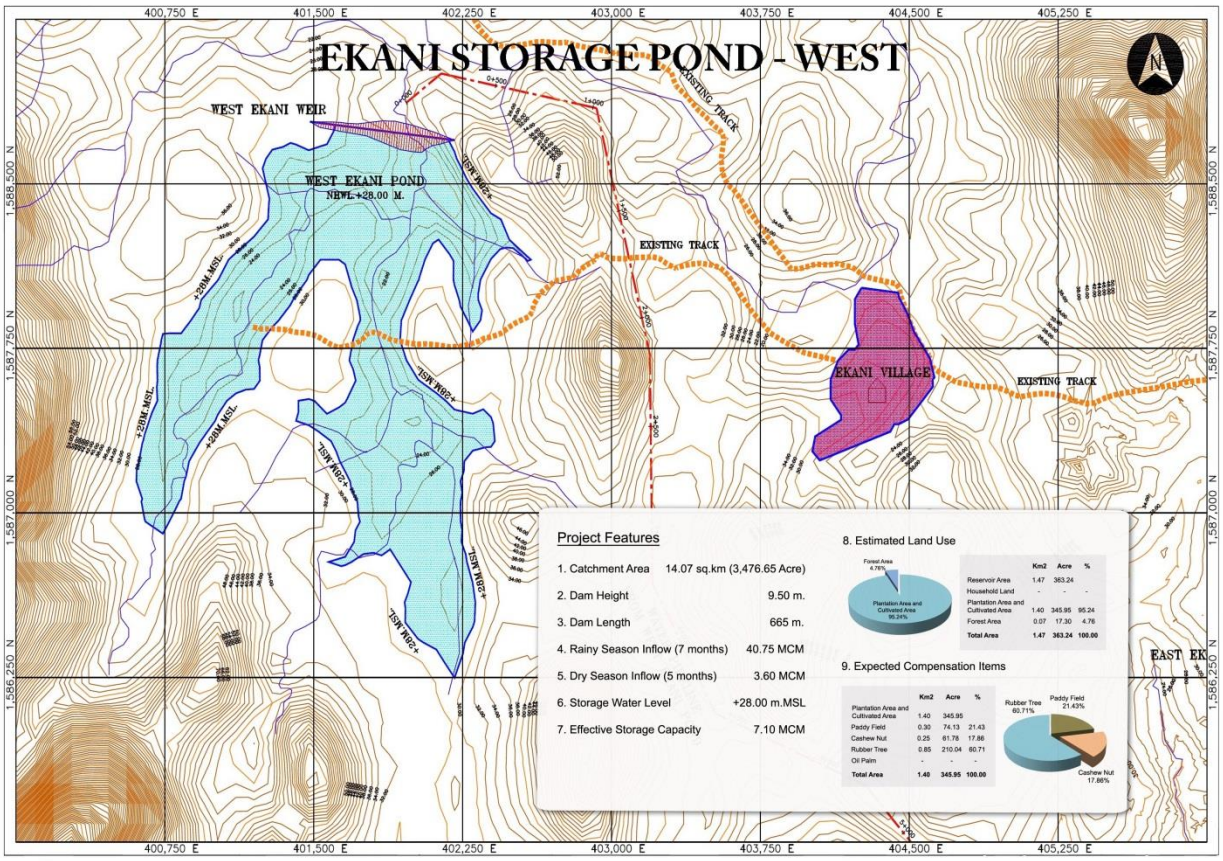

Figure 2.7-5 Feature of Dwe Taw Reservoir

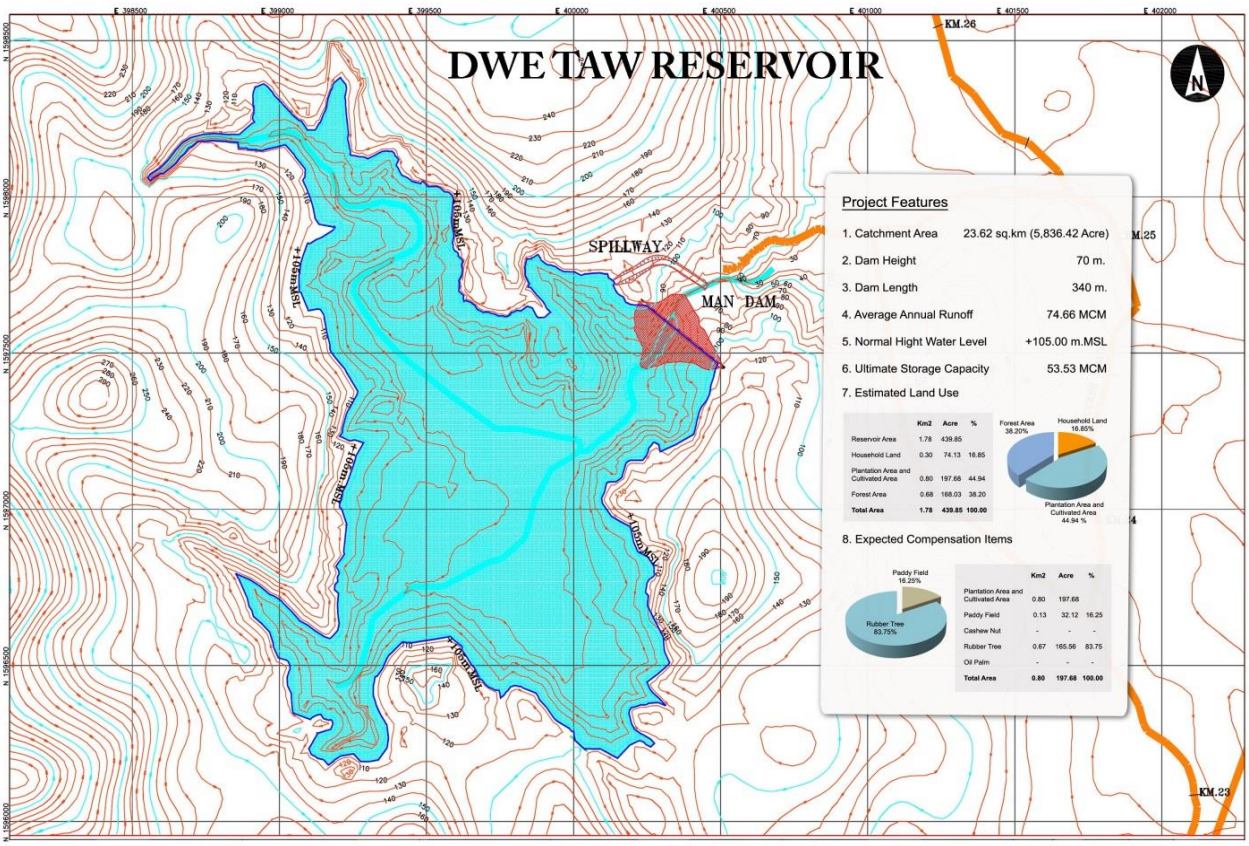

Figure 2.7-6 Feature of Ekani Reservoir

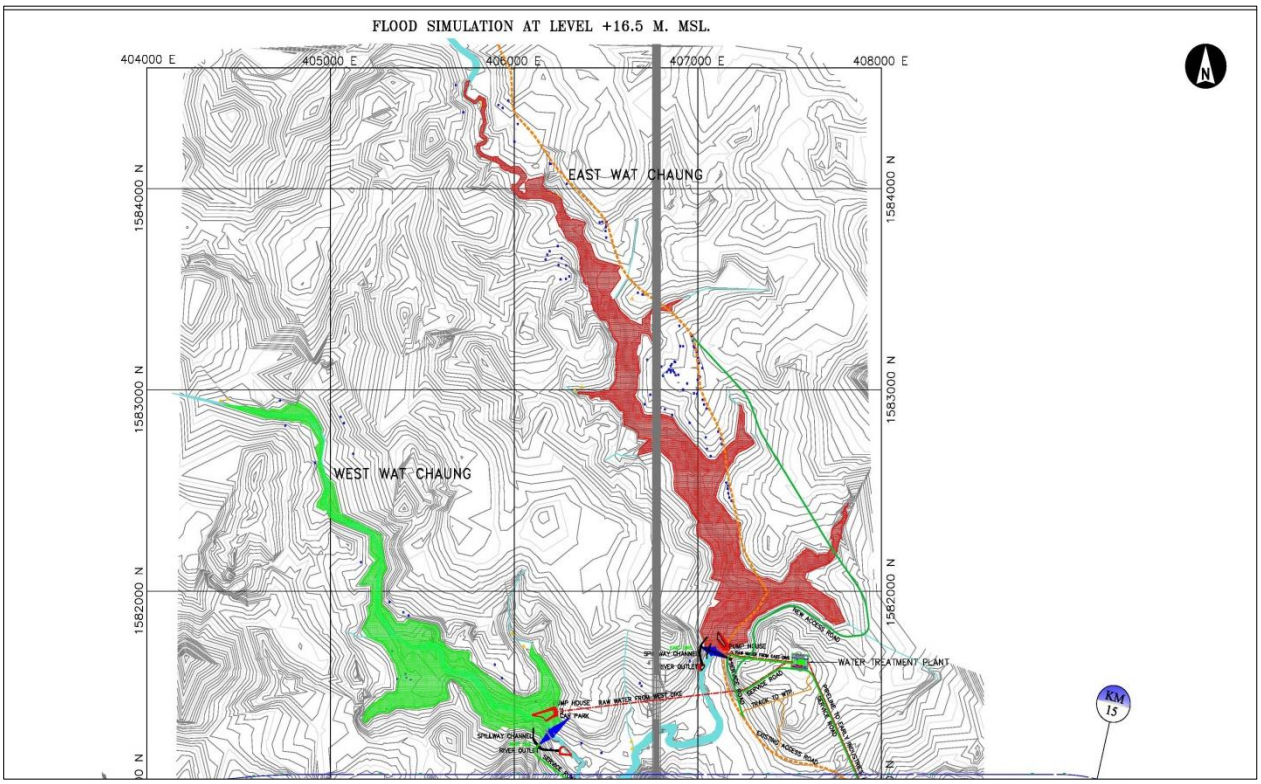

Figure 2.7.7 Feature of East Wat Chuang Reservoir

The 4 alternative reservoirs proposed by Irrigation department for DSEZ Water supply Project have not suitable and feasible site location to supply the water demand for DSEZ. The numbers of monthly shortages occur from November to May with no water storage and have less local inflow. The investment cost of raw water delivery system is costly and not functional. In addition, the construction of 4 proposed reservoirs create the extensive loss of the EIE sellable area, affect to storm drainage design and EIE Phasing development plan

According the above, The Pa Yain Byu Reservoir site has been considered the feasible and suitable water resource more than 5 alternative site location had explored and had studied, as shown on **Figure 2.6-1.**

Chapter 3

POLICY AND LEGAL FRAMEWORK

CHAPTER 3
POLICY AND LEGAL FRAMEWORK

During the course of this study, relevant Acts, Regulations, Policies and Guidelines have been thoroughly reviewed in order to understand the provisions made to integrate the construction and environmental conservation. This study is made on the basis of these policy and legal framework.

3.1 Regional Environmental & Social Safeguards

Three of regional key safeguards that were released in June 2009 by Asian Development Bank, which include:

- Environmental Safeguards;
- Involuntary Resettlement Safeguards;
- Indigenous Peoples Safeguards.

Main purposes of the June-2009 ADB's Safeguards are to:

- Avoid adverse impacts of projects on the environment and affected people, where possible;
- Minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- Help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

a) Environmental Safeguards (2009)

- **Objectives:** To ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.
- **Scope and Triggers:** Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts.
- **Policy Principles:**
  - Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.
  - Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans-boundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.

- Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.

- Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.

- Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.

- Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.

- Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.

- Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.

- Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.
- Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.
- Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.

b) Involuntary Resettlement Safeguards (2009)

- **Objectives:** To avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.
- **Scope & Triggers:** The involuntary resettlement safeguards covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary.
- **Policy Principles:**
  - Screen the project early on to identify past, present, and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.
  - Carry out meaningful consultations with affected persons, host communities, and concerned nongovernment organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in

planning, implementation, and monitoring and evaluation of resettlement programs. Pay particular attention to the needs of vulnerable groups, especially those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the affected persons' concerns. Support the social and cultural institutions of displaced persons and their host population. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.

- Improve, or at least restore, the livelihoods of all displaced persons through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.

- Provide physically and economically displaced persons with needed assistance, including the following: (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially into their host communities, and extension of project benefits to host communities; (ii) transitional support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructure and community services, as required.

- Improve the standards of living of the displaced poor and other vulnerable groups, including women, to at least national minimum standards. In rural areas provide them with legal and affordable access to land and resources, and in urban areas provide them with appropriate income sources and legal and affordable access to adequate housing.

- Develop procedures in a transparent, consistent, and equitable manner if land acquisition is through negotiate settlement to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status.

- Ensure that displaced persons without titles to land or any recognizable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets.

- Prepare a resettlement plan elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.

- Disclose a draft resettlement plan, including documentation of the consultation process in a timely manner, before project appraisal, in an

accessible place and a form and language(s) understandable to affected persons and other stakeholders. Disclose the final resettlement plan and its updates to affected persons and other stakeholders.

- Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project as a stand-alone operation.
- Pay compensation and provide other resettlement entitlements before physical or economic displacement. Implement the resettlement plan under close supervision throughout project implementation.
- Monitor and assess resettlement outcomes, their impacts on the standards of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Disclose monitoring reports.

c) Indigenous Peoples Safeguards (2009)

- **Objectives:** To design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.
- **Scope and Triggers:** The Indigenous Peoples safeguards are triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of Indigenous Peoples or affects the territories or natural or cultural resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (i) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (ii) collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (iii) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and (iv) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law, and any international conventions to which the country is a party will be taken into account. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the project area because of forced severance remains eligible for coverage under this policy.

- **Policy Principles:**
  - Screen early on to determine (i) whether Indigenous Peoples are present in, or have collective attachment to, the project area; and (ii) whether project impacts on Indigenous Peoples are likely.
  - Undertake a culturally appropriate and gender-sensitive social impact assessment or use similar methods to assess potential project impacts, both positive and adverse, on Indigenous Peoples. Give full consideration to options the affected Indigenous Peoples prefer in relation to the provision of project benefits and the design of mitigation measures. Identify social and economic benefits for affected Indigenous Peoples that are culturally appropriate and gender and inter generationally inclusive and develop measures to avoid, minimize, and/or mitigate adverse impacts on Indigenous Peoples.
  - Undertake meaningful consultations with affected Indigenous Peoples communities and concerned Indigenous Peoples organizations to solicit their participation (i) in designing, implementing, and monitoring measures to avoid adverse impacts or, when avoidance is not possible, to minimize, mitigate, or compensate for such effects; and (ii) in tailoring project benefits for affected Indigenous Peoples communities in a culturally appropriate manner. To enhance Indigenous Peoples' active participation, projects affecting them will provide for culturally appropriate and gender inclusive capacity development. Establish a culturally appropriate and gender inclusive grievance mechanism to receive and facilitate resolution of the Indigenous Peoples' concerns.
  - Ascertain the consent of affected Indigenous Peoples communities to the following project activities: (i) commercial development of the cultural resources and knowledge of Indigenous Peoples; (ii) physical displacement from traditional or customary lands; and (iii) commercial development of natural resources within customary lands under use that would impact the livelihoods or the cultural, ceremonial, or spiritual uses that define the identity and community of Indigenous Peoples. For the purposes of policy application, the consent of affected Indigenous Peoples communities refers to a collective expression by the affected Indigenous Peoples communities, through individuals and/or their recognized representatives, of broad community support for such project activities. Broad community support may exist even if some individuals or groups object to the project activities.
  - Avoid, to the maximum extent possible, any restricted access to and physical displacement from protected areas and natural resources. Where avoidance is not possible, ensure that the affected Indigenous Peoples communities participate in the design, implementation, and monitoring and evaluation of management arrangements for such areas and natural resources and that their benefits are equitably shared.

- Prepare an Indigenous Peoples Plan (IPP) that is based on the social impact assessment with the assistance of qualified and experienced experts and that draw on indigenous knowledge and participation by the affected Indigenous Peoples communities. The IPP includes a framework for continued consultation with the affected Indigenous Peoples communities during project implementation; specifies measures to ensure that Indigenous Peoples receive culturally appropriate benefits; identifies measures to avoid, minimize, mitigate, or compensate for any adverse project impacts; and includes culturally appropriate grievance procedures, monitoring and evaluation arrangements, and a budget and time-bound actions for implementing the planned measures.

- Disclose a draft IPP, including documentation of the consultation process and the results of the social impact assessment in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected Indigenous Peoples communities and other stakeholders. The final IPP and its updates will also be disclosed to the affected Indigenous Peoples communities and other stakeholders.

- Prepare an action plan for legal recognition of customary rights to lands and territories or ancestral domains when the project involves (i) activities that are contingent on establishing legally recognized rights to lands and territories that Indigenous Peoples have traditionally owned or customarily used or occupied, or (ii) involuntary acquisition of such lands.

- Monitor implementation of the IPP using qualified and experienced experts; adopt a participatory monitoring approach, wherever possible; and assess whether the IPP's objective and desired outcome have been achieved, taking into account the baseline conditions and the results of IPP monitoring. Disclose monitoring reports.

3.2 Environmental & Social Policy Framework in Myanmar

3.2.1 Environmental Legislation & Policy Framework

A) Environmental Conservation Law (ECL 2012) and Environmental Conservation Rules (ECR 2014)

Myanmar has updated and enforced environmental policy and legislation commitment to a development path that is economically strong, but also socially and environmentally sustainable for its citizens. The Framework for Economic and Social Reform (FESR 2013) and the National Comprehensive Development Plan (NCDP 2011-2030) express this vision.

The Environmental Conservation Law (ECL 2012) and Rules (ECR 2014) both have implications for domestic and foreign investors in Myanmar. Article 7 of the ECL states the duties and powers of the Ministry of Environmental Conservation and Forestry (MOECAF), which include:

- Prescribing environmental quality standards on emissions, effluents, solid waste, production procedures, processes and products

- Facilitating the settlement of environmental disputes
- Specifying categories and classes of hazardous wastes generated from the production and use of chemicals or other hazardous substances used in industry, agriculture, mineral production, sanitation and other activities;
- Prescribing categories of hazardous substances that may significantly affect the environment;
- Prescribing the terms and conditions for effluent treatment in industrial estates, buildings, and other sites and emissions of machines, vehicles and mechanisms;
- Developing and implementing a system of environmental impact assessment (EIA) and social impact assessment (SIA);
- Enforcing compensation by polluters for environmental impacts; collecting funds from organizations which benefit from natural ecosystems and revenues from businesses which explore, trade and use natural resources, in order to support environmental conservation works;

The ECL Chapter 10 "Prior Permission," Articles 21-25, describes that MOECAF, with the approval of the Union Government, can stipulate categories of business, work-sites, factories, or workshops which cause environmental impacts to require "prior permission."

The ECR, Chapter 12 "Prior Permission, Articles 62-68 further describes "Prior Permission."

In 2015, Myanmar passed National Environmental Quality (Emission) Guidelines and Environmental Impact Assessment (EIA) procedure. The conditions may be attached to existing investments, in order for them to comply with Myanmar's evolving environmental regulations. The Environmental Conservation Department (ECD) can provide additional information to investors who are unsure if they must meet specific environmental requirements.

ECD has been working with other ministries to test the new EIA system. ECD has provided support, guidance, and review for environmental assessments of more than 123 investment projects. This includes 40 projects by the end of 2014—mostly in energy, infrastructure, and manufacturing.

Since the Pa Yain Byu Reservoir is a small project that requires an Initial Environmental Examination (IEE), an IEE is the initial process which studies whether or not the potential impacts of a project, business or activity will be significant, and whether or not it is necessary to carry out an environmental impact assessment, or to prepare and submit other stipulated documents. [Legal Reference: Environmental Conservation Rule (ECR 2014) (Article 2f)].

The *National Environment Policy of Myanmar 1994* is the basis of Myanmar's environmental statutory framework. This is supported by the Myanmar Constitution (2008) that empowers Government to conserve Myanmar's natural environment and enables Parliament to enact environmental laws. Accordingly, *the Ministry of Natural Resources and Environmental Conservation (MoNREC) ha*s recently enacted the *Environmental Conservation Law 2012* and is charged with assessing compliance. ***(Figure 3.2-1)***

The Environmental Conservation Law (ECL 2012) is based on the "polluter pays principle", with compensation for environmental impacts to be paid to a fund to be set up by the *MoNREC*. In addition to the framework Environmental Conservation Law, there are several laws with some form of obligations on operators in respect of pollution, disposal, and other harmful impacts on the environment and local society.

Chapter 2: Objectives

- (c) To enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;
- (d) To reclaim ecosystems as may be possible which are starting to degenerate and disappear;
- (e) To enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;

Chapter 4: Duties and Powers relating to the Environmental Conservation of the Ministry

The following provisions of Duties and Powers relating to the Environmental Conservation of the Ministry are stipulated in EC Law Section 7

- (g) To specify categories and classes of hazardous wastes generated from the production and use of chemicals or other hazardous substances in carrying out industry, agriculture, mineral production, sanitation and other activities;
- (d) To prescribe categories of hazardous substances that may affect significantly at present or in the long run on the environment;
- (i) To promote and carry out the establishment of necessary factories and stations for the treatment of solid wastes, effluents and emissions which contain toxic and hazardous substances;
- (j) To prescribe the terms and conditions relating to effluent treatment in industrial estates and other necessary places and buildings and emissions of machines, vehicles and mechanisms;
- (n) To lay down and carry out a system of EIA and SIA as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause a significant impact on the environment;
- (o) To manage to cause the polluter to compensate for environmental impact, cause to contribute fund by the organizations which obtain benefit from the natural environmental service system, cause to contribute a part of the benefit from the businesses which explore, trade and use the natural resources in environmental conservation works.

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Section 13. The Ministry shall, under the guidance of the Committee, maintain a comprehensive monitoring system and implement by itself or in co-ordination with relevant Government departments and organizations in the following matters:

- (a) The use of agro-chemicals which cause to impact on the environment significantly;
- (b) Transport, storage, use, treatment and disposal of pollutants and hazardous substances in industries;
- (c) Disposal of wastes which come out from exploration, production and treatment of minerals, industrial mineral raw materials and gems;
- (d) Carrying out waste disposal and sanitation works;

- (e) Carrying out development and constructions;
- (f) Carrying out other necessary matters relating to environmental pollution.
- Section 14. A person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.
- Section 15. The owner or occupier of any business, material or place which causes a point source of pollution shall 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 shall be arranged to dispose the wastes in accord with environmentally sound methods.
- Section 16. A person or organization operating business in the industrial estate or business in the SEZ or category of business stipulated by the Ministry: (a) is responsible to carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste; (b) shall contribute the stipulated users' charges or management fees for the environmental conservation according to the relevant industrial estate, SEZ and business organization; (c) shall comply with the directives issued for environmental conservation according to the relevant industrial estate, SEZ or business.

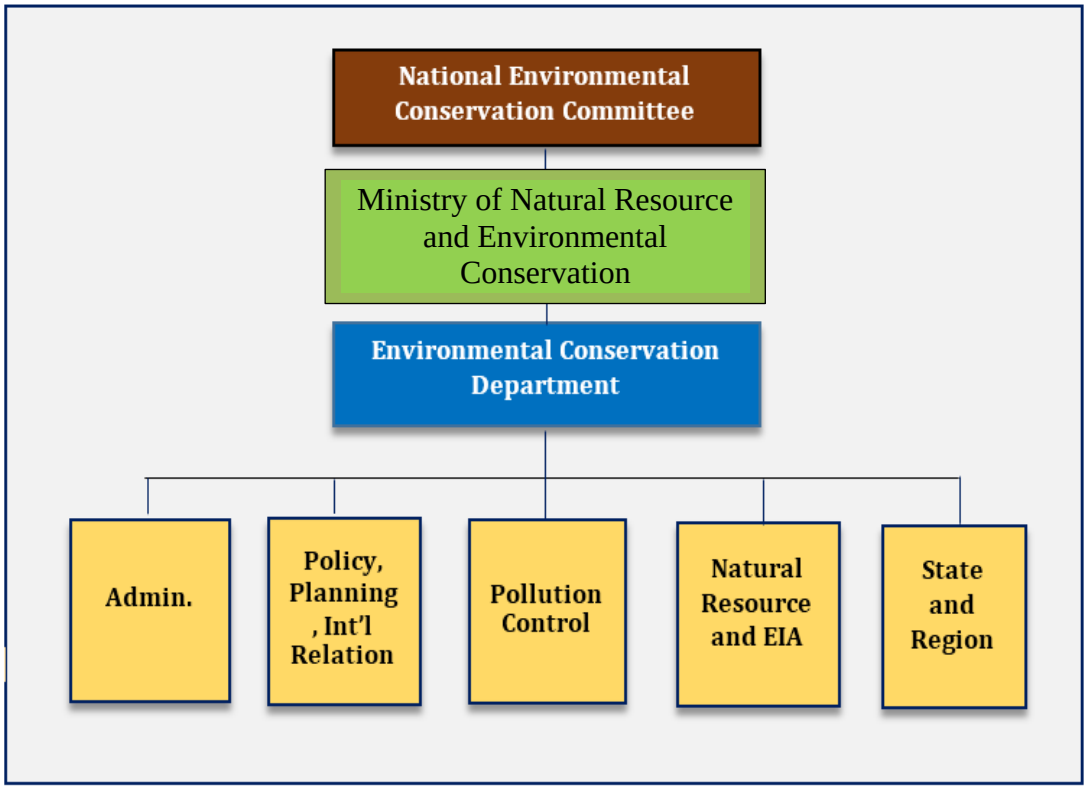


Figure 3.2-1: Myanmar National Environmental Conservation Organization Chart

B. Laws on Protection and Preservation of Antique Objects and Buildings

In 2015, the Government of Myanmar enacted two laws to protect cultural heritage of antiques and buildings that are more than 100 years old and have "historic, cultural, artistic, antique or archaeological value". These two laws include:

- Law Nº 43/15, The Law Protecting the Antique Objects enacted on 22 July 2015; and
- Law Nº 51/15, The Law Protecting the Antique Buildings enacted on 26 August 2015.

C. The IEE Approval Process – Addressed in the EIA Procedure (2015)

3.2.2 Social Policy Framework

A. Land acquisition and Resettlement Procedures

It was confirmed that the most of lands to be acquired for the Project are categorized as agricultural land. In order to acquire agricultural land to use for public purpose, two main steps are required. First, the project owner has to get approval from land record department at relevant township for conversion of land from agricultural land to other purposes. Secondly, the project owner has to set compensation price in consulting with compensation committee organized by general administrated department at relevant township. The following is the summery of these procedures.

B. Conversion of Agricultural Land

According to the Article 29 – 30 in Chapter X of the Farmland Law, 2012, application for use of farmlands by other means are permitted for the sake of long-term national interests and planning projects as proposed by Nay Pyi Taw Council or region / state governments or by concerned Union Ministries. The application must be submitted to Union Government with comments given by Central Farmland Management Committee. Only when the approval is received from the Union Government, the project shall be implemented accordingly. The detailed requirements and regulations are shown in Articles 78 – 94 of Chapter IX in Farmland Rules (2012).

As stated in the Article 80, in case of that if farmlands are required to be used for construction projects which are necessarily related to rural and urban development, such as schools, hospital, dispensary, library, street, bridge, rural market, religious building, cemetery and other necessary buildings, the following requirements should be met with application of the use of lands by other means. (a) If it is for school, the approval of Union education ministry and availability of fund. (b) If it is for healthcare unit such as hospital or dispensary, the approval of union health ministry and availability of fund. (c) If it is for religious building, the approval of union ministry of religious affairs, and availability of fund. (d) If it is for other matters, the approval of concerned union ministry and availability fund.

The procedures and steps of the application as shown in the Articles 82 – 90 of the Farmland Rules (2012) are here presented in ***Table 3.2-1*** for more clarification.

Table 3.2-1: The Farmland Application Process

Step No.	Procedures	Concerning Department	Process	Further Action	Time Taken
1	Application with Form -14	Township Land Records Department (TLRD)	Open the dossier for using farmlands by other means on the application	Scrutinizing the requirements as listed in the Article 84 of the Rules	Within 30 days starting from the acceptance date of application
2	Submitting the application to Township Farmland Management Committee with the comments given by TLRD	Township Farmland Management Committee (TFMC)	Scrutinizing the requirements as listed in the Article 86 of the Rules	the application shall be submitted to Region / State Farmland Management Committee through the District Farmland Management Committee with the comments	Within 15 days starting from the acceptance date of the application in TLRD
3	If the application of farmlands by other means is for Paddy land (Le)	Region / State Farmland Management Committee (R/S - FMC)	Scrutinizing the application	Continued Submission of the application to Central Farmland Management Committee with the comments given by the Region / State Farmland Management Committee	Within 30 days
4	If the application of farmlands by other means is except Paddy land	Region / State Farmland Management Committee	Scrutinizing the application which has been passed by step by step	Continued submission of the application to Region / State Government with the comment given by Region / State Farmland Management Committee	Within 30 days
5	Issuing Form - 15 Approved Permit shall be issued for the Paddy lands (Le) which are to be used by other means	Central Farmland Management Committee (CFMC)	If the application is met with the requirements, the approval shall be issued regarding to the Article 87 (a)		

Step No.	Procedures	Concerning Department	Process	Further Action	Time Taken
6	*Issuing Form – 15 A* Approved Permit shall be issued for the except Paddy lands which are to be used by other means	Region / State Farmland Management Committee	If the application is met with the requirements, the approval shall be issued regarding to the Article 87 (b)		
Total time taken for the whole application process until the approval for the use of farmlands by other means					*105 days*
7	Form – 16 Inspection Report on condition of implementations in the granted farmlands for other means, The report is to be submitted in every 6-months basis to Central Farmland Management Committee	Region / State Farmland Management Committee	Field inspections shall be done by DFMC and TFMC into the granted farmlands by using other means. The inspection reports with the photo documents shall be presented to R/S-FMC	If the DFMC and TFMC find that the granted lands is not yet started utilizing by other means or the proposed project is not yet implemented within 6 months from the date of approval, the case shall be opened as a separate dossier, then the report shall be submitted with photo evidences to Region / State Farmland Management Committee 8. Presenting the case to Central Farmland Management Committee	Within 6 months
8	Presenting the case to Central Farmland Management Committee for necessary actions to be taken	Central Farmland Management Committee (CFMC)	Upon receiving the case, CFMC shall analyze and scrutinize the case	After scrutinizing the case, the necessary actions shall be taken as shown in the Article 93.	
9	Confiscate the land	Central Farmland Management Committee (CFMC)	CFMC shall confiscate the land as it is revoked under rule (93) (a) or the land revoked by Region / State Government as it is informed under sub rule (b).		

Source: SEM (2014)

C. Setting-Up Compensation Price

After obtaining the approval of conversion for the proposed project land from the land record department at relevant township the project owner draft compensation price for the land in consulting with relevant village heads and affected peoples. Then the project owner makes a request to general administrated department at relevant township for organizing a compensation committee in order to scrutinize the drafted compensation price. In general, compensation committee is comprised of project owner, land record department, police officer, agriculture and irrigation department, conservation environment and forestry department and general administrated department at the relevant township.

After the compensation price was finalized at compensation committee, the project owner shall pay the compensation to affected peoples. In case affected people is not satisfied the compensation price, he/she can appeal to the compensation committee to reconsider the price.

There is no such adequate laws and rules related to construction activities in Myanmar especially for rules and regulations of Health, Safety, and Environment (HSE). As stated earlier in this report that the project proponent and/or the operator are most responsible to follow the existing international guidelines such as ADB or World Bank (IFC) etc. "The *MoNREC* recommends the environmental service companies to follow and adhere to the world known environmental standards e.g. the Asia Development Bank (ADB) and International Finance Corporation (IFC)**.**

D. Legal framework related to Occupational Health & Safety

In Myanmar, the law relating to factory workers is Factories Act 1951. It provides requirements concerning with working hours, working days, overtime, and certain health and safety measures. The following is a summary but not detail. Detail may be some different.

- **Working Hours** - Normal working hour is 8 hours a day and 44 hours/ 40 hours/ 48 hours a week. A worker is entitled to minimum thirty minute rest period after working continuously for five hours.
- **Working Days** - Working days may be up to six days a week (Remark: For government services, 5 days a week)
- **Overtime** - Overtime is permissible. It pay is twice the normal pay rate. And other rights can also get.
- **Safety & Health** - The employer has an obligation to protect workers from occupational hazards relating to the physical facilities, harmful substances, and environment factors at the workplace.
- The employer has other obligations, depending on the number of workers employed.
- The workers can also get other rights in accordance with Leave and Holidays Act, (1951), Social Security Act (1954) and the Worker's Compensation Act (1923).

For example,

- How many leaves with salary can get for a male or female worker?
- How many holidays can get for a worker?
- How much compensations can get for a worker?

In this factory worker field, Oilfield workers and Mine workers are also involved. There are also other rights for them and it may be a little different with other field of factory workers.

3.3 Other Environmental Related Legislation

Listed below are other statutory policies, laws and regulations in Myanmar that considered related to the environmental issues (**Table 3.3-1**).

Table 3.3-1: Other Myanmar Policies, Laws & Regulations Related to Environment

Sector	Laws & Regulation
Finance & Revenue	1) The Myanmar Insurance Law, 1993 2) The State Law and Order Restoration Council (The Law amending the financial institutions of Myanmar Law, 1994)
Forestry	3) The Protection of Wild Life and Wild Plants and Conversation on Natural Areas Law, 1994 4) The Forest Law, 1992
Health	5) The National Food Law, 1997 6) The Traditional Drug Law, 1996 7) The Prevention and Control of Communicable 8) Diseases Law, 1995 9) The National Drug Law, 1992 10) The Union of Myanmar Public Health Law, 1972
Hotels & Tourism	11) The Myanmar Hotel and Tourism Law, 1993
Industrial	12) The Private Industrial Enterprise Law, 1990 13) The Factorial Act, 1951 14) The Oilfield (Workers and Welfare) Act, 1951 15) The Petroleum Act, 1934 16) The Oilfield Act, 1918
Livestock & Fisheries	17) The Animal Health and Development Law, 1993 18) The Freshwater Fisheries Law, 1992 19) The Myanmar Marine Fisheries Law, 1990 (The Law Amending the Myanmar Marine Fisheries Law, 1993) 20) The Law Relating to Aquaculture, 1989 21) The Law Relating to the Fishing Right of Foreign Fishing Vessels, 1989 (The Law Amending the Law Relating to the Fishing Rights of Foreign Fishing Vessels, 1993
Mining	22) The Myanmar Gemstone Law, 1995 23) The Myanmar Pearl Law, 1995 24) The Myanmar Mines Law, 1994 25) The Salt Enterprise Law, 1992 26) The Land Acquisition (Mines) Act, 1885
Science & Technology	27) The Science and Technology Development Law, 1994
Transportation	28) The Highways Law, 2000 29) The Motor Vehicles Law, 1964 (The Law Amending the Motor Vehicles Law of 1964 enacted in 1989) 30) The Myanmar Aircraft Act, 1934 31) The Island Steam Vessels Act, 1917 32) The Ports Act, 1908 33) The Defile Traffic Act, 1905 34) The Yangon Port Act, 1905 35) The Canal Act, 1905 36) The Obstruction in Fairways Act, 1881
Electricity	37) The State Law and Order Restoration Council (The Law Amending the Electricity Law, 1990)
Air Quality	38) National Environmental Quality (Emission) Guidelines

3.4 Myanmar's International Commitments

The International and regional treaties concerning the environment to which Myanmar is a party (in chronological order) can be listed as follows:

- Plant Protection Agreement for the Southeast Asia and Pacific Region
- Treaty Banning Nuclear Weapons Tests in the Atmosphere in Outer Space and Under Water
- Outer Space Treaty: Treaty on Principles Governing the Activities of States in the Exploitation and Use of Outer Space including the Moon and other Celestial Bodies
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and Ocean Floor and in the Subsoil there of (Seabed Treaty)
- Convention on the Prohibition of the Development, Production and
- Stockpiling of Bacteriological and Toxin Weapons, and their Destruction
- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer
- MARPOL: International Convention for the Prevention of Pollution from Ships
- MARPOL: International Convention for the Prevention of Pollution from Ships as amended 1978
- Agreement on the Networks of Aquaculture Centers in Asia and the Pacific Region
- London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer
- United Nations Framework Convention on Climate Change
- Treaty on the Non-Proliferation of Nuclear Weapons
- ICAO: ANNEX 16 Annex to the Convention on International Civil Aviation
- Environmental Protection Vol. I, II, Aircraft Noise
- United Nations Convention to Combat Desertification
- Vienna Convention for the Protection of Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer
- London Amendment to the Montreal Protocol
- Convention Concerning the Protection of the World Cultural and Natural Heritage
- Convention on Biological Diversity
- United Nations Convention on the Law of the Sea
- International Tropical Timber Agreement
- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- ASEAN Agreement on the Conservation of Nature and Natural Resources
- Catagena Protocol on Biosafety
- ASEAN Agreement on Transboundary Haze Pollution
- Kyoto Protocol to the United Nations Framework Convention on Climate Change
- Convention on the Prohibition of the Development, Production, and
- Stockpiling and Use of Chemical Weapons and on their Destruction
- Stockholm Convention on Persistent Organic Pollutants
- Ramsar Convention on Wetlands
- Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer.

3.5 Environmental Quality Standard

The Environmental Quality standards are complying with the Myanmar National Environmental Standards (2015), and the regional and global environmental standards.

3.5.1 Ambient Air Quality

In good practice, the ambient air quality will be in line with Asia countries and IFC as provided in **Table 3.5-1.**

Table 3.5-1: Ambient Air Quality Standard in South-east Asia, Japan and IFC

Parameter	Guideline Values				
SO_2	10 min	-	-	-	0.5mg/m^3
	1hour	0.1ppm	0.3ppm	0.35mg/m^3	0.125mg/m3(InterimTarget-1) 0.05mg/m3(InterimTarget-2) 0.02mg/m3(Guideline)
	24hours	0.04ppm	0.12ppm	0.125 mg/m^3	-
	1 year	-		0.05mg/m^3	-
NO_2	1hour	-	0.17ppm	-	0.2mg/m3
	24hours	0.04-0.06ppm	-	-	-
	1 year	-	0.03ppm	-	0.04mg/m3
NOx	1hour	-	-	0.2mg/m^3	
	24hours	-	-	0.04mg/m^3	
CO	1hour	--	30ppm	30mg/m^3	-
	8hours	20ppm	-	10mg/m^3	-
	24hours	10ppm	9ppm	-	-
TSP	1hour	-	-	0.3mg/m^3	-
	24hours	-	0.33mg/m^3	0.2mg/m^3	-
	1 year		0.10mg/m^3	0.14mg/m^3	-
PM_{10}	24hours	-	0.12mg/m^3	0.15mg/m^3	0.15mg/m^3(InterimTarget-1) 0.10mg/m^3(InterimTarget-2) 0.07mg/m^3(InterimTarget-3) 0.05mg/m^3(Guideline)
	1 year	-	0.05mg/m^3	0.05mg/m^3	0.07mg/m^3(InterimTarget-1) 0.05mg/m^3(InterimTarget-2) 0.03mg/m^3(InterimTarget-3) 0.02mg/m^3(Guideline)
SPM	1hour	0.2mg/m^3	-	-	-
	24hours	0.1mg/m^3	-	-	-
	24hours	0.035mg/m^3	0.05mg/m^3	-	0.075mg/m^3(InterimTarget-1) 0.05mg/m^3(InterimTarget-2) 0.0375mg/m^3(InterimTarget-3) 0.025mg/m^3(Guideline)
	1 year	0.015mg/m^3	0.025mg/m^3	-	0.035mg/m3(InterimTarget-1) 0.025mg/m3(InterimTarget-2) 0.015mg/m3(InterimTarget-3) 0.01mg/m3(Guideline)
$PM_{2.5}$	1hour	-	0.10ppm	0.3mg/m^3	-
Ozone	8hourdaily maximum	-	0.07ppm	0.2mg/m^3	0.16mg/m^3(InterimTarget-1) 0.1mg/m^3(Guideline)
	1 year	-	0.04ppm	0.14mg/m^3	-
Ox	1hour	0.06ppm	-	-	-
Pb	24hours	-	-	0.0015mg/m^3	
	1 month	-	0.0015mg/m^3	-	
	1 year	-	-	0.0005mg/m^3	

Sources: 1/ NotificationsofNationalEnvironmentalBoardNo.10, 24, 28, 33, and 36, Ministry of Natural Resources and Environment
2/ Thailand National Ambient Air Quality Standard (TCVN5973:2005), Ministry of Science and Technology in Vietnam
3/ Environmental, Health, and Safety Guidelines, General EHS Guidelines, IFC, 2007
4/ National Air Quality Standard in Japan (CircularNo.25, 1973, originally), Ministry of Environment, Japan

3.5.2 Noise Level

1) Construction Phase

Currently, there is no noise standard of construction activities to receptors in Myanmar. Therefore, the target noise level at construction stage is set based on the standard in the other foreign countries. ***Table 3.5-2*** shows noise standard at construction stage in the other countries. In the south-east Asia countries, only Singapore has the noise standard of construction activities to receptors categorized as quiet area, residential area, and the other areas. Thus target noise level is set with following the standard in Singapore.

2) Operation Phase

Currently, there is no ambient noise standard to receptors in Myanmar. On the other hands, most of the countries in south-east Asia as well as in Japan have the ambient noise standard to receptors categorized land use or requirement of quiet as shown in ***Table 3.5-3***. International standard is also available in the EHS Guidelines prepared by IFC. On the basis of the existing standards in other countries, target noise level is set with following consideration and target ambient noise level.

Table 3.5-2: Noise Level Standard at Construction

Items	Guideline Values	
	Day time (Leq)	Night time (Leq)
Using heavy equipment with high noise level (piling, excavating etc.)	85 dB (Maximum)	-
Hospitals, schools, institutions of higher learning, homes for the aged sick, etc.	60 dB (7am – 7pm, 12hrs)	50 dB (7pm – 7am, 12hrs)
Residential buildings located less than 150mfrom the construction site where the noise is being emitted	75 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
Other Buildings	75 dB (7am – 7pm, 12hrs)	65 dB (7pm – 7am, 12hrs)
In rural, suburban and urban areas away from main road traffic and industrial noise.	70 dB (8:00-18:00)	-
Urban areas near main roads	72 dB (8:00-18:00) -	-
Residential	80 dB (8hrs)	70 dB (8hrs)
Commercial	85 dB (8hrs)	85 dB (8hrs)
Urban Area with high ambient noise level(>65 dB)	Ambient Noise Level +10dB	

Table 3.5-3: Ambient Noise Standard at Operation Stage in South-East Countries

Items	Guideline Values	
	Day time (Leq)	Night time (Leq)
Noise standard for sensitive areas such as residences hospitals, schools and places of religious worships	55 dB	
Noise standard for office and commercial	65 dB	
Noise standard for commercial and service	70 dB	
Sensitive Areas/ Low Density Residential Areas	55 dB (7am – 10pm,15hrs)	50 dB (10pm – 7am, 9hrs)
Sub Urban Residential	60 dB (7am – 10pm, 15hrs)	55 dB (10pm – 7am, 9hrs)
Urban Residential	65 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
Commercial and Business	70 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
Sensitive Areas	60 dB (7am – 7pm, 12hrs)	50 dB (10pm – 7am, 9hrs)
Residential Areas	65 dB (7am – 7pm, 12hrs)	55 dB (10pm – 7am, 9hr)
Commercial Areas	70 dB (7am – 7pm, 12hrs)	65 dB (7pm – 10pm, 3hr) 60 dB (10pm – 7am, 9hr)
Noise standard	70 dB (24hrs)	
Sensitive Area (Class AA)	50 dB (6am – 10pm, 16hrs)	40 dB (10pm – 6pm, 8hrs)
Residential Area (Class A and Class B)	55 dB (6am – 10pm, 16hrs)	45 dB (10pm – 6pm, 8hrs)
Commercial and Industrial Area (Class C)	60 dB (6am – 10pm, 16hrs)	50 dB (10pm – 6pm, 8hrs)
Residential; institutional, educational	55 dB (7am – 10pm, 15hrs)	45 dB (10pm – 7am, 9hrs)
Industrial; commercial	70 dB (7am – 10pm, 15hrs)	70 dB (10pm – 7am, 9hrs)

Source: Noise Standard in Indonesia (KEP-48/MENLH/11/1996)
Effect of Traffic Noise on Sleep: A Case Study in Serdang Raya, Selangor, Malaysia, Environment Asia, 2010
Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)
Notification of Environmental Board No. 15 B.E.2540 (1997) under the Conservation and Enhancement of National Environmental Quality Act B.E.2535 (1992) dated March 12, B.E.2540 (1997) and Notification

3.5.3 Water Quality

The industrial wastewater effluent guideline value is determined by the Ministry of Industry (MOI) as shown in ***Table 3.5-4***. Factories shall comply with the effluent standard for certification on the discharge of sewage and process wastewater from their factories. In this Project, the Project proponent follows the MOI guidelines values and national wastewater quality standard.

Table 3.5-4: Industrial Wastewater Effluent Standard

No	Items	Guideline Values	Unit	Notes
1.	BOD (5days at 20·℃)	max 20-60	ppm	Depending on geography of waste discharging point
2.	Suspended Solids	max 30	ppm	
3.	Dissolved solids	max 2,000	ppm	
4.	pH Value	between 5 and 9		
5.	COD Permanganate value	max 60	ppm	
6.	Sulphide (as HS)	max 1	ppm	
7.	Cyanide (as HCN)	max 0.2	ppm	
8.	Oil and grease	max 5	ppm	
9.	Tar	none	-	
10.	Formaldehyde	max 1	ppm	
11.	Phenols and cresols	max 1	ppm	
12.	Free chlorine	max 1	ppm	
13.	Zinc	max 5	ppm	
14.	Chromium	max 0.5	ppm	
15.	Arsenic	max 0.25	ppm	
16.	Copper	max 1.0	ppm	
17.	Mercury	max 0.005	ppm	
18.	Cadmium	max 0.03	ppm	
19.	Barium	max 1.0	ppm	
20.	Selenium	max 0.02	ppm	
21.	Lead	max 0.2	ppm	
22.	Nickel	max 0.2	ppm	
23.	Insecticides	None	-	
24.	Radioactive Materials	None	-	
25.	Temperature	max 40	ºC	
26.	Color and Odor	-		Not objectionable when mixed in receiving water

Source: Ministry of Industry

3.6 Developer's Environmental & Social Policy Framework

The Project Developer's social and environmental policies focus on three areas: the development of balanced economic, social and environmental resources with the emphasis on local participation in order to use folk wisdom with the right technology for the management of natural resources and environment, consistent with the ecology of the area. This will lead to sustainable development. The projects are divided into the following sub-projects.

1) **Corporate Social Responsibility** - To up level the quality of life of the people on the basis of good education by participating in community development, promote the education, basic medical service as well as promote the local tradition and cultural activities.
2) **Training Project and Career Development** - Creating future job opportunities and various training programs for the community and providing guidelines for their traditional agricultural and fishery productions.
3) **Environmental Restoration** - In order to maintain a sustainable and stable environment and ecosystem, this project includes the environmental and natural resources managements, re-landscaping, seedling center, plant nursery and taking actions to prevent erosion for both soil and costal line, and

developing a green industrial zone. This project also concerns about the balanced ecosystems in DSEZ.

4) **Public Relations** - To create a better understandings and a good relationship with the locals regarding the environmental plan and project information, the PR project will focus on public involvement and participation of all government sectors. There will be knowledge, career development and activities promotions including publicizing the project. The problems and any misunderstandings would be clarified by concerned organizations or agencies.

Myandawei Industrial Estate Co., Ltd., will at all times comply fully with the commitments, mitigation measures, and plans that have been presented in IEE Report on Pa Yain Byu Reservoir, Small Water Reservoir Project.

The Project Proponent shall 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, including the Environmental Conservation Law (2012), Environmental Conservation Rules and Environmental Impact Assessment Procedure (2015), as well as the EMP, Project commitments and conditions, and National Environmental Quality (Emission) Guidelines in policy.

The Project Proponent and Phisut Technilogy Co.,Ltd hereby confirm that:

(1) The IEE Report is accurate, consolidated and complete to the best of our knowledge, at the time of preparing this Report;
(2) The IEE has been conducted in accordance with relevant laws, including the EIA Procedure (2015).
(3) The Project Proponent will fully follow the commitments, mitigation measures and plans set out in this IEE Report.

Chapter 4

DESCRIPTIONS OF THE ENVIRONMENT

CHAPTER 4
DESCRIPTIONS OF THE ENVIRONMENT

4.1 ENVIRONMENTAL CATEGORY OF THE PROJECT

There are four categories of environmental and social aspects as shown in **Table 4.1-1** that included in the IEE study.

Table 4.1-1 Category of Environmental and Social Aspects

No.	*Category*	*Description*
1	Physical Resources	- Climate - Hydrology - Topography and Soil - Water Quality - Geology and Seismology
2	Ecological Resources	- Aquatic biology - Wildlife - Forests
3	Economic Development	- Infrastructure facilities - Transportation - Land Use Pattern - Water Supply and Water Use
4	Social and Cultural Resources	- Demography - Population and Community - Health Facilities - Education Facilities - Communication - Socio-economic Condition

4.2 DETAILED APPROACH AND METHODOLOGY

In conducting the baseline study of above aspects, the detailed IEE approach and methodology were generally followed according to the regional environmental safeguard and the Myanmar Environmental Conservation Rule and others that described in Chapter 3 (Policy and Legal Framework) of this report. Data collection was performed by the IEE study team (Environment Specialists, Irrigation Engineer, Geologist, Ecologist, Socio-economist, etc.).

4.2.1 Desk Review

The following steps were followed during the desk review:

- ***Collection and review of secondary information from various sources***

Secondary information was collected through published and unpublished reports and interpretation of maps and photographs. The sources of information were District Forest Office, other line agencies, and other project offices in the district. Similarly, collection of project details from Consultant/Irrigation Office will be also done.

- ***Initial interaction and consultation with the local community and district level Stakeholders***

During the IEE report preparation, IEE study team met, discussed and interacted with concerned community leaders of Pa Yain Byu Village, local inhabitants, teachers, community based organization member and other key informants in the project study zones.

- ***Delineation of geographical boundary of the influence area on the topographic map***

It is necessary to specify area that shall be covered for assessment of environmental impacts so as to avoid future confusion. Depending upon nature and extent of expected impact area the geographical area is categories into Directly Impact Area and Indirectly Impact Area. The designate and demarcate the area of assessment shown on **Figure 4.2-1.**

- ***Preparation of project specific checklist***

Study team has prepared the Environmental checklist and Questionnaire Survey in order to conduct the detail field study and to collect baseline environmental information of the project area.

4.2.2 Field Survey

A multi-disciplinary team visited the project area for updating/ verifying the baseline information on physical, biological, socio-economic and cultural environment of the proposed project, the anticipated environmental impacts and practical mitigation measures while implementing the specified activities. Interaction meetings and key informant interviews were undertaken with local people and measurement of infrastructures were also carried out. Field survey comprised of walk through survey, water quality sampling, geological investigation, consultation with community, site inspection and observation. The following tools were used for the collection of primary data.

- Field survey on water quality sampling was conducted at two stations along the Pa Yain Byu Creek within project area.
- SPT and Test Pitting had been conducted in the project area and surrounding area.
- Focus group discussion - To conduct consultation with the local communities at different settlements, Focus group discussion was organized with key informants and other knowledgeable persons. It was done to collect biological, socio-economic and cultural environment related information using a checklist.
- Household survey - Questionnaire was used to collect socio-economic information of all the households in the project area.
- Household listing survey - Total enumeration was done for the listing of agricultural land, forest, trees, houses and other affected properties.
- Topographical map - It was used to show environmental features on the map during walkthrough survey.
- Photographs - Necessary photographs were taken to show different environmental features.

4.2.3 Mitigation Measures and Monitoring Requirement

Based on the identified impacts their nature, extent and magnitude, the mitigation and monitoring prescriptions were developed. A realistic approach was applied for the application of the mitigation measures in the local context. Environmental monitoring plan was developed to assess the effectiveness of the mitigation measures and implementation status.

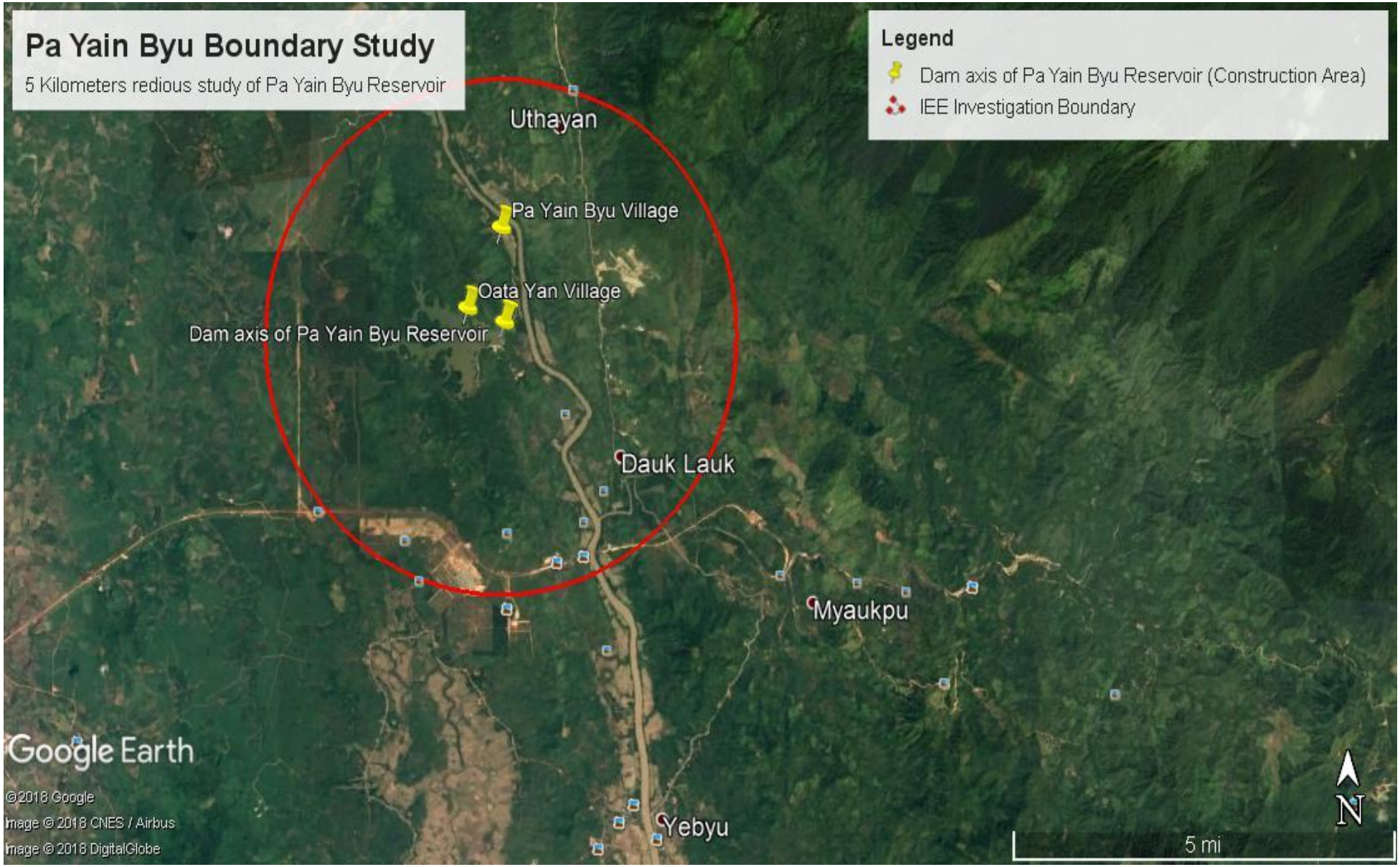


Figure 4.2-1 Demarcate area of Pa Yain Byu study

4.3 Physical Resources

4.3.1 Climate

The southwest and the northeast monsoons exert a dominant influence on the climate with marked wet and dry seasons for the southwest monsoon and cyclone depression from the India Ocean, causing the rainy season from about mid of May to October. With the retreat of southwest monsoon in October, the rain decreases with northeast monsoon from the mainland of China that starts the cold season from November until February. In this study, the meteorological data observed at Dawei, in the area near the study basin, is used to provide the climate condition of the project area.

(1) Precipitation

Dawei is one of the areas from 30 meteorological stations with the highest amount of annual rainfall in Myanmar. From 1989-2010, the average annual rainfall at Dawei station was 5,459 millimeters (mm) with the highest monthly rainfall with the average of 1,309 in August. A lowest record was 3 mm found in December at Dawei station. The rainfall and rainy day records from 1989 to 2010 at the Dawei station are provided in **Table 4.3-1**.

Table 4.3-1 Monthly Rainfall Data at Dawei Station

Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
1989	25	5	50	5	431	975	726	1,476	560	278	32	0	4,563
1990	0	0		229	533	1,116	1,021	1,500	686	466	58	0	5,621
1991	0	0	0	1	95	120	1,465	1,620	1,201	606	328	0	5,437
1992	0	1	0	0	2	189	787	1,002	1,646	605	318	3	4,554
1993	0	0	0	50	14	407	691	1,318	1,246	869	198	0	4,794
1994	1	2	40	54	571	1,046	1,690	1,564	855	154	35	0	6,012
1995	0	0	110	32	663	1,171	1,249	1,275	832	127	23	0	5,483
1996	0	52	55	203	357	964	1,325	809	1,227	146	86	0	5,224
1997	0	0	0	45	872	738	1,970	2,405	503	187	12	0	6,733
1998	10	0	0	0	433	706	530	574	1,360	270	137	1	4,021
1999	52	7	120	916	748	1,145	1,609	1,345	755	336	178	1	7,212
2000	12	25	49	328	815	931	1,275	1,244	924	283	6	0	5,892
2001	7	6	113	6	965	1,313	976	1,974	323	184	21	9	5,897
2002	0	0	13	47	972	959	1,278	1,471	1,346	116	114	15	6,331
2003	1	1	189	68	566	904	1,431	1,205	706	256	0	0	5,327
2004	3	11	57	8	931	1,030	665	1,370	268	109	0	0	4,452
2005	0	8	8	20	419	1,234	1,664	1,011	857	186	120	6	5,534
2006	0	24	67	215	759	737	2,081	1,896	605	455	0	0	6,839
2007	1	0	0	117	610	620	1,460	1,228	815	454	7	0	5,312
2008	0	52	47	188	975	1,026	1,038	766	1,149	259	51	0	5,551
2009	0	0	47	283	416	1,223	1,825	903	1,107	440	6	0	6,250
2010	31	0	0	0	411	478	478	832	417	381	0	40	3,068
Average	**6**	**9**	**44**	**128**	**571**	**865**	**1,238**	**1,309**	**881**	**326**	**79**	**3**	**5,459**

Source: Department of Meteorology and Hydrology, Dawei Station, the Union of Myanmar

(2) Temperature

The mean highest and lowest temperature in each month at Dawei varies from 14 ºC in January to 37 ºC in April. Mean highest and lowest of temperatures in each month are shown in **Table 4.3-2**

Table 4.3-2 Average Temperature in 1931-1960

Celsius

Temperature	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Mean highest	34	35	36	37	36	32	32	31	32	33	33	33
Mean lowest	14	16	18	21	23	22	22	22	22	21	17	15

Source: Department of Meteorology and Hydrology, Dawei Station, the Union of Myanmar

(3) Humidity

The relative humidity is rather high throughout the year with monthly means ranging from 67 percent to 93 percent. The period of highest relative humidity is from June to January, while low relative humidity is observed from February to May. Mean monthly variation of relative humidity as shown in **Table 4.3-3**

Table 4.3-3 Average Monthly Humidity in 1931-1960

Unit: Percent

Temperature	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Mean highest	87	88	86	83	87	92	93	93	93	89	83	83
Mean lowest	67	67	68	73	83	90	91	90	90	84	78	69

(4) Wind

The dominant wind system in the project area has two monsoons. However, tropical depressions and storms are developed only in moderate wind fields.

The maximum observed during the SW-monsoon was 20 knots, while the maximum was 14 knots for the period of NE-monsoon.

4.3.2 Hydrology

(1) Runoff

The Pa Yain Byu Creek is located in the Dawei Basin and close to Ta Lai Ya basin. The inflow of Ta Lai Ya basin is based on the Dawei rainfall station and the runoff data from nearby basin in Thailand, namely Quae Noi basin as studied in Feasibility Study of Ka Loat Htar Dam and Reservoir for DSEZ Water Supply Project, 2013. The runoff at Pa Yain Byu Pond is estimated based on the runoff at Ka Loat Htar Dam. The runoff at Pa Yain Byu is analyzed by the catchment ratio method in the following equation.

$$Q_x = \frac{A_x}{A_i} Q_i$$

Q_x	=	runoff at alternative site	MCM
Q_i	=	runoff at index station	MCM
A_x	=	catchment area at site	km^2
A_i	=	catchment area at index station	km^2

According to the Pa Yain Byu is small catchment area the runoff should be adjusted by the following criteria;

1) No runoff in Pa Yain Byu during dry season from December to March
2) The runoff-rainfall coefficient of Pa Yain Byu is 0.48

The results of monthly runoff estimation at Pa Yain Byu Pond are shown in **Table 4.3-4** and the annual runoff at damsite is shown in **Figure 4.3-1**. The average annual runoff at Pa Yain Byu Pond (1982-2010) was about 18.54 MCM. The maximum annual runoff was 28.47 MCM in 1997 and minimum annual runoff was 9.63 MCM in 1987. The maximum monthly runoff was in August.

Table 4.3-4 Monthly Runoff at Pa Yain Byu Reservoir

Year	Monthly Runoff (MCM)												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(MCM)
1982	0.00	0.00	0.00	0.01	0.42	1.66	6.24	8.44	2.84	1.43	0.27	0.00	21.31
1983	0.00	0.00	0.00	0.03	0.08	0.24	1.47	3.62	2.96	1.38	0.36	0.00	10.14
1984	0.00	0.00	0.00	0.12	0.39	1.78	5.22	7.84	2.35	0.85	0.12	0.00	18.68
1985	0.00	0.00	0.00	0.08	0.16	1.76	5.84	8.53	1.94	1.22	0.36	0.00	19.91
1986	0.00	0.00	0.00	0.04	0.34	1.40	3.35	7.71	1.89	0.99	0.19	0.00	15.91
1987	0.00	0.00	0.00	0.09	0.01	0.50	1.27	4.40	1.84	1.27	0.24	0.00	9.63
1988	0.00	0.00	0.00	0.17	2.23	2.68	4.31	5.41	1.33	0.99	0.22	0.00	17.34
1989	0.00	0.00	0.00	0.01	0.16	1.48	2.66	6.92	2.32	1.40	0.37	0.00	15.34
1990	0.00	0.00	0.00	0.04	0.61	1.75	3.31	6.41	1.97	1.40	0.33	0.00	15.81
1991	0.00	0.00	0.00	0.01	0.02	0.51	3.73	8.25	4.15	1.69	0.49	0.00	18.85
1992	0.00	0.00	0.00	0.01	0.01	0.06	0.78	4.07	6.84	1.66	0.44	0.00	13.88
1993	0.00	0.00	0.00	0.01	0.01	0.09	1.41	5.96	2.70	1.27	0.28	0.00	11.73
1994	0.00	0.00	0.00	0.02	0.31	2.10	6.69	7.38	2.28	0.99	0.32	0.00	20.10
1995	0.00	0.00	0.00	0.15	1.26	3.76	5.76	6.30	2.47	1.22	0.36	0.00	21.28
1996	0.00	0.00	0.00	0.12	0.20	1.44	5.89	5.73	3.92	0.82	0.27	0.00	18.37
1997	0.00	0.00	0.00	0.11	2.13	4.44	7.91	10.78	2.01	0.87	0.22	0.00	28.47
1998	0.00	0.00	0.00	0.01	0.23	2.07	1.94	2.70	3.99	0.84	0.30	0.00	12.10
1999	0.00	0.00	0.00	0.40	2.22	4.75	5.67	6.81	2.78	1.10	0.37	0.00	24.09
2000	0.00	0.00	0.00	0.39	2.23	3.94	5.55	6.61	3.16	0.71	0.11	0.00	22.71
2001	0.00	0.00	0.00	0.16	2.20	3.73	5.33	8.62	1.89	0.92	0.26	0.00	23.11
2002	0.00	0.00	0.00	0.02	2.23	3.43	5.76	7.88	6.15	1.40	0.15	0.00	27.02
2003	0.00	0.00	0.00	0.10	0.56	1.14	3.26	6.35	1.75	1.45	0.22	0.00	14.82
2004	0.00	0.00	0.00	0.17	2.23	5.10	4.68	6.77	1.78	0.88	0.09	0.00	21.69
2005	0.00	0.00	0.00	0.05	0.42	2.16	5.74	6.54	2.43	0.92	0.28	0.00	18.54
2006	0.00	0.00	0.00	0.19	1.71	3.44	8.84	9.08	2.39	1.19	0.26	0.00	27.10
2007	0.00	0.00	0.00	0.03	0.68	1.67	5.68	6.98	1.86	1.32	0.36	0.00	18.60
2008	0.00	0.00	0.00	0.18	2.23	3.88	5.60	4.69	3.41	1.08	0.25	0.00	21.33
2009	0.00	0.00	0.00	0.16	0.19	1.52	6.27	7.50	2.01	1.38	0.32	0.00	19.34
2010	0.00	0.00	0.00	0.01	0.27	0.82	2.20	3.99	2.31	0.81	0.13	0.00	10.53
Mean	0.00	0.00	0.00	0.10	0.89	2.18	4.56	6.63	2.75	1.15	0.27	0.00	18.54
Max	0.00	0.00	0.00	0.40	2.23	5.10	8.84	10.78	6.84	1.69	0.49	0.00	28.47
Min	0.00	0.00	0.00	0.01	0.01	0.06	0.78	2.70	1.33	0.71	0.09	0.00	9.63

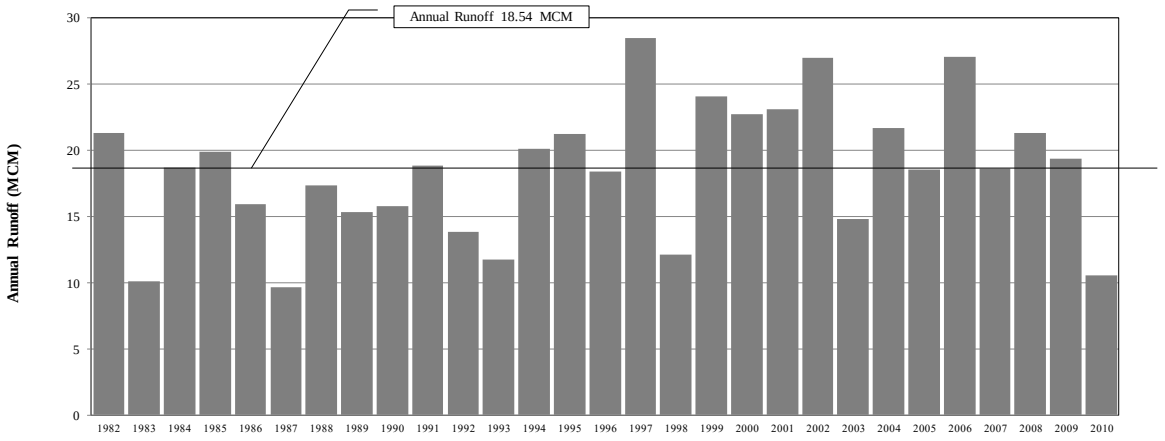


Figure 4.3-1 Annual Runoff at Pa Yain Byu Reservoir

(2) Flood Analysis

The Pa Yain Byu is a small catchment area with less than 10 km^2 and without no records of flood. The flood analysis of Pa Yain Byu used the rational method, which is one of the flood estimate methods and often used for estimating the peak flood discharge in the small catchment area with no flood records available. The formula by the rational method is presented as follows:

$$Q_p = f \frac{R_t^1 A}{3.6} \quad [1]$$

Where

Q_p	=	Peak flood discharge	m^3/s
f	=	Runoff coefficient	
R_t	=	Rainfall intensity during the period, until which the flood reaches out of the catchment area	mm/hr
A	=	Catchment area	km^2

Regarding estimate of R_t in the above formula, the following empirical formula is provided:

$R_t = r_{day} [t/24]^k$ [2]

$t = L/W$

I	More 1/100	1/100 ~ 1/200	Less 1/200
W	3.5 m/s	3.0 m/s	2.1 m/s

Where,

r_{day}	=	Daily rainfall mm/day	
t	=	Period, until the flood reaches outlet of the catchment area (hr)	
k	=	Constant = 1/2	
I	=	Average river bed slope	
W	=	Flood velocity	m/s
L	=	Maximum length of river course in the basin	m

The above rational formula is applied to the estimated flood peak. The maximum daily rainfalls at Dawei Station were analyzed by using Gumbel distribution as details in Feasibility Study of Ka Loat Htar Dam and Reservoir (Draft Final Report 2012) presented in **Table 4.3-5**. The watershed parameters for the Pa Yain Byu catchment area is measured and computed by using topographic map scale 1:50,000. The watershed parameter is presented below:

Pa Yain Byu Pond	Watershed Parameters			t
	A	L	S	hr
	7.14	3.865	0.0086	0.4

The flood peak at Pa Yain Byu Pond is analyzed by using the Equation [1]. The runoff coefficient is 0.70. The flood peaks for various return periods at Pa Yain Byu Pond are presented in **Table 4.3-6**.

Table 4.3-5 Maximum Rainfall Depth for Various Return Periods at Dawei Station

Return Period Years	Maximum rainfall depth (mm) 1 day
2	234
5	336
10	404
20	469
25	490
50	553
100	616
200	679
500	762
1,000	825

Source: Feasibility Study of Ka Loat Htar Dam and Reservoir, Draft Final Report 2012

Table 4.3-6 Flood Peak for Various Return Periods at Pa Yain Byu Pond

Return Period (Years)	Flood Peak (m^3/s)
2	39.69
5	57.04
10	68.53
20	79.56
25	83.05
50	93.82
100	104.52
200	115.17
500	129.22
1,000	139.84

The flood peak of 104.52 m^3/s in 100-year return period is selected for spillway design of Pa Yain Byu Pond.

(3) Reservoir Simulation Study

Mathematical Model

The reservoir simulation model used in this study is the HEC-3 program (Reservoir System Analysis for Conservation). This program was developed by the Hydrologic Engineering Center, Corps of Engineers, US Army. The program simulates the operation of a reservoir system based on water balance computations for conservation purposes such as water supply, recreation, and hydroelectric power, etc.

A reservoir system can be divided into four basic system components for Pa Yain Byu simulation study, namely, system hydrology, reservoirs, control points, water diversion.

1) System hydrology consisting of three primary components:
   (1) Inflows
   (2) Local flows
   (3) Evaporation

2) Reservoir characteristics:
   (1) Elevation and storage relationships
   (2) Surface area
   (3) Outlet capacity
   (4) Operating criteria

3) Control point characteristics: they are used to regulate the system operation by establishing constraints and targets on stream flow at the location where information is needed.

4) Diversion characteristics: one diversion may exist at any control point, and may be specified as the actual flow diverts, or as a function of the natural flow, regulated flow or reservoir storage.

A basic continuity equation is used to calculate water balance of the reservoir system as follows:

$$S_i = S_{i-1} + (I_i - Q_i - L_i)\,\Delta_t$$

Where S_i = Reservoir storage volume at the end of current period, i
S_{i-1} = Reservoir storage volume at the end of previous period, i-1
I_i = Inflow during period i, comprising all diversions into the reservoir released from the upstream reservoir and the natural inflow
Q_i = Release discharge during period i, comprising all diversions out of the reservoir, leakage from the reservoir and release for different purposes
L_i = Net evaporation during period i, reflecting gain or loss in reservoir
Δ_t = Time interval from i-1 to i

Input Data

The input data of simulation model consists of:

1) System configuration: The configuration used in the simulation model on Pa Yain Byu Pond is shown in **Figure 4.3-2**.

2) Inflow: The available monthly inflow data from year 1980 to 2009 are computed in Section 2.3.

3) Reservoir evaporation loss: The Pa Yain Byu Reservoir is about 23.30 percent of catchment area, so the estimated monthly reservoir evaporation loss is calculated using an average monthly pan evaporation of Dawei Station as shown in **Table 4.3-7** The rainfall is not used to calculate the reservoir evaporation loss according to use to compute the inflow of Pa Yain Byu.

Table 4.3-7 Pa Yain Byu Pond Evaporation Loss

Unit: mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Evaporation at Thong Phaphum	117.3	136.5	175.5	180.7	134.9	95.1	90	83	99.8	107.6	106.9	107.4	1,431.7
Pond Evaporation Loss (0.7E)	82.11	95.55	122.85	126.49	94.43	66.57	63	58.1	69.86	75.32	72.73	75.18	1,002.19

4) Area-storage-elevation curve: The reservoir area and volume of Pa Yain Byu Pond is computed by using the topographic map at a scale of 1:50,000 as shown in **Figure 4.3-3**.

5) The monthly water requirement of 43,000 m^3 per day or 15.7 MCM is used to water supply in the beginning of DSEZ. The water demand is 47,000 m^3 per day including 10 percent loss or 17.26 MCM per year is used to simulate for Pa Yain Byu Reservoir.

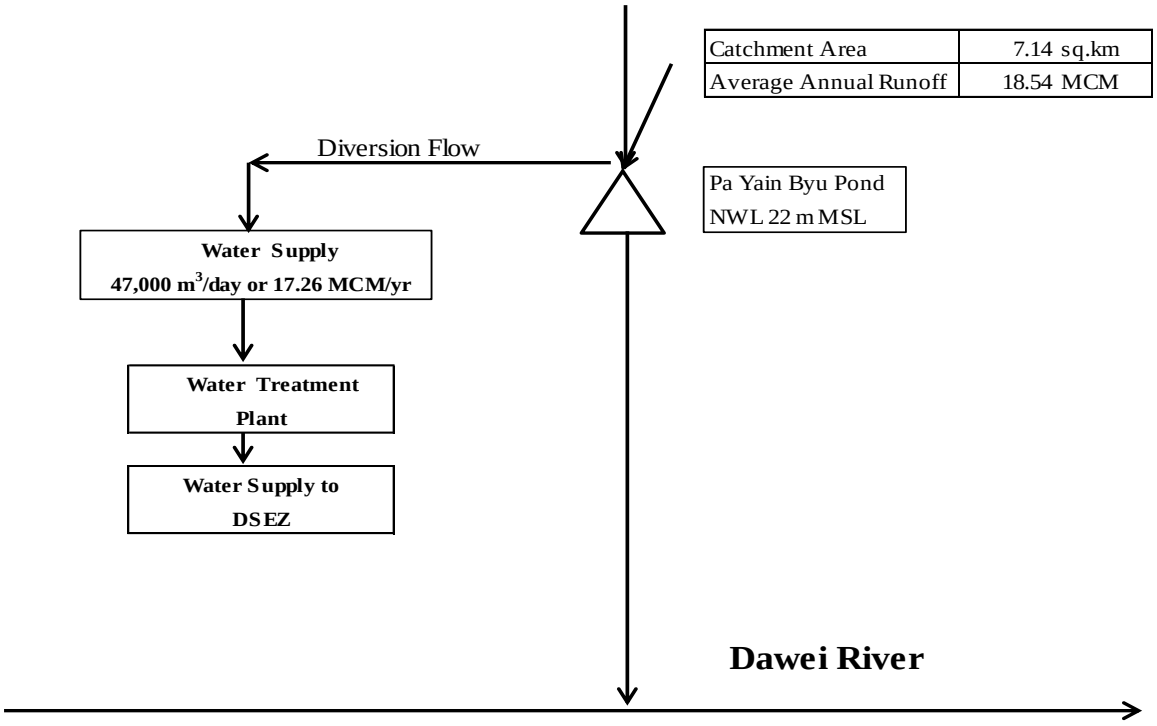


Figure 4.3-2 Schematic Diagram of Pa Yain Byu Reservoir Project

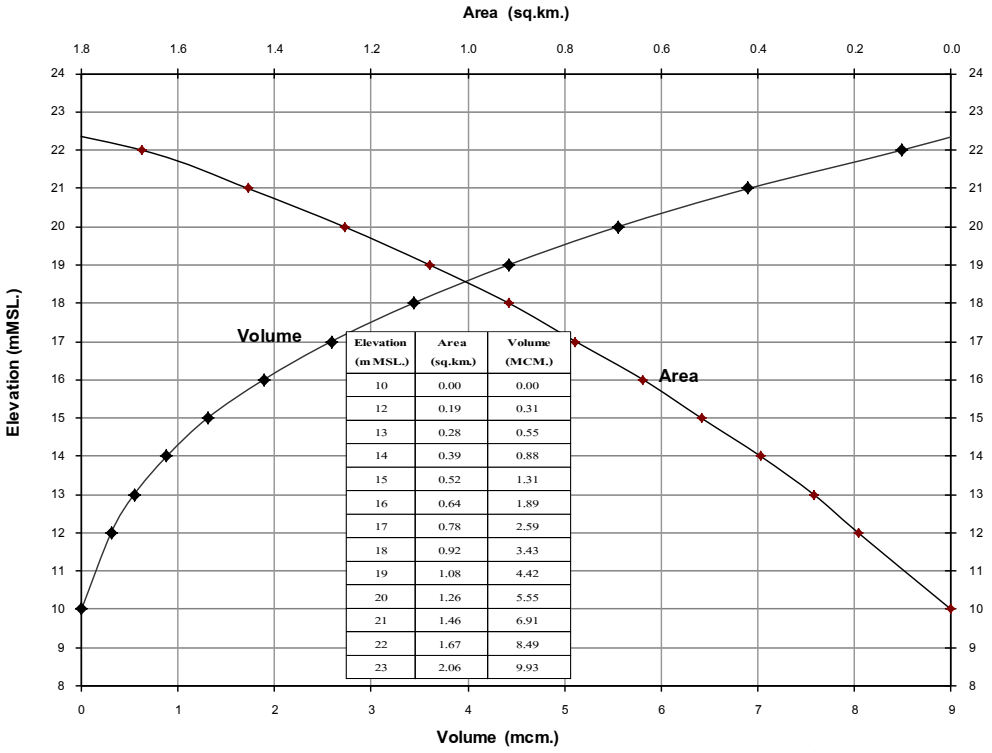


Figure 4.3-3 Area-Volume-Elevation Curve of Pa Yain Byu Reservoir

Result of Simulation Study

The Pa Yain Byu is simulated based on the input data and the assumption as follows;

1) The normal high water level at 22.00 m MSL
2) The lower water level at 14.00 m MSL
3) The active storage is 7.61 MCM
4) The starting water level of reservoir simulation is set at 22 m MSL.

The Pa Yain Byu Reservoir of 29 years (1982-2010) has the average annual runoff of 18.54 MCM. The 29-year annual runoff is between 9.63 and 28.47 MCM. The annual water supply is 17.26 MCM. The results of monthly simulation study are shown in **Figure 4.3-4** and **Table 4.3-8**. The storage of Pa Yain Byu Pond can carry the runoff in the wet season to be used in the dry season. The water shortages of Pa Yain Byu occurred every year simulated as shown in **Table 4.3-9**. The maximum water shortage in 1984 is about 6.10 MCM. The shortage occurs every year, especially in April. There is serious water shortage in 3 months, such as March, April and May. The water supply is required to pump the water from the Dawei River during the wet season (June-November) to be stored in Pa Yain Byu and used for water supply without water shortage. However, the water pumping from the Dawei River can be pumped to Pa Yain Byu pond from September to November every year without spill.

Table 4.3-8 Results of Pa Yain Byu Pond Simulation

Order	Description	Unit	Pa Yain Byu Pond
1	Average annual runoff	MCM	18.54
2	Normal high water level	m. MSL	22.00
3	Storage at NWL	MCM	8.49
4	Lower water level (LWL)	m. MSL	14.00
5	Storage at LWL	MCM	0.88
6	Active storage	MCM	7.61
7	Water supply	MCM	17.26
8	Maximum annual water shortage	MCM	6.10
9	Average annual water shortage	MCM	3.06
10	Maximum monthly water shortage	MCM	1.47
11	Average water level	m. MSL	17.98
12	Minimum water level	m. MSL	14.00
13	Average annual water spill	MCM	1.31

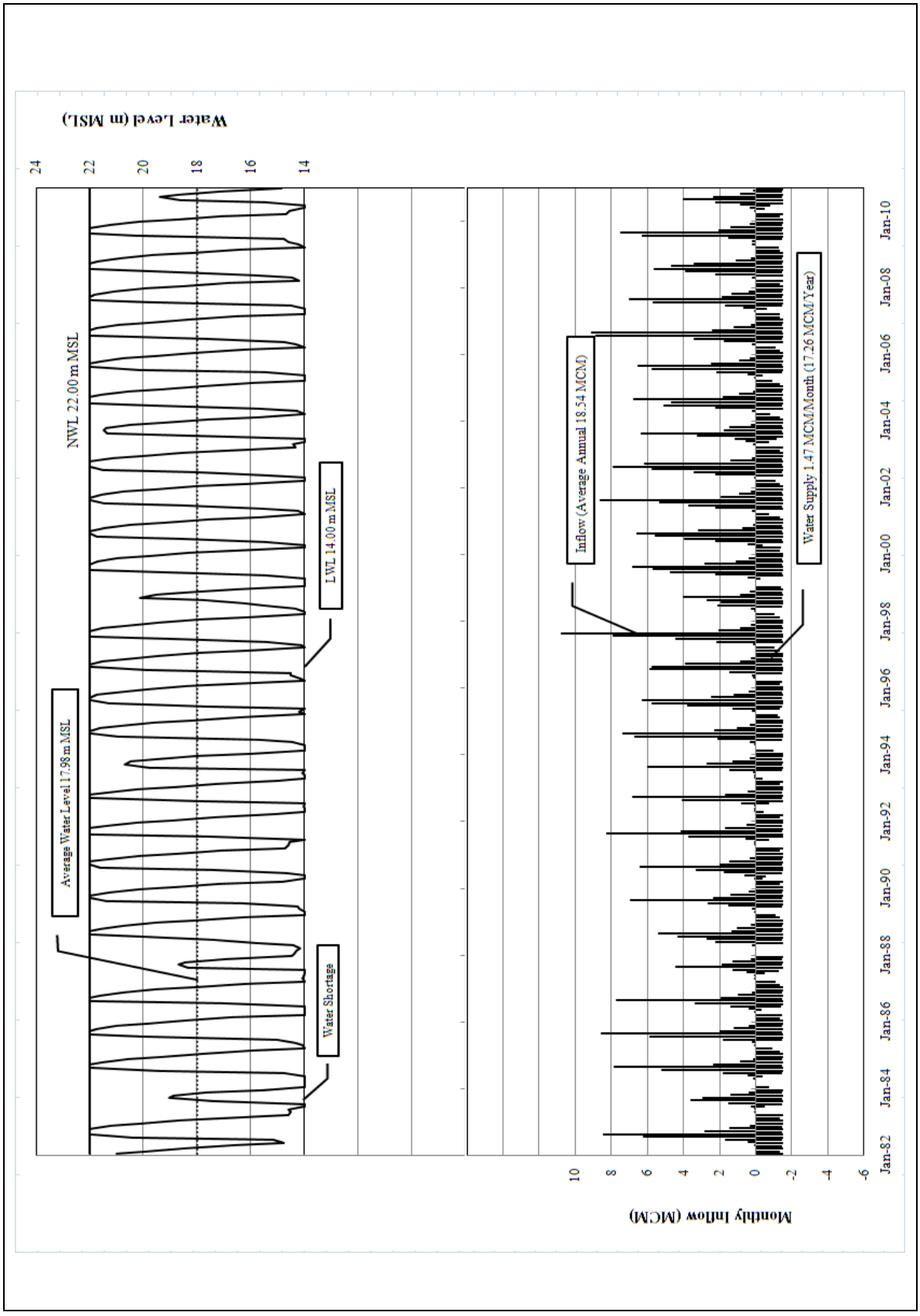


Figure 4.3-4 Results of Pa Yain Byu Pond Simulation at NWL 22.00 m MSL from 1982 - 2010

Table 4.3-9 The Water Shortage in Pa Yain Byu for Water Supply

unit: MCM

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	1.43	1.47	0.96	0.03	0.00	0.00	0.00	0.00	0.00	3.88
1984	0.75	1.33	1.47	1.43	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10
1985	0.00	0.00	0.59	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.49
1986	0.00	0.00	0.00	1.43	1.18	0.05	0.00	0.00	0.00	0.00	0.00	0.00	2.66
1987	0.00	0.00	0.37	1.43	1.47	0.93	0.21	0.00	0.00	0.00	0.00	0.00	4.42
1988	1.47	1.33	1.47	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.70
1989	0.00	0.00	0.35	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25
1990	0.00	0.00	0.00	1.09	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97
1991	0.00	0.00	0.00	1.43	1.47	0.70	0.00	0.00	0.00	0.00	0.00	0.00	3.60
1992	0.00	0.00	0.00	1.01	1.47	1.43	0.70	0.00	0.00	0.00	0.00	0.00	4.61
1993	0.00	0.00	0.00	1.06	1.47	1.43	0.05	0.00	0.00	0.00	0.00	0.00	4.02
1994	0.00	0.36	1.47	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.73
1995	0.00	0.00	0.27	1.43	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85
1996	0.00	0.00	0.00	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90
1997	0.00	0.00	0.48	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.91
1998	0.00	0.00	0.48	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.38
1999	0.11	1.33	1.47	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.05
2000	0.00	0.00	0.11	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20
2001	0.00	0.00	0.72	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.15
2002	0.00	0.00	0.37	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
2003	0.00	0.00	0.00	1.43	0.78	0.31	0.00	0.00	0.00	0.00	0.00	0.00	2.51
2004	0.00	0.00	0.70	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12
2005	0.00	0.00	0.59	1.43	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.11
2006	0.00	0.00	0.37	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
2007	0.00	0.00	0.13	1.43	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42
2008	0.00	0.00	0.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43
2009	0.00	0.00	0.24	1.43	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.14
2010	0.00	0.00	0.00	1.43	0.99	0.62	0.00	0.00	0.00	0.00	0.00	0.00	3.04
Average	0.08	0.15	0.40	1.32	0.80	0.22	0.03	0.00	0.00	0.00	0.00	0.00	3.06

4.3.3 Topography and Soil

4.3.3.1 Topography

The sub-project area under consideration lies in the mountainous rocky terrain of the eastern hill's region, Tanintharyi Division. Some part of the proposed project area is located on an alluvial soil, red brown forest soil, rest of the parts formed with Granite. The bedrock is well exposed along both banks of Ta Lai Ya River. The bedrock consists of banded granite and sandstone and massive pebbly sandstones. The other geological unit is alluvial terrace deposit, which is developing on various locations. It consists of thick conglomerates and breccias. The topsoil is mainly composed of silty soil and the thickness often varies from 1 m. or less containing organic materials. Sand and gravel deposits fill the present river channel. Sand is generally fine. At some residual soils and decomposed rocks are also observed.

4.3.3.2 Soil

SPT **-** SPT had been taken place on 3 projects components, 2-Saddle Dike and 1-Main Dike. For Main Dike, SPT had conducted for additional 6 drilling points, 3 points on Upstream Toe and 3 point on Downstream Toe. For 2-Saddle Dike, 3 drilling points had been drilled to measure density and also conduct soil classification in order to confirm the foundation of rock.

Test Pitting **–** Test Pitting had been conducted for total 37 holes in the area of reservoir for finding the suitable soil borrow area that will supply the soil material to Dam construction process and to ensure there is enough construction mater as shown **Figure 4.3-5**.

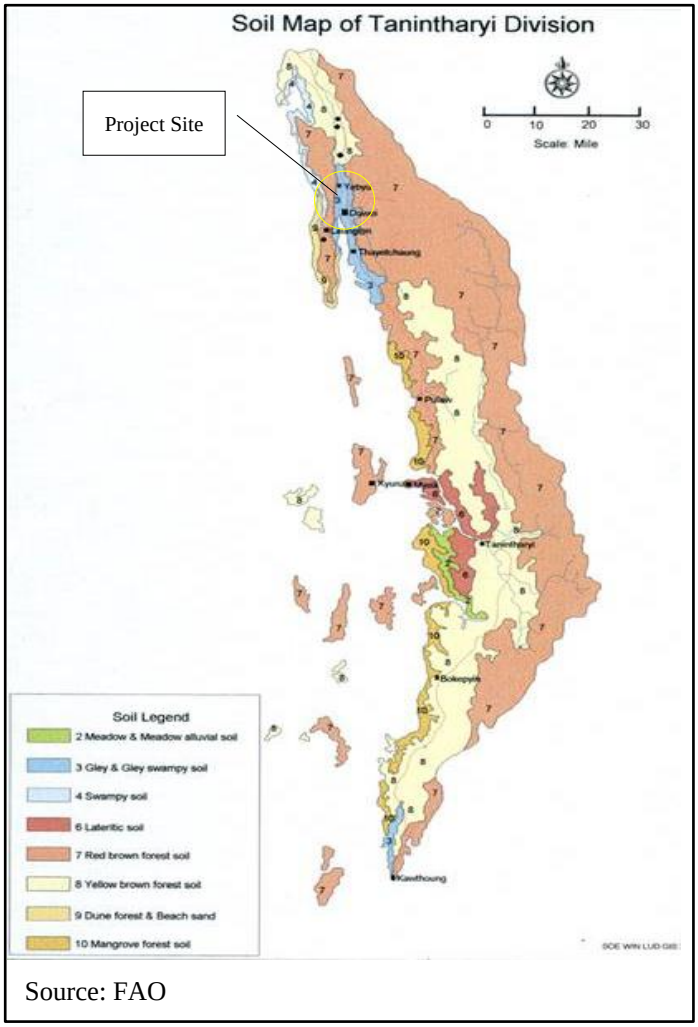
The types of soil commonly found in the project area are Grey & Grey Swampy Soil and Red Brown Forest Soils (Rhodic Ferralsol) as follow;

(1) Grey & Grey Swampy Soil

These soils occur in Ayeyarwady Delta and along the river bands of the Gulf of Motama and the marine flat lowlands influenced by the tidal sea water which is always salty. Due to high salinity and whole year tidal sea water, the land can only be utilized for prawn breeding and mangrove firewood forests.

(2) Red Brown Forest Soils (Rhodic Ferralsol)

The 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 1000 to 4000 feet above sea level. These soil also occur in the northern hilly region and on the hill slopes of Rakhine mountain range, Tenassarim and Donna range. These soils are formed under the influence of tropical evergreen forests with the annual rainfall of about 80 to 200 inches. Some are also found at the low uplands. The soils are well structured and have a good drainage. The soil is slightly acid with the pH value ranging from 5.5 to 6.5. Usually these soils have medium to heavy loamy texture. The soils contain moderate amount of plant available nutrients. These soils can be regarded as forest land of good productivity, however, the soils on the lower elevation are suitable for gardens and plantation. The immediate project area soil is mostly Gley & Gley Swampy Soil and Red Brown Forest Soils. Soil map of Tanintharyi Division as shown in **Figure 4.3-6.**



Source: FAO

Figure 4.3-6 Soil map of Tanintharyi Division

4.3.4 Water Quality

4.3.4.1 Surface Water Analysis

Field investigation of surface water sampling was performed at two stations along the stream within project area and surrounding area in pre-construction phase, construction phase and operation phase by ITD Environmental Team (**Table 4.3-10 and Figure 4.3-7**). The concern physical and chemical parameters are listed in **Table 4.2-11** by ITD environmental team.

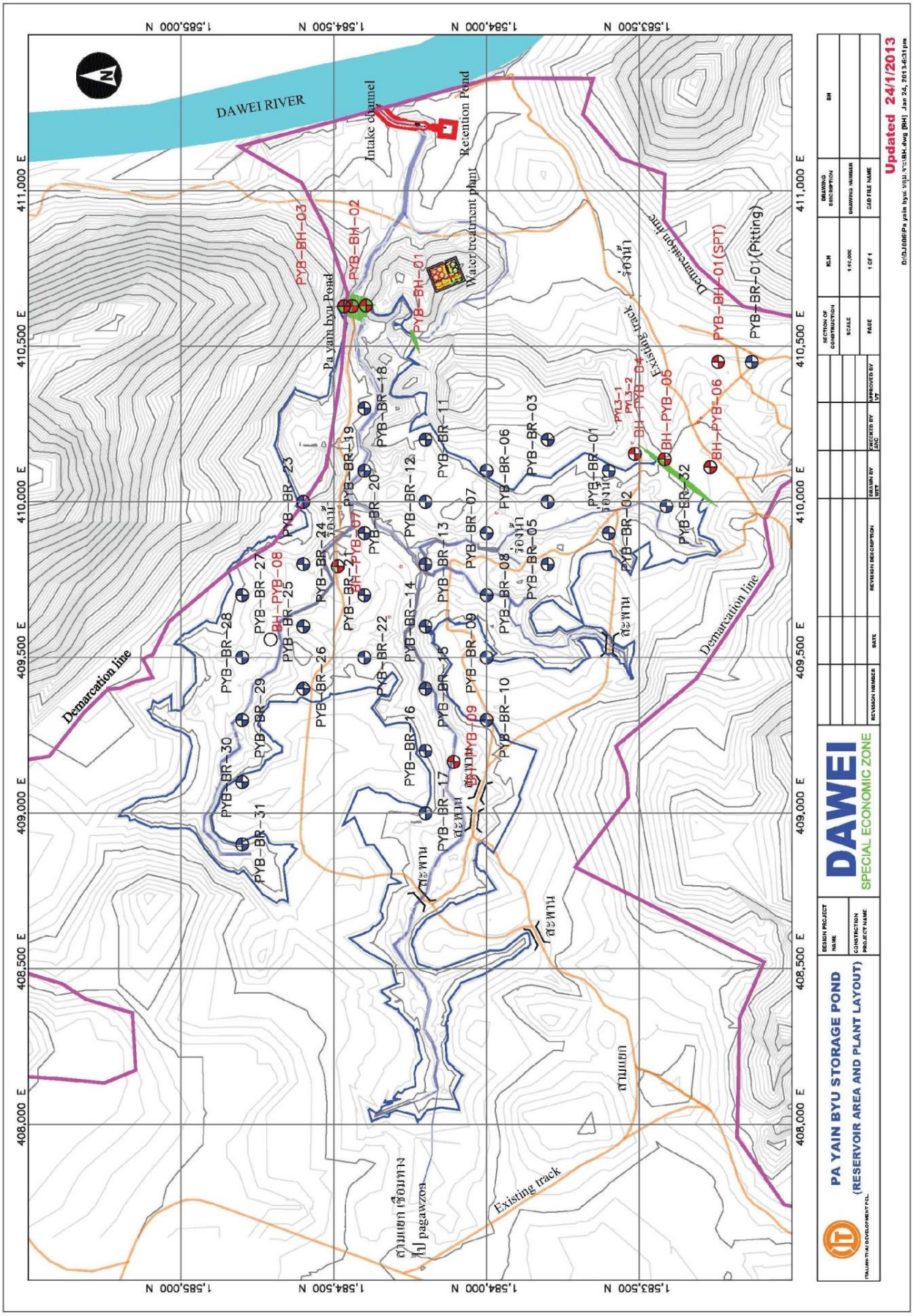

DAWEI RIVER
Intake channel
Retention Pond
Water treatment plant
Pa yain byu Pond
Demarcation line
Existing track
PYB-BH-01
PYB-BH-02
PYB-BH-03
BH-PYB-01(SPT)
BH-PYB-05
BH-PYB-06
PYB-BR-01(Pitting)
PA YAIN BYU STORAGE POND
(RESERVOIR AREA AND PLANT LAYOUT)
DAWEI
SPECIAL ECONOMIC ZONE
Updated 24/1/2013

Table 4.3-10 Water Sampling Schedule

Date	Station		Location			
	1	2	Station 1		Station 2	
			N	E	N	E
December 2012*	/	/	1584425	410504	1583570	409975
January 2013*	ND	/	1584425	410504	1583570	409975
February 2013**	ND	/	1584425	410504	1583570	409975
March 2013**	ND	/	1584425	410504	1583570	409975
April 2013**	ND	/	1584425	410504	1583570	409975

Note: * Pre-construction phase
** Construction phase

Table 4.3-11 Surface Water Quality at Pa Yain Byu Pond Area

Parameter	*Unit*	*Station*		*Myanmar National Standards*
		1	2	
pH	-	7.90	6.90	Between 5 to 9
Temperature	◦C	27.60	29.60	Maximum 40
Conductivity	µs	8.00	31.00	N.A.
Total Dissolved Suspended Solid	ppm	8.00	10.00	Maximum 2,000
Dissolved Oxygen	mg/L	5.60	5.50	N.A.
Suspended Solid	mg/L	6.00	22.00	Maximum 30
Turbidity	NTU	3.00	23.00	N.A.
Nitrate	mg/L	2.10	3.30	N.A.
Ammonia	mg/L	0.01	0.09	N.A.
Fe	mg/L	0.19	0.71	N.A.
So_4	mg/L	0.00	1.70	N.A.
Aluminium	mg/L	0.02	0.43	N.A.
Zinc	mg/L	0.12	0.10	Maximum 5
Po_4	mg/L	0.27	0.47	N.A.
Cyanide	mg/L	0.002	0.003	Maximum 0.2
Hardness	mg/L as $CaCO_3$	2.00	8.00	N.A.

Results of lab-test water quality of two key samples at the Pa Yin Byu stream indicated that all surface water quality parameters are within a normal range and can be used as water supply for the initial phase of the DSEZ development.

4.3.5 Geology and Seismology

4.3.5.1 Geology

Myanmar can be subdivided into three provinces (Maung Thein, 1993) namely, the Western Fold Belt (WFB) in the west, the central Lowland (CL) in the middle and the Eastern Highland (EH) in the east.

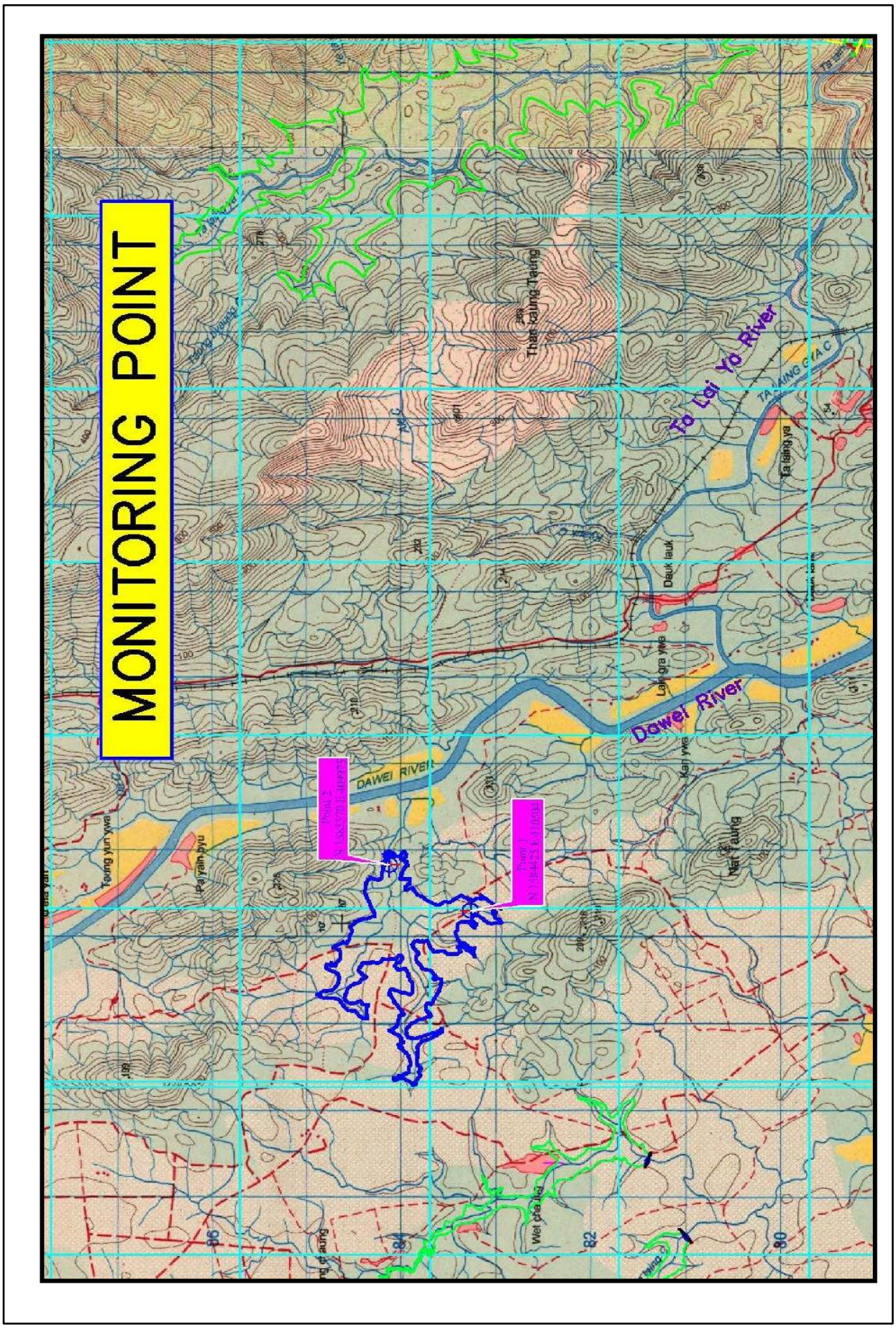


Figure 4.3-7 Water Sampling Point of Surface

1) Regional geology of prospecting area

The project area is located in Tanintharyi region as shown in **Figure 4.3-8** and **Figure 4.3-9** which is referred to either as the Shan-Tanintharyi Massif or simply as Karen-Tanintharyi Unit. Mergui Group of Carboniferous age formed as the basement and consists of thick sequence of folded argillite, greywacke and slate, with lessor amount of limestone, quartzite, agglomerate and congromerate. The Mergui Group is later intruded by tin bearing granitic rocks of late Mesozoic age.

Geologically, the Kayin & Thanintharyi consists mostly of Alluvium laterites, Oil shale of the Hitchara Basin Red Bed of Monstate, Kamawkala Limestone, Taungnyo Formation, Mergui Group as the resulted by the subduction of the Indian Plate underneath the Burma plate along the Bengal tectonic boundary and also continued collision between these two plates leading to high mountain arc in the west and north western part of the Myanmar.

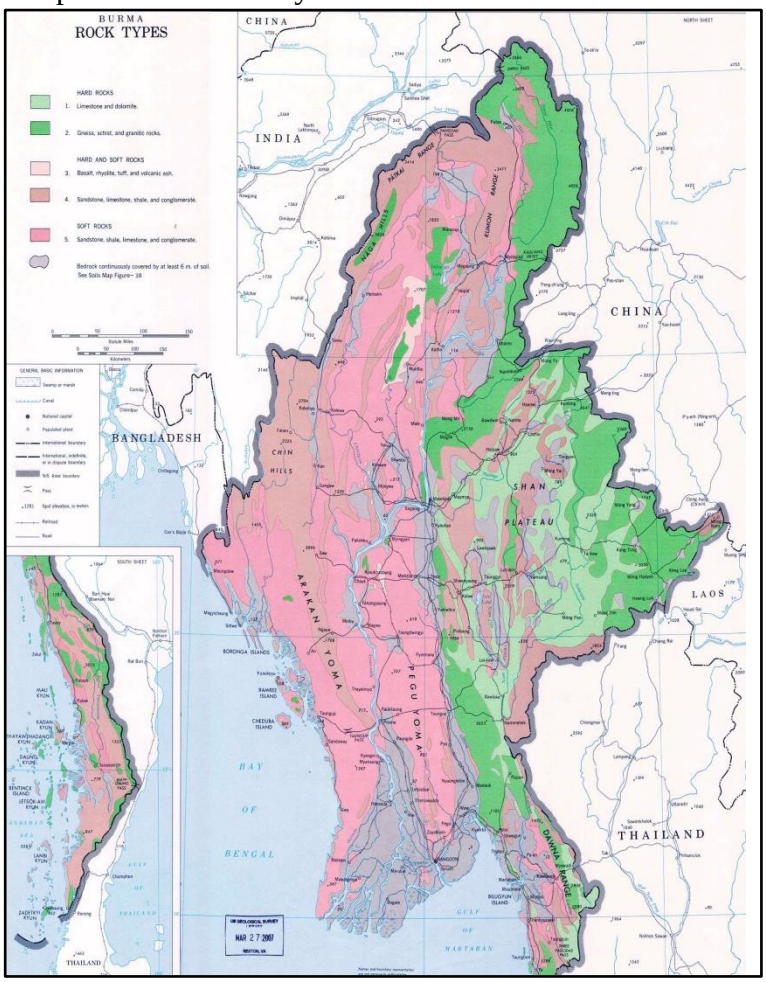


Figure 4.3-8 The geologic map and rock types of the project area

Tectonic Setting of Myanmar related WFB & the Kayin & Thanintharyi caused from the northward movement of the Burma plate from the spreading centered in the Andaman Sea at an average rate of 2.5–3 cm/year, resulted in very large over thrust along the western fold belt. These seismotectonics processes are still going on. The earth quakes generated by sea-floor spreading in the Andaman Sea, however, are mostly small to moderate and shallow-focus.

Geomorphologies as well as tectonically on prospecting area are North-South trending linear belts, these are form east to west, related to Shan- Tanintharyi Block. The model proposed here is inspired from Mitchell's model with a slight difference the dip of the subduction zone does not change. Instead, the trench moves westward during the Cenozoic and the Arakan-Yoma-Naga Suture Zone is created as a result of collision between the Indian Plate and China plate as shown in **Figure 4.3-10**.

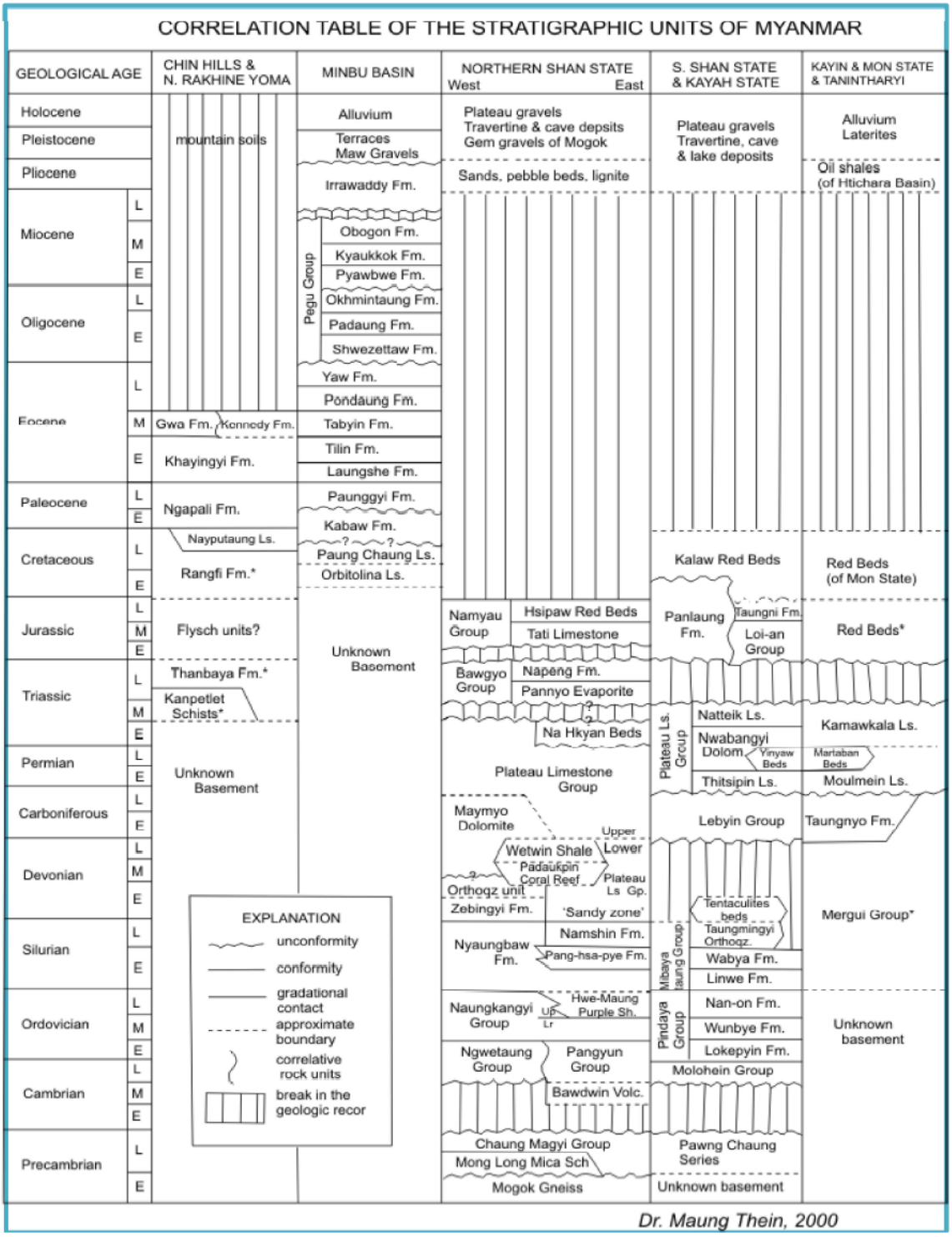


Figure 4.3-9 Correlation Table of Stratigraphic Units of Myanmar

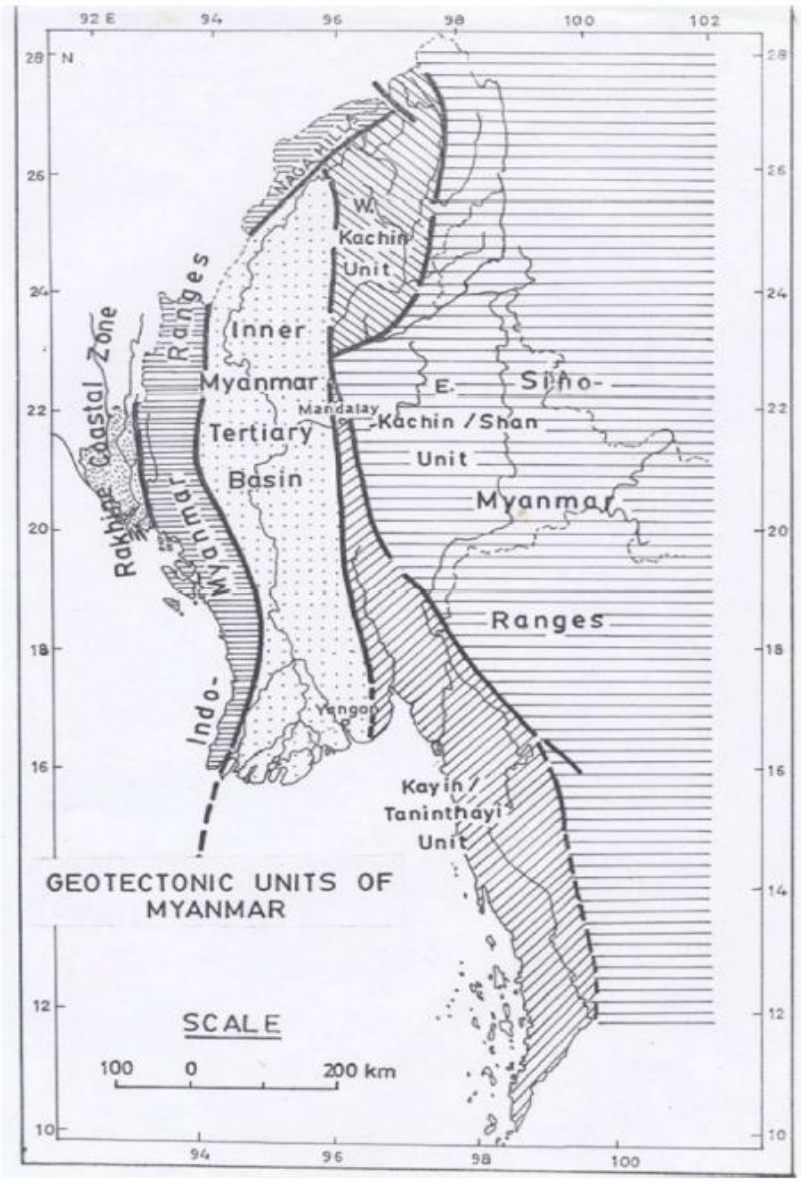


Figure 4.3-10 Geotectonic Map of Myanmar

This report will be emphasizing on local geology of Shan Tanintharyi Block, Kay in Tanintharyi Unit, the west side of Myanmar, where located on "Pa Yain Byu Pond, which geology sequence can be describes by major events;

Early Paleozoic; Deposition of Mergui Sediment probably began during Silurian in Proto-Tanintharyi Region.

Devonian; Deposition of Mergui sediments continued in Proto-Tanintharyi region.

Early Carboniferous; Separation of Sinoburmalaya from Gondwanaland, and its initial movement northeastwards in the paleo-tethys in Carboniferous times.

- Continued deposition of Mergui sediments, locally with tuff and aggromerate beds, under deep-sea conditions in Proto-Tanintharyi-Mon region. (The depositional site extended northwestwards into the western marginal part of the Southern Proto-Shan region where Lebyin Clastics were deposited)
- Orogeny at the end of Early Carboniferous resulting in the deformation and low grade regional metamorphism of Mergui Group, and possibly the intrusion of some

granite plutons in Proto-Shan region e.g. Taung-baring Granite. The fairly widespread small-scale antimony mineralization in the Lebyin and Taungnyo clastics was possibly related to this igneous activity

Late Carboniferous - Middle Triassic;

- Deposition of thick limestone sequence (Plateau Limstone, Moulmein Limestone, and Kamawkala Limestone), Later partially dolomitized, in a wide warm shallow sea that covered most of Proto-Shan-Kayah-Kayin region. (This wide carbonate platform extended into Proto-Yunnan in the northwest, and into Proto-Western Thailand in the East). A thin clastic wedge was also deposited in some parts of Proto-Mon-Kayah region during Late Permian.
- Earth Movements intrusion of granited in eastern Proto-Shan region, and initial emergence of Proto-Shan-Taninthayi region at the end of middle Triassic.

Middle-Late Triassic; Continued northeastward movement of Sinoburmalaya in the neo-Tethys. Southwest of the emerging land by lay a deep sea in which flysch bed were laid down. The northeastward moving ocean floor then began to subduct below the emerging Proto-Shan-Tanintharyi landmass.

Jurassic;

- Concurrently, there was deposition of shallow-sea and deltaic sediment in a few down faulted intermontane basins and shallow seas within and along the western part of the still rising Proto-Shan Plateau-turbites with coal seams in proto-Kalaw Basin; Sandstone, Shale and Limestone in Proto-Kinda-kyaukse area; Limestone and red beds in Proto-Lashio Basin.
- Subduction related large-scale intrusion of granitoid plutons and batholiths (Locally with volcanics) with associated tin-tungsten mineralization along Proto-tanintayi and the western marginal zone of Proto-Shan Plateau during Late Jurassic
- Late Jurassic orogeny causing tight folding of the incompetent Jurassic beds; limited metamorphism along the western marginal zone of Proto-Shan Plateau.

Cretaceous; During the Early Cretaceous, the northeast-moving Sinoburmalaya collided and combined with Indochina Block along Nan Suture to form Proto-Southeast Asian, the Southeastern part of Eurasian Plate. At about that time, Indian plate started to move Northeast wards and there was more subduction of the ocean floor beneath Sinoburmalaya.

- Continue deposition of thick flysch, with Globotruncana-bearing limestone locally in the upper part, in the subduction trench; and there was deposition of thin unit of Orbitolina-bearing limestone in some places of the shallow sea (of the fore-arc basin) that lay between the said subduction trench and Proto-Shan Plateau.
- In contrast a unit of red fanglomerates and siltstones (kalaw Red Beds) was laid down in an oxidizing continental environment in the Kalaw basin in the western part of Southern Proto-Shan Plateau.
- Intrusion of more granitoid plutons, also with associated tin-tungsten mineralization, again along Proto-Tanintharyi and the western maginal zone of Proto-Shan Plateau during Late Cretaceous.
- Epirogenic movements and final uplift of Proto-Shan-Taninthayi region to become a high landmass at the end of cretaceous.

Paleocene-Eocene;

- Concurrently, thick upper Paleocene-Eocene molassic sediments were laid down as a lateral tecto-facies in Proto-Chindwin and proto-Minbu basins which lay in the intervening region between the said trench and Proto-Shan Plateau.

Pliocene; Continued Northward movement of Burma Plate as Irrawady sandstone with fairy abundant fossil wood and vertebrate remains were laid down under

fluvial conditions along the Ayeyarwady and Chindwin river valleys as the Low-lying Central Belt was finally filled up.

Quaternary;

- Deposition of Uyu boulder conglomerates, plateau gravels, and river terraces along big river valleys in northern Central Belt during Pleistocene.
- Deposition of newer alluvium and denudation have been going on side by side since the beginning of Holocene to form the present landscape of Myanmar.

2) Local geology

Local geology of Pa Yain Byu Pond can be subdivided into Stratigraphy unit, Shale, Siltstone, Sandstone and Quaternary sediment. Due to complications in geology and the delicate details required more exploration plan. From sedimentary exploration on the prospect area and geological map of Myanmar compilation based on the geological survey, according to SPT drilling, Pitting, Field geological mapping and Drill coring. The Sedimentary rock have not identified and classified. The arrangement details based on upper to lower ages are as follow:

A. "Alluvium Sediment" is composed of narrow disperse sand, Silt, Clay and rock fragment from Erosion processes; It is settled on V-shape valley and other watersheds in downstream valley of Pa Yain Byu Pond area. It structure normally lamination to cross bedding and inter-fingerings with other layer.

B. "Residual soils" are composed of loose soil from weathering of various types of rock, and overburden of host rock.

C. "Sandstone" Yellow to reddish brown in color. It almost folding appear along the northeast side of pond to the north of their area. It composed of fine to coarse grain sandstone with lateritic sandstone on some places. Trending of the sandstone is almost gentle dipping to steep dipping angles due to position of occurrences on it structure and a compressional force within the areas resulted in small scale to large scale folding. Moreover, lateritic sandstone can be defined as fold crest or fracture of folding structure resulted from quartz precipitated with metallurgical minerals on fracture.

D. "Siltstone" reddish brown and greenish gray in color. It almost folding appears beneath sandstone layer, High fracture content; it composed of silt grain with lateritic siltstone on some places. It thickness around 30 - 40 meter.

E. "Shale" Gray in color. It exposed underneath siltstone layer, there composed of calcite, pyrite and veinlet quartz recrystallized on their fracture. Gentle to steep dipping in angles.

Therefore, the structural geology of the Pa Yain Byu Pond area is almost pointing towards north- south, with folding structure, but local geology might be different on each specific area.

4.3.5.2 Seismology

Data collected by the Myanmar Earthquake Committee (MEC) show that there have been at least 16 major earthquakes (Richter scale ≥7.0) within Myanmar and nearby regions during the period 1839 to 2008 in **Table 4.3-12**. The frequency with respect to time of occurrence is summarized in **Table 4.3-13** According to historical records, ancient capitals of Myanmar around the Mandalay area. Ava. (Innwa), and Sagaing were devastated by huge earthquakes. Active faults and epicenter earthquake distribution are shown in **Figure 4.3-11** Earthquakes in the Richter scale range 7 to 8 have been experienced along the Sagaing fault system, which runs north-south. The former capitals were located along the Sagaing fault zone, which is the principal source of seismic hazards in Myanmar. The regions that

have high levels of seismic hazard are in the Kachin state and Sagaing Division. Earthquakes with intermediate depth foci occur along the borders with India and Bangladesh. The lowest level of seismic hazard in Myanmar is in the south of the country in the Dawei.

Table 4.3-12 List of Some Major Earthquakes in Myanmar within the Myanmar and Nearby Regions During the Period 1839-2008. (MEC)

No.	*Date*	*Epicenter*		*Magnitude*	*Remark*
		Latitude	*Longitude*	*(Richter Scale)*	
1	23/05/1912	21	97.00	8.0	North of Taimsiyyi serious landslides
2	06/03/1913	17	96.50	7.0	"Golden umbrella al tile peak" of Sliwc-maw-daw Pagoda grounded
3	05/07/1917	17	96.50	7.0	"Golden umbrella al tile peak" of Sliwc-maw-daw Patioda mounded
4	19/01/1929	25.9	98.50	7.0	Brick building destroyed at Htaw-Gaw
5	08/08/1929	19.25	96.25	7.0	Brick building destroyed at Swa
6	16/12/1929	25.9	98.50	7.0	Landslide
7	05/05/1930	17	96.50	7.3	Many houses destroyed 500 killed in Bago. Some houses destroyed 50 killed in Yangon.
8	03/12/1930	18	96.50	7.3	Sonic houses destroyed, about 30 killed
9	27/01/1931	25.6	96.80	7.3	Brick budding collapse. landslide
10	12/09/1946	23.5	96.00	7.5	Pagoda collapse.
11	15/08/1950	28.5	96.50	8.6	Under the influence of Assam earthquake. Chindwin river at Mawlaik and Kalewa. Ayeyarwady river al Aunglan flow upstream.
12	16/07/1956	22	96.00	7.0	Pagoda and building at Sagaing destroyed, about 40 killed Sagaing bridge, moved slightly.
13	08/07/1975	21.5	94.70	6.8	Many historical pagodas al Bagan destroyed. 2 killed
14	05/01/1991	23.48	95.98	7.1	Landslide and some building destroyed at Tagaung and surrounding area 2 killed
15	06/08/1988	24.15	98.13	7.3	Myanmar – India border, no casualty reported
16	22/09/2003	19.91	95.72	6.7	Landslide, liquefaction and sand Eruption. Pagodas, some bridges, houses and schools destroyed at Taungdwingyi and surrounding areas. 7 killed

Table 4.3-13 Summary of Earthquake Frequency in Myanmar (1839-2008)

Type of Earthquake	*Richter Scale*	*Frequency*	*Time Range*	*Data Source*
Great	>8	1	1839-2008	Historical record and NEIC
Major	7-7.9	15	1839-2008	Historical record and NEIC
Strong	6-6.9	25	1950-2008	ANSS Catalogue
Moderate	5-5.9	549	1950-2008	ANSS Catalogue

The seismic zone map of Myanmar prepared by a team led by Thein (2009) is presented in **Figure 4.3-12** The five seismic zones are demarcated and named (from low to high), and a probable maximum range of ground acceleration in g values and equivalent Modified Mercalli Scale classes are given for each zone.

Zone V is the highest intensity zone (Destructive Zone) and is designated the area with the highest probable maximum range of ground acceleration (0.4 to 0.5 g). This is equivalent to Modified Mercalli Intensity (MMI) class IX. There are four areas in the most vulnerable zone; Bago-Phyu, Mandalay-Sagaing-Tagaung, Putao-Tanaing, and Kale-Homalin.

Zone IV the Severe Zone is that where the probable maximum range of ground acceleration is 0.3 to 0.4 g. This is equivalent to MMI class VII to IX. The cities and towns that lie in this zone are Taungoo, Taungdwingyi, Bagan-Nyaung-U, Kyaukse, Pyin Oo Lwin, Sliwebo, Wuntho, Hkamti, Flakha, Myitkyina, Taunggyi, and Kunglong.

Yangon straddles the boundary between zones II and III, with the old and new satellite towns in the eastern part in Zone III, and the original city in Zone II. Yangon, Mandalay and Bago are in earthquake prone areas, and it is noted that vulnerability increases with urbanization in cities.

Mon State and Tanintharyi division in the south of the country lie in Zone I, which is the lowest hazard zone with a probable maximum range of ground acceleration 0.05 to 0.07 g. This is equivalent to MMI class VI. According to the Figure 3.2-12, proposed project area is located in the moderate zone II with a probable maximum range of ground acceleration 0.1-0.15 g.

However, seismic hazard and zone should be considered more deeply in feasibility engineering study.

4.4 Ecological Resources

4.4.1 Aquatic Biology

There are several species of aquatic animals available in the river and water bodies of the project area such as catfish, butter catfish. Dawei River is major habitat for the aquatic animals, which are located near by the Project area. The secondary data of Aquatic Biology in Dawei River is the best representative related to the Project area. The results of Fishes, Aquatic Organisms and Aquatic Flora are shown in table 4.4-1, table 4.4-2 and table 4.4-3 respectively.

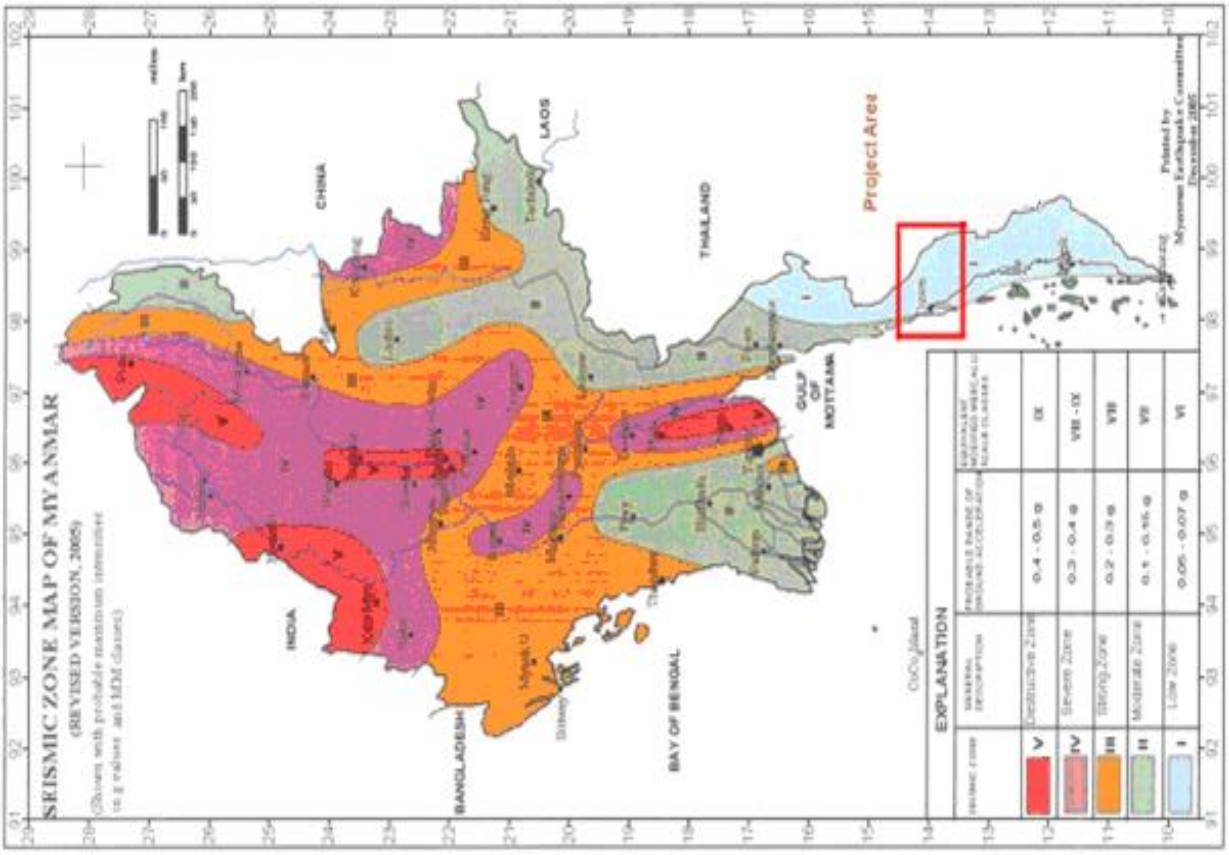


Figure 4.3-12 Seismic Hazard Map of Myanmar (Thein, 2009)

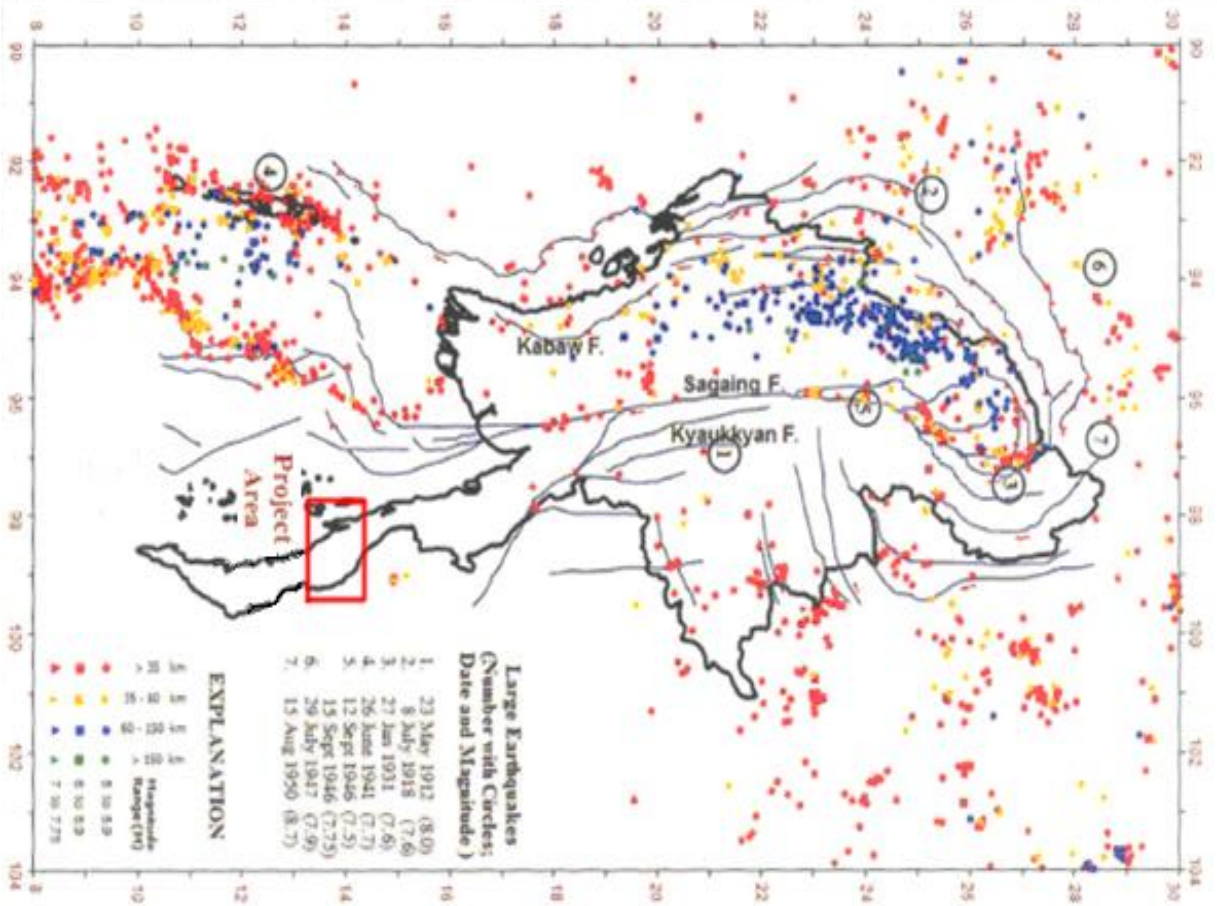


Figure 4.3-11 Earthquake Epicentral and Seismotectonic Map of Myanmar and Surrounding Regions (Thein, 2009)

Table 4.4-1 The Results of Fishes in Dawei River

Family	Species	Common Name	Result (Density(Abundance))
Engraulidae	*Stolephorus* sp.	Anchovy	100 (0.215)
Bagridae	*Mystus gulio*	Long-whiskered Catfish	100 (1.000)
Hemiramphidae	*Dermogenys pusilla*	Needle Fish	300 (0.145)
Polynemidae	*Polynemus dubius*	Eastern Paradise Fish	100 (3.250)
Sciaenidae	*Otalithes biaurites*	Tigertooth Croaker	400 (0.270)
Gobiidae	*Caragoboides geomys*	Goby	1,950 (2.890)
	Periopthalmodon schlosseri	Mudskipper	400 (0.380)
	Trypuchen vagina	Burrowing Goby	1,050 (0.360)
Total 8 species			

Remark: Density = Individual/Hectare
Abundance = Kg/Hectare

Table 4.4-2 The Results of Aquatic Organisms in Dawei River

Aquatic Organisms	Result
Phytoplankton	
Total Abundance (Units/m^3)	2,386,200
Amount of Species	19
Diversity Index	1.28
Dominant Genera	*Cyclotella*
Zooplankton	
Total Abundance (Units/m^3)	135,300
Amount of Species	4
Diversity Index	0.66
Dominant Genera/Group	*Nauplius of Copepod*
Benthic Fauna	
Total Density (Individuals/m^2)	14
Amount of Species	2
Dominant Family/Group	*Palaemonidae*
Littoral Fauna	
Total Density (Individuals/m^2)	176
Amount of Species	3
Dominant Family/Group	*Palaemonidae*

Table 4.4-3 The Results of Aquatic Flora in Dawei River

Aquatic Flora	Result
Family Cyperaceae *Actinoscirpus grossus*	xx
Family Acanthaceae *Acanthus ebracteatus*	x
Family Araceae *Cryptocoryne ciliate*	xx
Family Rhizophoraceae *Rhizophora apiculata*	x
Family Avicenniaceae *Avicennia alba*	x
Family Arecaceae *Nypa fruticans*	xx
Amount of Species	6

Remark:
- xxx (Abundance) : occupies 66.67-100.00% in about 500 sq.m. area.
- xx (Moderate) : occupies 33.34-66.66 % in about 500 sq.m. area.
- x (Sparse) : occupies 00.00-33.33 % in about 500 sq.m. area.

4.4.2 Wildlife

From the study of field survey and interviews with Pa Yain Byu and Oata Yan Villagers, there are numerous species found in the project and nearby area.

Commonly found deer and barking deer. Species of reptiles in the project area such as pythons and cobras. Most common species of wildlife as informed by local villager are given in **Figure 4.4-1.**

Figure 4.4-1 Wildlife in the project area

Species of Conservation Significance

The Project Study Area resides within the Myanmar Coastal Rain Forests (IM0132) EcoRegion[1]. This ecoregion represents the lowland evergreen and semi-evergreen rain forests of the western side of Arakan Yoma and Tenasserim ranges along the west coast of Myanmar. A small area extends into southeast Bangladesh. It falls within the tropical wet climate zone of the Köppen climate system. Although low in endemism, it has a rich fauna and flora, largely as a result of its lush vegetation, extensive range of habitats from mangroves to mountains, and position as a corridor between the Sundaic, Indochinese, and Indian sub-regions. Two mammal species (both bats) are considered endemic to the EcoRegion. More than 350 bird species are found in the diverse habitats of this ecoregion, although none are considered ecoregional endemics.

Most of the seasonal evergreen forest and almost all the freshwater swamp of this ecoregion have been cleared for agriculture. This ecoregion is inadequately protected. The continued development of flat, lowland areas for irrigated paddy rice and subsistence crops such as hill rice, cassava, yams, and vegetables on hilly ground will be a major threat in the future. Wildlife trade and poaching are a major threat to the rapidly declining large mammals and medicinal plants.

[1] WWF 2016 WWF EcoRegions Southern Asia: Western Myanmar into Bangladesh. Myanmar Coastal Rain Forests (IMO132) http://www.worldwildlife.org/ecoregions/im0132

According to Biodiversity of the Project area, no Important Bird Areas (IBA), Alliance for Zero Extinction (AZE), Important Plant Areas (IPA) and Important Sites for Freshwater Biodiversity are present within 100 km of the Project Area.

Species classified as Critically Endangered, Data Deficient, Endangered or Vulnerable on the IUCN Red List are shown in Table 1

Table 4.4-4 Critically Endangered, Data Deficient, Endangered and Vulnerable Species within the Myanmar Coastal Rain Forests (IM0132) EcoRegion.

Scientific Name	Common Name	Class	Redlist Category
Ardea insignis	White-bellied Heron	Aves	Critically Endangered
Rhodonessa caryophyllacea	Pink-headed Duck	Aves	Critically Endangered
Aythya baeri	Baer's Pochard	Aves	Endangered
Aceros subruficollis	Plain-pouched Hornbill	Aves	Vulnerable
Emberiza aureola	Yellow-breasted Bunting	Aves	Vulnerable
Mulleripicus pulverulentus	Great Slaty Woodpecker	Aves	Vulnerable
Turdoides longirostris	Slender-billed Babbler	Aves	Vulnerable
Leptoptilos javanicus	Lesser Adjutant	Aves	Vulnerable
Columba punicea	Pale-capped Pigeon	Aves	Vulnerable
Manis javanica	Malayan Pangolin	Mammalia	Endangered
Manis pentadactyla	Chinese Pangolin	Mammalia	Endangered
Hapalomys longicaudatus	Marmoset Rat	Mammalia	Endangered
Tapirus indicus	Malayan Tapir	Mammalia	Endangered
Axis porcinus	Hog Deer	Mammalia	Endangered
Elephas maximus	Asiatic Elephant	Mammalia	Endangered
Prionailurus viverrinus	Fishing Cat	Mammalia	Endangered
Lutra sumatrana	Hairy-nosed Otter	Mammalia	Endangered
Cuon alpinus	Dhole	Mammalia	Endangered
Trachypithecus phayrei	Phayre's Leaf Monkey	Mammalia	Endangered
Hylobates lar	White-handed Gibbon	Mammalia	Endangered
Bos javanicus	Banteng	Mammalia	Endangered
Trachypithecus germaini		Mammalia	Endangered
Panthera tigris	Tiger	Mammalia	Endangered
Melogale personata	Burmese Ferret-badger	Mammalia	Data Deficient
Berylmys mackenziei	Kenneth's White-toothed Rat	Mammalia	Data Deficient
Tragulus javanicus	Lesser Mouse-deer	Mammalia	Data Deficient
Eudiscopus denticulus	Disk-footed Bat	Mammalia	Data Deficient
Macaca arctoides	Stump-tailed Macaque	Mammalia	Vulnerable
Helarctos malayanus	Sun Bear	Mammalia	Vulnerable
Ursus thibetanus	Asiatic Black Bear	Mammalia	Vulnerable
Hemigalus derbyanus	Banded Palm Civet	Mammalia	Vulnerable
Arctictis binturong	Binturong	Mammalia	Vulnerable
Viverra megaspila	Large-spotted Civet	Mammalia	Vulnerable
Neofelis nebulosa	Clouded Leopard	Mammalia	Vulnerable
Pardofelis marmorata	Marbled Cat	Mammalia	Vulnerable

Scientific Name	Common Name	Class	Redlist Category
Lutrogale perspicillata	Smooth-coated Otter	Mammalia	Vulnerable
Rusa unicolor	Sambar	Mammalia	Vulnerable
Macaca leonina		Mammalia	Vulnerable
Nycticebus bengalensis		Mammalia	Vulnerable
Petinomys vordermanni	Vordermann's Flying Squirrel	Mammalia	Vulnerable
Batagur baska	River Terrapin	Reptilia	Critically Endangered
Heosemys depressa		Reptilia	Critically Endangered
Manouria emys	Asian Brown Tortoise	Reptilia	Endangered
Nilssonia formosa	Burmese Peacock Softshell	Reptilia	Endangered
Indotestudo elongata	Elongate Tortoise	Reptilia	Endangered
Lygosoma anguinum	Burmese Writhing Skink	Reptilia	Data Deficient
Dryocalamus gracilis	Scarce Bridal Snake	Reptilia	Data Deficient
Enhydris maculosa	Blanford's Spotted Water Snake	Reptilia	Data Deficient
Lissemys scutata		Reptilia	Data Deficient
Oligodon planiceps		Reptilia	Data Deficient
Sibynophis bistrigatus	Günther's Many-tooth Snake	Reptilia	Data Deficient
Morenia ocellata	Burmese Eyed Turtle	Reptilia	Vulnerable
Siebenrockiella crassicollis	Black Marsh Turtle	Reptilia	Vulnerable
Amyda cartilaginea	Asiatic Softshell	Reptilia	Vulnerable
Pelochelys bibroni	Asian Giant Softshell	Reptilia	Vulnerable
Cuora amboinensis	Southeast Asia Box Turtle	Reptilia	Vulnerable
Heosemys grandis		Reptilia	Vulnerable
Ophiophagus hannah	King Cobra	Reptilia	Vulnerable

Terrestrial Flora and Fauna

Observations made during the rapid field assessment included Natural Habitats consisting of remnant evergreen and deciduous forests. Typical species of forest trees include *Xylia keri, Salmalia malabrica, S. insigni, Dalbergia kurzii, Lannea grandis, Teminalia balerica, T. chebula, Eugenia spp., Anogeissus acuminata, Terminalia spp., Vitex pubescens, Adina cordifolia,* and *Spondias pinnata.* Bamboo breaks of *Melocanna bambusoides* are also likely prevalent.

No floral species of conservation significance were identified within the Project Area and AoI.

Fauna observations made during the rapid field assessment identified the species as shown in ***Table 4.4-5*** below. Interviews undertaken with local villagers did not identify any species of conservation significance within the AoI. Common farm animals were the only fauna identified by local people during the interviews. Similarly, no species of conservation significance were identified during market surveys.

No fauna species of conservation significance was identified within the Project Area and AoI.

Table 4.4-5 Fauna Observations during Rapid Field Assessment

Scientific Name	Common Name	Class	IUCN Red List
Callosciurus caniceps	Grey Squirrel	Mammalia	LC
Muntiacus muntjak*	Barking Deer	Mammalia	LC
*Malayopython reticulatus**	Reticulated Python	Reptilia	LC
Naja sumatrana	Equatorial Spitting Cobra	Reptilia	LC

**Observed during survey for the Pa Yain Byu Reservoir IEE*

4.4.3 Forest

According to the national classification for forests, the total area of the country is divided into five classes: closed forest, open forest, other wooded land, inland water bodies and other land. Land classification and estimated area changes from 1990 to 2000, and then to 2005 are shown in **Table 4.4-6** The total forest area decreased from 56 percent of total land in 1990 to 52.1 percent in 2000, and yet again to 50.2 percent in 2005. The percentage change of the total forest area between 1990 and 2000 was -6.9 percent and that between 2000 and 2005 was -3.7 percent. From 1990 to 2005, the total forest area changed at the rate of -10.3 percent.

Table 4.4-6 Status of major forest types in 2002

Forest type	*Extent*	*Percentage*	*Extent*	*Percentage*	*Extent*	*Percentage*	*% Change (Year 1990- 2005)*
	(Year 1990)		*(Year 2000)*		*(Year 2005)*		
Closed forests	28,114.7	41.6	25,841	38.2	24,704.2	36.5	-12.1
Open forests	9,755.8	14.4	9,426.9	13.9	9,262.4	13.7	-5.1
Total forests	37,870.5	56.0	35,267.9	52.1	33,966.6	50.2	-10.3
Other wooded land	10,405.8	15.4	11,435.3	16.9	11,950	17.7	14.8
Other land (including water bodies)	19,381.6	28.6	20,954.7	31.0	21,741.3	32.1	12.2
Total land area	**67,657.9**	**100**	**67,657.9**	**100**	**67,657.9**	**100**	**0**

Source: FAO (2006)

In the project area, there are no any other environmental sensitive locations in or near project site. The project area surrounded by land that was converted for agricultural use and government plantation many years ago. There is remaining a few natural habitat. Main tree.

4.4.4 Terrestrial Habitats

Terrestrial habitats observed within the Project Area and Area of Influence was primarily of cleared agricultural land in production or fallow and palm oil plantations.
The distribution of Natural Habitats and Modified Habitats within the Project Area and AoI is shown in ***Figure 4.4-2***.

Natural Habitats consisted of evergreen and deciduous forests. No Natural Habitat was identified within the Project Area. The percentage area of natural habitat within the AoI was <5% and was located along natural drainage features and some steep hill slopes as shown in the photograph below.

Figure 4.4-2 Natural Habitat located on hillslopes

Modified Habitats consisted of timber plantations, rubber plantations, palm oil plantations, rice paddies, fruit and nut tree plantations and fallow agricultural land. These agricultural areas were located mainly to the South of the Project Area. Palm oil plantations dominate this area.

Photographs of modified habitats within the AoI are shown below.

Figure 4.4-3 Modified Habitat showing Palm Oil Plantation

Figure 4.4-4 Modified Habitat showing Cashew nut and Rubber Plantation

The Project Area consisted entirely of Modified Habitat, being a palm oil plantation. The percentage area of land uses identified as Modified Habitat within the AoI is shown in **Table 4.4-7.**

Table 4.4-7 Area of Land use for Modified Habitats within the Area of Influence

Land Use	Area (Km^2)	Percentage of Area within AoI
Water bodies	0.5	5%
Cultivated Fields and Rice Paddies	0.9	10%
Plantations (Timber, Rubber, Palm Oil, Fruit and Nut)	6.6	70%
Fallow Land	1.4	15%

4.5 Economic Development

4.5.1 Infrastructure and facilities

4.5.1.1 Electricity

Due to no public electricity and transmission line grid in the project area, Most of the people depend upon firewood for cooking purpose and in each settlements have diesel generator used for lighting, are shown in **Figure 4.5-1**.

Figure 4.5-1 Electricity system in the project area

4.5.2 Transportation

Myanmar is only accessible by air. As the result, the majority of visitors have to visit the country by airplane through Yangon International Airport. The national carrier is Myanmar Airways. The direct international flights arrive from Bangkok, Kuala Lumpur, Singapore, Taipei, Kolkata and Kunming on each country's respective national carriers.

Together with a handful of other regional airlines service, there've still had a limited service for domestic and international demand in order to get in and out of this country.

4.5.2.1 Air Transport

In domestic services, there are flights with destinations of 29 townships from Yangon, 9 townships from Mandalay and 1 township from Myitkyina.

There are four Private Domestic Airlines in Myanmar which are Air Bagan, Air Mandalay, Asian Wings and Air KBZ. Air KBZ Airline is new airline service that launched in April 2011 with a brand new Air craft ATR72-500 equipped with 64 all-leather seats.

For the International airlines, apart from Myanmar Airways International (MAI), there are about 13 airlines having Myanmar as a destination such as Thai Airways, Air Asia, Silk Air etc. Domestic Airlines and International Airlines are shown in **Table 4.5-1** and **Figure 4.5-2**

Table 4.5-1 Domestic Airlines and International Airlines in Myanmar

Domestic Airlines	*International Airlines*
Air Bagan	Myanmar Airways International (MAI)
Air Mandalay	Thai Airways International
Asian Wings	Air Asia
Air KBZ	Silk Air
	Korean Air
	Bangkok Airways
	Malaysia Airlines
	Air China
	China Eastern Airlines
	Indian Airlines
	Mandarin Airlines
	Phuket Air
	Qatar Airways


Mandalay International Airport


Mandalay International Airport


Yangon International Airport

Yangon International Airport

Figure 4.5-2 International Airport

However, there are 3 International Airport in Myanmar as presented below:

1) Mandalay International Airport

The Mandalay International Airport opened on 17 September 2000 has the characteristics of world class airport. It is located about 7 miles south of Tada-U and some 18 miles south-west of Mandalay. Its runway is 14000 feet in length and 200 feet in width.

The area of the airport is 25,015 acres. There are six passenger boarding bridges and three of them can handle modern Boeing 747 building. The basement is for storage of goods and maintenance of machines. The ground floor is for arrival passengers and the first floor for departure passengers. The second floor consists of offices and meeting halls. The airport will be able to handle 8,000 passengers a day and 3 million passengers a year.

The Mandalay International Airport takes up a geographically-strategic position in upper Myanmar.

2) Yangon International Airport

The airport was bu2lt on a former World War II airfield in 1947 by the Calcutta Metropolitan Airports Authority. Once regarded as the best in Southeast Asia, the airport fell into disrepair and was for decades dilapidated and antiquated. A modernization programme launched in April 2003 has so far resulted in a new terminal and an extended 11,200 foot (3,414 m) runway. The new terminal can handle 900 arriving and 900 departing passengers simultaneously. Other notable features include

- Separate floors for arriving and departing passengers to lessen congestion
- Automated baggage handling system, integrated check-in system
- Four air bridges, capable of handling four Boeing 747s
- Special lounges for use by government officials and business people
- Two-story car park with spaces for 340 vehicles.

3) Nay Pyi Taw International Airport

Nay Pyi Taw International Airport; previously known as Ela Airport, officially Nay Pyi Taw International Airport, is located 16 kilometers southeast of Nay Pyi Taw, the capital of Burma. Before the foundation of Nay Pyi Taw, this was referred to as the airport of the nearby town of Pyinmana. The airport officially opened on 19 December 2011.

The airport is able to handle 3.5 million passengers annually. The company previously designed the annex to Yangon International Airport, as well as Singapore's Changi Airport and several airports of Vietnam and Laos. The construction work of the airport, performed by Asia World Company, a Myanmar corporation, began in January 2009. At the completion of the project, the airport will have 2 runways and 3 terminals with modern facilities.

4.5.2.2 Waterways

The major transportation mode for passengers or cargo is the use of the inland waterways. There are about 8,000 miles of rivers and 2,000 miles of canals which can be navigable for large commercial boats. Considering the fact that most of the major cities in Myanmar are near water, this isn't surprising as shown in **Figure 4.5-3**.

Figure 4.5-3 Waterways Transportation in the Project Area

4.5.2.3 Railways Transportation Service

The railways aren't much better, since they had been built since the time of British rule (and government owned and run). There are about 2,000 miles of track, but they don't connect with railways outside of Myanmar, only with major cities within the country.

The Ministry of Rail Transportation is made up of Myanmar Railways, Transport Planning Department, Directorate of Road Transport, Road Transport and Central Institute of Transport and Communications.

Myanmar rail transportation services began by opening the Yangon-Pyay railroad on 1 May 1877. Myanmar rail road stretches 2,850.08 miles.

4.5.2.4 Road Transportation

Myanmar's roadways received the government's attention in the 90's, but there is not improvement has been made. With an approximation, only 12 percent of the roads are paved with an overwhelming, the majority have been made of gravel (about 2/3). The remaining roads are not easily accessible by cars, but by jeeps or ox carts.

In the project area, most of the road in this area is two-lane which its surface composition was between poor and very poor conditions. Internal travel in the project area is mainly through public transport, motorcycle and boat as shown in **Figure 4.5-4**.

Figure 4.5-4 Road Condition and Transportation in the Project Area

4.5.3 Land use pattern

Myanmar has been endowed with a rich diversity of natural habitats. As these diverse biological resources have been protected and conserved on a sustainable basis for about 150 years, about half of the country's total land area is still covered with forests. As a result, Myanmar can stand as one of the countries with highest forest cover in the Asia-Pacific region until now. Myanmar being an agro-based country, the Myanmar Government has systematically carried out special tasks with greater emphasis on the sustainable development of agriculture and irrigation.

For the project area, there are natural forest areas, cultivated and agriculture land in northern part of the site. The trees and agriculture land are much denser in the southern area of the site. The project area covers the area approximately of 427 acre, which are three major types of land use in project area, i.e., cultivated land, forest land and non-cultivated land. Cultivated land includes paddy field. The most common of agriculture land were rubber and cashew nut cover approximately 175 acre. Furthermore, the project area is an oil palm plantation of Ministry of Industry (MOI) about 252 acre. The land use in Pa Yain Byu Pond is shown in **Figure 4.5-6.**

As the population is rapidly increasing in Myanmar, proper land use planning and management is of utmost importance to minimize the conflict over the land among the various sectors such as the agriculture, forestry, livestock breeding, mining etc.

The primary source of domestic water supply is the Nat stream and groundwater that are useful for communities in the extent of project area as shown in **Figure 4.5-5**. Uses of water include drinking, agriculture, household, recreation and environmental activities. Other sources of water for local village are from the rain. Therefore, Pa Yain Byu Pond Project will be developed to supply the raw water for early industries construction and industrial uses and provides benefit to the local village by retaining the excessive to maintain the natural water in dry season.

Figure 4.5-5 Water supply in the project area

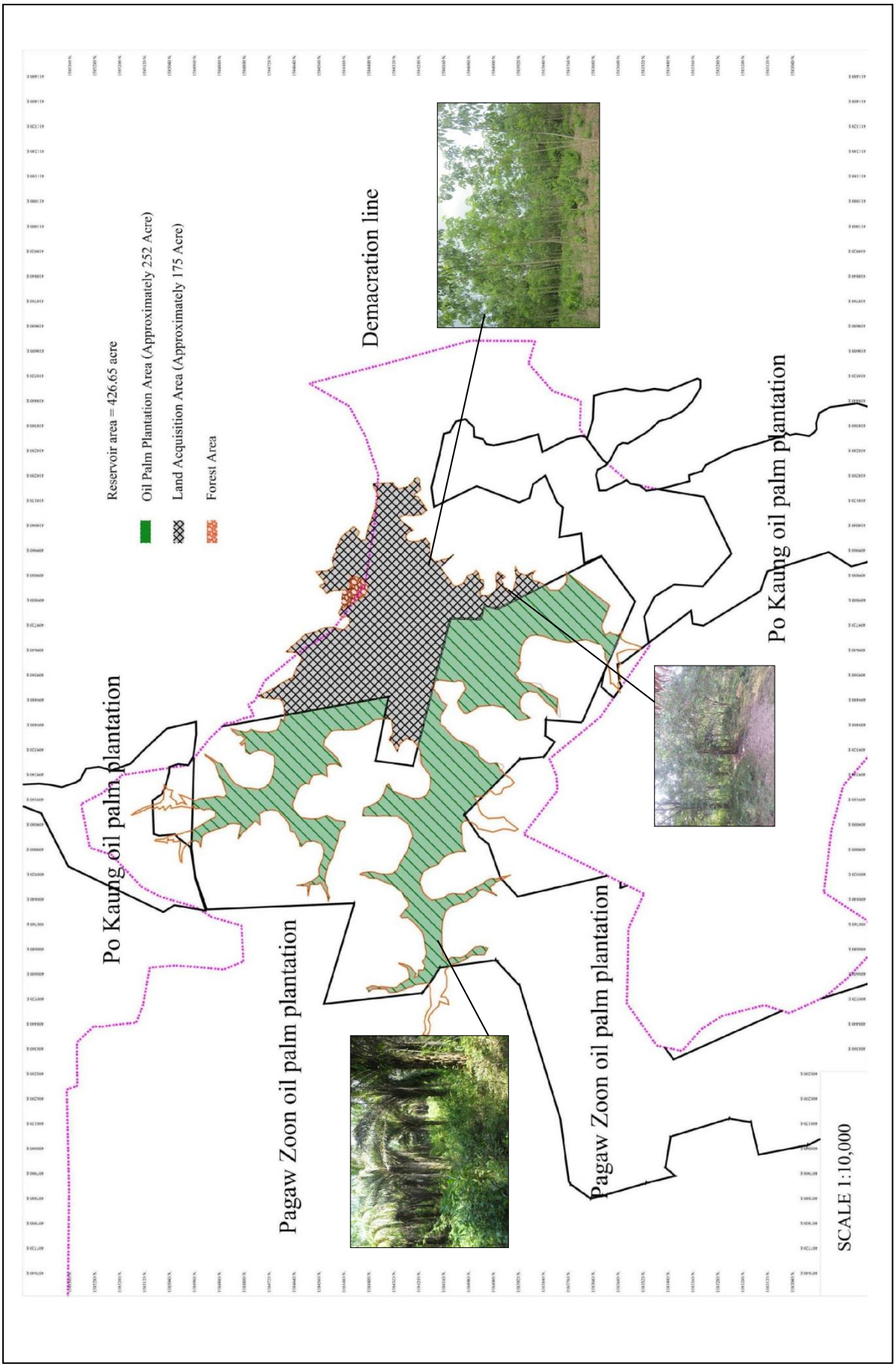


Figure 4.6-1 Land Use in the Project Area

4.6 Social and Cultural Resources

4.6.1 Demography

Myanmar has a population of 58.38 million in **Table 4.6-1**. In 1990, population census had been conducted by Department of Population. There are over 600,000 registered migrant workers from Myanmar in Thailand, and more than million Burmese live illegally. According to the record of Thai Labor Ministry, Burmese workers are about 80% of total migrant workers in Thailand. In Tanintharyi, where the project area occupied, the population density is relatively low as shown in **Figure 4.6-1**. In Additional, as per the 2004 census, the population of the Dawei District is 139,900.

Table 4.6-1 Population Estimates of Myanmar

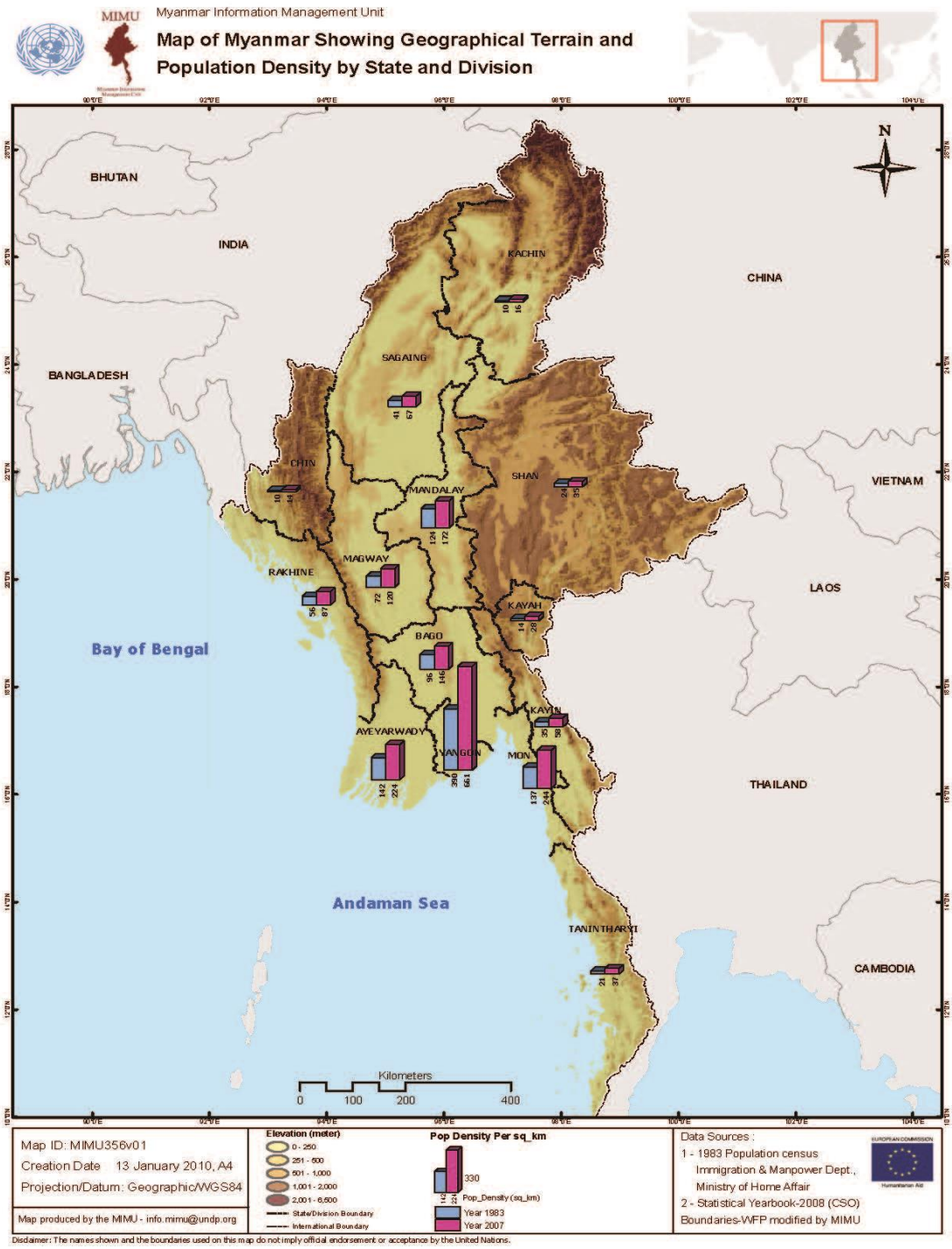
No.	*Year*	*Population (million)*			*Annual Growth Rate (percentage)*
		Total	*Male*	*Female*	
1	1990-1991	40.78	20.21	20.57	1.88
2	1995-1996	44.74	22.22	22.52	1.87
3	2000-2001	50.13	24.91	25.22	2.02
4	2002-2003	52.17	25.94	26.23	2.02
5	2003-2004	53.22	26.47	26.75	2.02
6	2004-2005	54.30	27.00	27.30	2.02
7	2005-2006	55.40	27.54	27.86	2.02
8	2006-2007	56.52	28.10	28.42	2.02
9	2007-2008	57.50	28.58	28.92	1.75
10	2008-2009	58.38	29.03	29.35	1.52

Note: Estimates for 1985-93 are based on 1983 population census. Estimates for the subsequent period are based on 1983 population census as well as on 1991 Myanmar population changes and fertility survey.

4.6.2 Population and community

The investigation of population, households had been carried out as a basis three area:

1) Upstream Area: There is only one village in the project area such as Oata Yan village.
2) Construction Area: There is no villages in this area.
3) Downstream Area: There is only one village in this area such as Pa Yain Byu village.



Source: http://www.themimu.info/

Figure 4.6-1 Population density in Myanmar

4.6.3 Health facilities

The concerned disease in Myanmar included HIV/AIDS, Tuberculosis (TB), Malaria, Septicaemia, Pneumonia, etc. These diseases have been causing high morbidity and mortality in the country. The tropical diseases prevalent in Burma are shown in **Figure 4.6-2** and **Figure 4.6-3**

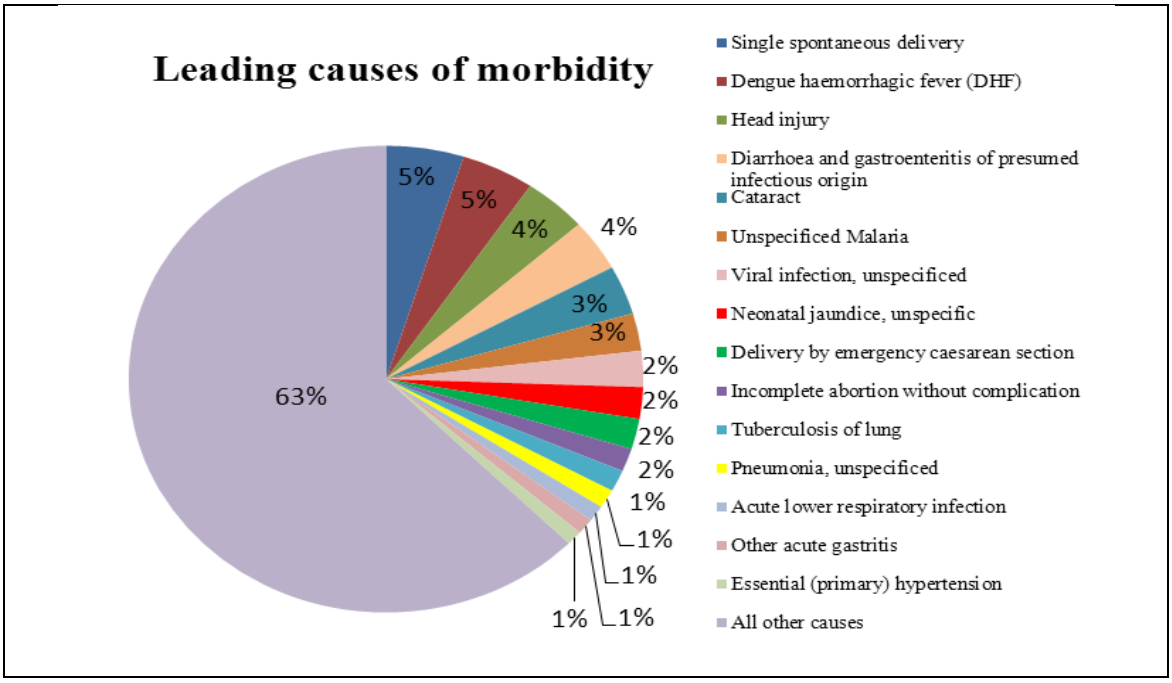


Figure 4.6-2 Leading causes of morbidity in Myanmar (2008)

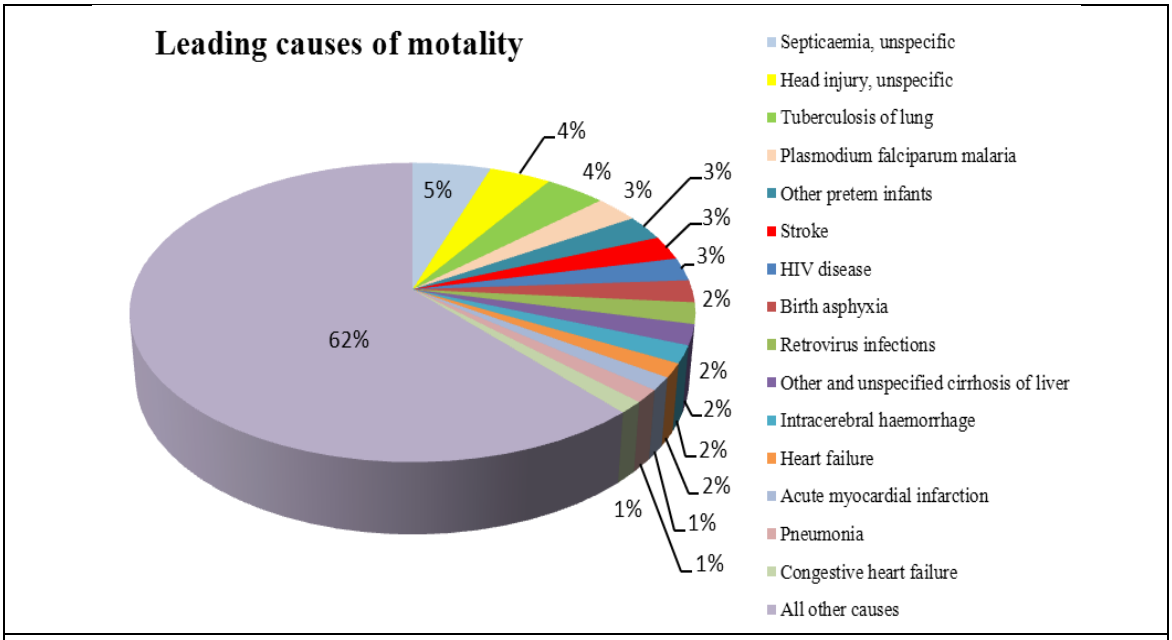


Figure 4.6-3 Leading causes of mortality in Myanmar (2008)

Source: Annual Hospital Statistics Report, Department of Health Planning, 2008

Myanmar people's health condition in the project area is poor due to widespread illiteracy, lack of awareness and better life services. Malaria, Typhoid, Jaundice, Diarrhea, Worms, Respiratory Diseases, Whooping cough, Gastric, various types of skin diseases, Tuberculosis, deficiency disease are the disease can largely be found in the project area. Among the various type of disease found in Pa Yain Byu Pond Area, Malaria is the major disease. The settlement within project area and surrounding area are lack of sanitation facilities. However, condition of community and personal sanitation have been improving along with growing sanitary awareness among people. Sanitary awareness is gradually encouraging people to build their own private toilet and mange solid waste. In urban areas of Dawei Township, almost households have their own toilet.

At the present time, There is no healthcare facility in all the affected communities. Majority of the local village to self-help medical care or they patronise herbal medicine men. For those that can afford it, they travel to Yebrue/ Dawei, which have various clinics and pharmacy shops and Thailand for the treatment of their ailments.

4.6.4 Education facilities

The education level rate of Burma, according the Central Statistical Organization (2008-2009) stands at Primary level, Middle level and High level are 62%, 26% and 6%, respectively as shown **Figure 4.6-4**.

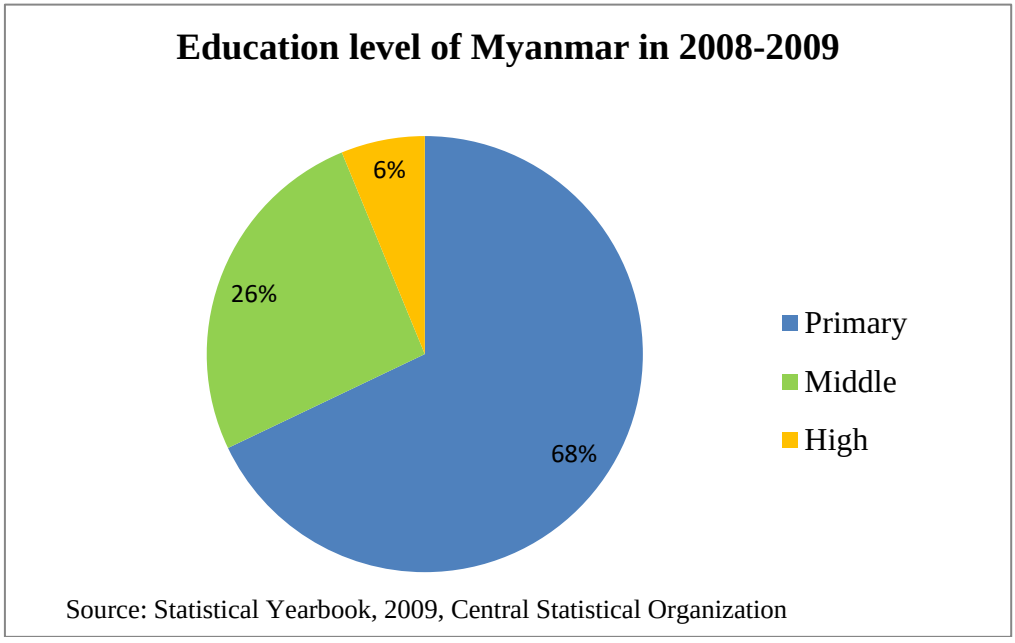


Figure 4.6-4 Education level in Myanmar

The finding on the education institutions of the population in the project area, which located in the downstream area. There is only one primary school in the Pa Yain Byu Village that is not the affected area from the Pa Yain Byu Pond Project as shown in **Figure 4.6-5.**

This school has only one teacher, 18 students and lacked of facilities such as sanitation system, teacher, canteen, learning media, etc.

4.6.5 Communication

Regarding communication, all settlements have telephone facilities and mostly with CDMA set connection. Post offices located in each Township have been also serving the local people to ease communication as shown in **Figure 4.6-6**.

Figure 4.6-5 Pa Yain Byu School

Figure 4.6-6 Communication in the project area

4.6.6 Socio-economic condition

As a result of field investigation and interview the Local people in the upstream, downstream and construction zones, it was found that there is only the area of construction sites that do not exist any village settlement. The result of socio-economic survey on upstream and downstream zones identified 2 villages, Oata Yan and Pa Yain Byu, residing in the areas. From an interview with village representatives at Pa Yain Byu and Oata Yan villages, it revealed that all populations are Buddhist with gardening as major livelihood. The average livelihood income and expenditure is approximately 0-500,000 MMK per month and 2,000,001-3,000,000 MMK per month, respectively.

Chapter 5

POTENTIAL PROJECT IMPACTS AND MITIGATION MEASURES

CHAPTER 5
POTENTIAL IMPACTS, CUMULATIVE IMPACTS, RISK ASSESSMENTAND MITIGATION MEASURES

5.1 Environment and Social Impacts

Like other development projects, the project activities may create both beneficial and adverse impacts. In this chapter, the environmental and social impacts will be identified based on the analysis of environmental baseline information and activities that are to be performed by the Project. Most of the identified impacts have been quantified to the extent possible on the value judgment. Each of the environmental issues has been examined in terms of their current condition, likely impacts during construction and subsequent operation phases. The impacts have been predicted in terms of their magnitude, extent and duration in a preliminary basis. The possible impacts from the proposed project activities during pre-construction, construction and operation phases are described.

Key actions affecting environmental resources and value include:

1) **Resettlement:** Resettlement of population in inundated areas that required compensation, relocation and livelihood restoration plans to make affected people to be better-off.
2) **Employment & Economic Opportunity:** Creation of jobs, money circulation, demand for necessities, construction materials, and services.
3) **Forestry:** Project lands that create losses to forest areas.
4) **Inundation to historical/cultural resources:** Project lands that lead losses of historical/cultural resources.
5) **Watershed erosion/silt run-off:** If the existing condition of erosion/silt run-off in the watershed is sufficient to jeopardize the life of the dam by an excessive filling rate, consideration must be given to expand the project to include a watershed reforestation program.
6) **Impairment of navigation:** Will the dam itself impair downstream navigation and, if so, what provisions may be made to offset this loss?
7) **Impairment of groundwater hydrology:** Will the reservoir result in waterlogging in the vicinity and, if so, how can damages be feasibly offset?
8) **Migrating valuable fish species:** Will the dam obstruct valuable migrating fisheries and, if so, how can these losses be offset?
9) **Inundation of mineral resources:** Will the reservoir cause loss of valuable mineral resource development potentials?
10) **Effects on downstream ecology and water uses:** Does the storage dam release water to maintain downstream ecology and community water uses?
11) **Earthquake hazards:** Does the project induce earthquake hazards?

5.1.1 Impact Assessment Methodology and Approach

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

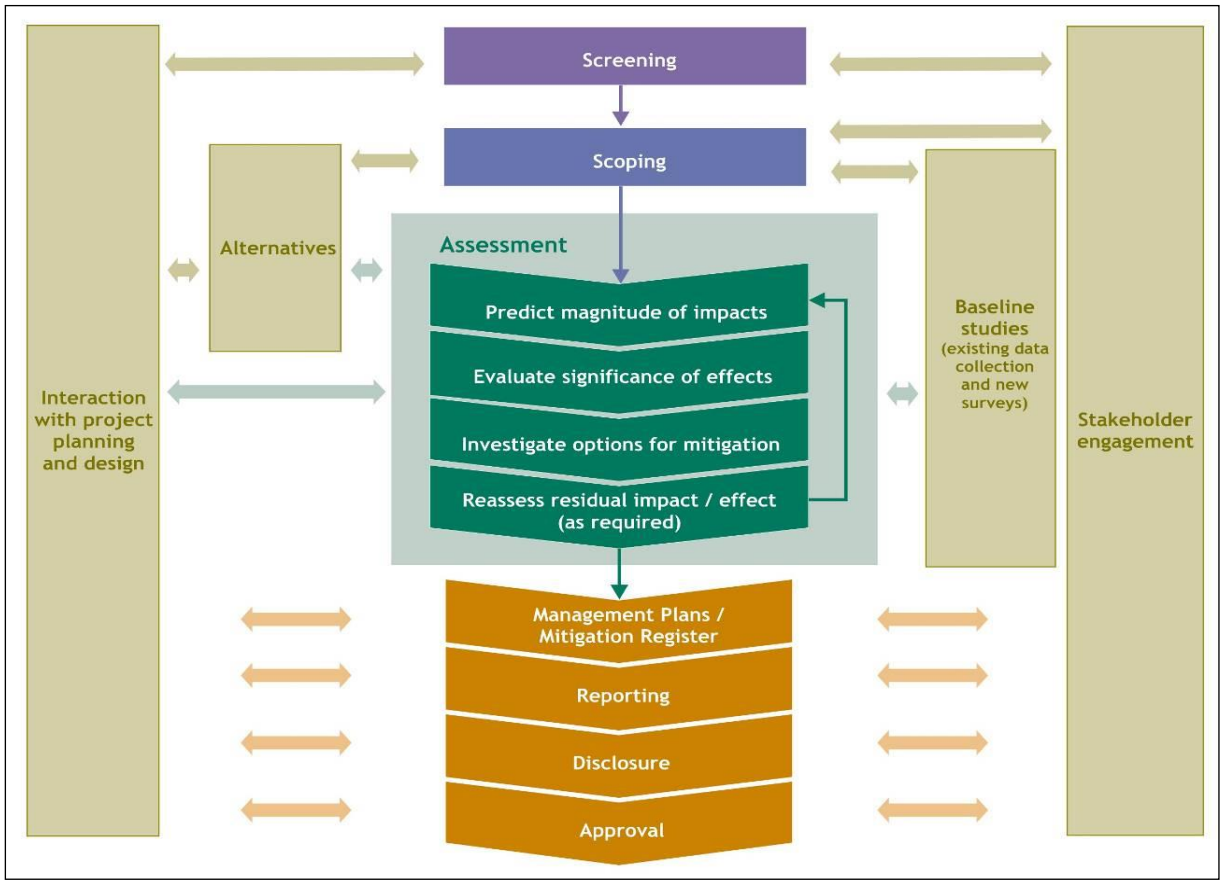


Figure 5.1-1 Overall Impact Assessment Process

A. Screening

At the initial stage of the IEE, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. The screening process of this Project has been conducted and the Project Proponent has discussed and agreed with the relevant authorities that an Initial Environmental Examination (IEE) Study is required for the Project.

B. Scoping

Scoping has been undertaken to identify the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance.

This stage is intended to ensure that the IEE focuses on those issues that are most important for design, decision-making and stakeholder interest.

Table 5.1-1 presents the resources/receptors considered in the scoping stage, together with the changes that might indicate a potential Project-related impact.

Table 5.1-1 Resources/Receptors and Potential Impacts Considered in Scoping

Resources/Receptors	Changes that May Indicate Potential Impacts
Environmental	
Geology	Changes to geology, geomorphology, topography.
Surface Water	Changes to physical, chemical or biological quality of rivers, seas and other surface water bodies, changes in aquatic habitat, abundance, diversity.
Groundwater	Change in ground water resources.
Sediments	River/waterbed morphology, physical and chemical properties, benthic organisms.
Fisheries	Changes in fisheries productivity.
Wildlife	Changes to wildlife assemblages, impact on endangered and economic species, food chain effects.
Air	Particulate Matter such as PM10, TSP.
Social / Socio-economic	
Socio-economic development	Creation 200 jobs and demand for commodities and services.
Compensation and resettlement	No resettlement but affects 175 acres of farmland, and 252 acres of government oil palm.
Community Health and Safety	
Mortality and Key Health Indicators	Change in the mortality profile of the community; changes in life expectancy, birth rates, death rates, maternal mortality rates etc.
Environmental Change	Decreased air quality (e.g. CO, PM), contamination of surface waters and potable ground water, increased vibration and noise, increased night time light beyond acceptable limits, changes to the visual environment.
Communicable and Non Communicable Diseases	Change in incidence and /or prevalence of communicable and non-communicable diseases or disease causing factors.
Sexually Transmitted Diseases	Changes in the incidence and /or prevalence of sexually transmitted diseases and the factors that contribute to this (external workforce, transport routes etc.)
Health Care/ Recreational Facilities	Changes in availability of and access to health care and recreational facilities including green space.
Psychosocial /Lifestyle Factors	Drug use/abuse, prostitution, communal violence, crime, suicide and depression; changing expectations of quality of life.

C. Project Description

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

Description of the Surrounding Environment

To provide a context within which the impacts of the Project can be assessed a description of physical, biological, social / socio-economic that would be expected to prevail in the absence of the Project is presented.

Public Consultation and Disclosure

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

Impact Assessment

Impact identification and assessment starts with Scoping and continues through the remainder of the IEE Process. The principal impact assessment steps are summarized in and comprise:

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

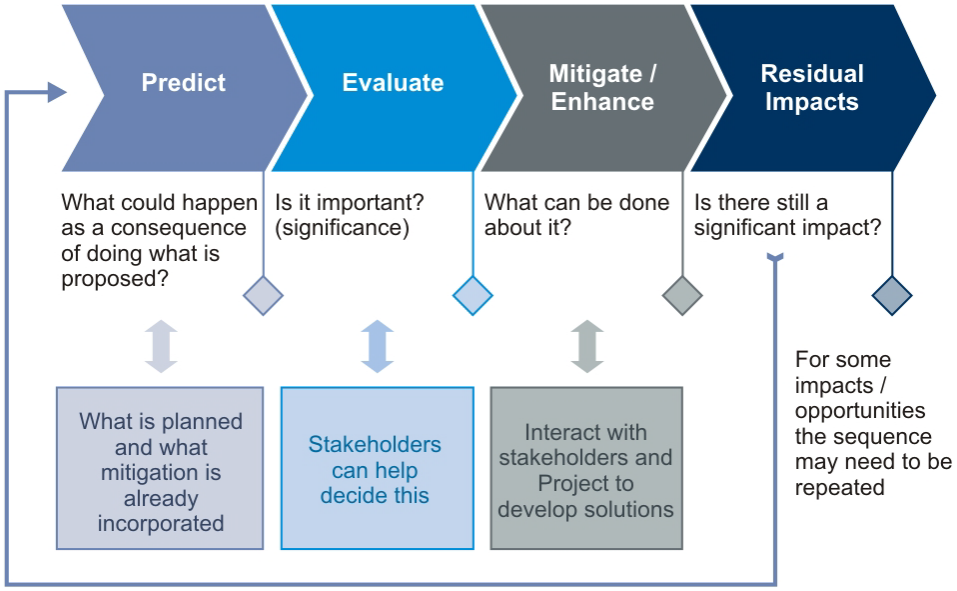


Figure 5.1-2 Impact Assessment Process

- **Prediction of Impacts**

Prediction of impacts is essentially an objective exercise to determine what is likely to happen to the environment, social, or health aspects as a consequence of the Project and its associated activities. From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse range of potential impacts considered in the IEE process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

- **Evaluation of Impacts**

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in **Table** . The definitions for the "type" designations are shown in **Table .** Definitions for "extent", "duration", "scale", and "frequency" are resource/receptor-specific, but typical examples are shown in **Table .**

Table 5.1-2 Impact Characteristic Terminology and Definitions

Characteristic	Definition	Designations	Description
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
		Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
		Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local	The potential impact is limited to the Project area and vicinity.
		Regional	The potential impact covers a large area and/or affects the area beyond a local level.
		International	Potential impact may occur on a large scale at the regional level, and may expand to the national or international level.
Duration	The time period over which a resource / receptor is affected.	Temporary	Temporary potential impact occurs, or short-term impacts occur only occasionally.
		Short-term	Potential impact occurs over short term.
		Long-term	The potential impact occurs continuously for a long period of time and/or it is a permanent impact.
Scale	The size of the impact	No fixed designations	Intended to be a numerical value or a qualitative description of "intensity" or scale, e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.
Frequency	A measure of the constancy or periodicity of the impact.	No fixed designations	Intended to be a numerical value or a qualitative description of frequency, e.g. continuous, daily, weekly, etc.

Once impact characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. The magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale; and
- Frequency.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor. The universal magnitude designations are:

- Positive;
- Negligible (Insignificant);
- Small;
- Medium (Moderate); and
- Large (Major).

In the case of a *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a *positive* impact, without characterizing the exact degree of positive change likely to occur.

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterized, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in **Table 5.1-3**

Table 5.1-3 Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations. **Figure 5.1-3** provides a context for what the various impact significance ratings signify.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IEE Process). This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor significance** is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESHIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Figure 5.1-3 Context of Impact Significances

- **Mitigation and Enhancement Measures**

Once the significance of an impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are warranted. The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect

to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigation measures have been applied to reduce the impact magnitude).

- **Residual Impact Evaluation**

Once mitigation and enhancement measures are declared, the next step in the IEE Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

Issues and Selection of Valued Environmental Components

Valued Environmental Components (VECs) for the Project are those environmental and social attributes associated with the development of the proposed Project which have been identified to be of concern by the public, government or professional community. The identified VECs and issues of concern will need to be presented to stakeholders and finalized based on comments from the stakeholders.

VECs to be covered in the IEE are presented in **Table 5.1-4**. For each VEC, one or more parameters will be selected to facilitate quantitative or qualitative measurement of potential project impacts and cumulative impacts. Most of the identified impacts have been quantified to the extent possible on the value judgment. Each of the environmental issues has been examined in terms of their current condition, likely impacts during construction and subsequent operation phases. The impacts have been predicted in terms of their magnitude, extent and duration in a preliminary basis. The possible impacts from the proposed project activities during pre-construction, construction and operation phases are described

Table 5.1-4 VECs during Pre-Construction, Construction and Operation Phases

VEC	*Main Concern*
Resettlement	Resettlement of population in inundated areas that required compensation, relocation and livelihood restoration plans to make affected people to be better-off.
Employment & Economic Opportunity	Creation of jobs, money circulation, demand for necessities, construction materials, and services.
Forestry	Project lands that create losses to forest areas.
Inundation to historical/cultural resources	Project lands that lead losses of historical/cultural resources.
Watershed erosion/silt run-off	If the existing condition of erosion/silt run-off in the watershed is sufficient to jeopardize the life of the dam by an excessive filling rate, consideration must be given to expand the project to include a watershed reforestation program.

VEC	*Main Concern*
Impairment of navigation	The Reservoir might impair downstream navigation and, if so, the mitigation measure should be made to offset this loss.
Impairment of groundwater hydrology	The Reservoir might impact to waterlogging in the vicinity and, if so, the mitigation measure should be made to offset this loss.
Migrating valuable fish species	Impeding fishing activities due to construction activities.
Inundation of mineral resources	Loss of valuable mineral resource development potentials
Effects on downstream ecology and water uses	Water user and water ecology might be impacted due to consumption of water by the Project.
Earthquake hazards	Induce to earthquake hazards.

5.1.2 Pre-construction Phase (Location and Design)

In many environmental assessments there are certain effects that, although they will occur during either the construction or operation phase, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen.

During site selection and preliminary design stage, the field investigation revealed very limited major impacts that are a result of the design or location. This due to:

- The project involves straightforward construction, in an environment that is not especially sensitive, so it is unlikely that there will be major impacts;
- Most of the predicted impacts are associated with the construction work. However, the routine nature of the impacts means that most can be managed.

5.1.3 Construction Phase

Impact prediction can be described in **Matrix 5.1-5** below:

Table 5.1-5: Matrix of Impact Prediction in the Construction Phase

Action Affecting Environmental Resources & Value	Potential Project Impacts	Recommended Feasible Protection/ Mitigation Measures	Impact Significance			
			Insignificant	Significant Effect		
				Small	Moderate	Major
1. Socio-economic development	Creation 200 jobs and demand for commodities and services	Training to unskilled labor, enhance local economic development by using local products and services				**X**
2. Compensation and resettlement	No resettlement but affect 175 acres of farmland, and 252 acres of government oil palm.	Fair compensation to agricultural lands and farm shelters		**X**		
3. Forestry & wildlife	Very few forests will be lost.	No specific mitigation is required.		**X**		

4. Inundation of historical/cultural resources	None	None	**X**			
5. Watershed erosion silt runoff	Need long-term use of reservoir	Support catchment management		**X**		
6. Impairment of navigation	Very little navigation observed	People use land transportation		**X**		
7. Groundwater hydrology	Minimal impact is predicted.	No specific mitigation is required.		**X**		
8. Migrating valuable fish species	Expected small impacts	Yearly monitoring is required.		**X**		
9. Inundation of mineral resources	No valuable mineral resources will be inundated.	None	**X**			
10. Effects on downstream ecology and water uses	Minimal impact is predicted.	Yearly monitoring is required.		**X**		
11. Earthquake hazards	No impact is expected.	No specific mitigation is required.	**X**			

a) Socio-economic Development

- ***Employment opportunity to local people***

The majority of population in the project area is dependent on agriculture. However, manpower will be recruited during the construction phase. This project is expected to open additional sources of occupation and income to local residents, which are considered as a positive effect of the project. The impact will be direct, short term and significant.

- ***Enhancement of technical skill***

Although many people in the project area are unskilled, the development of project is likely to enhance their skill in construction, and approximately 100 unskilled labors will get practical or hands on training, which will develop their technical skills. The skill and knowledge acquired from the project during construction will surely increase 200 employment opportunities. This will help them to find job as skilled workers in other future projects as an alternative occupation in addition to agriculture. The impact will be direct and considered significant.

- ***Induced commercial business activities***

In addition to jobs, the activities relating to construction of works will increase the need for small equipment, material and services which will increase the economic activity of Dawei District, including the services to the workers. This expected to be at least USD 5 million during the construction phase.

5.1.3.1 Adverse Impacts

The activities during the construction phase of the project will create a number of adverse impacts on the local environment. These can be discussed below:

a) Physical Resources

- ***Air quality impacts***

The construction activities will generate airborne dust as well as particulate matter. Significant amounts of dust may be produced as a result of site clearing, burning, construction machinery, excavation, blasting and transportation. Concurrently, construction activities will produce noise at the construction sites. The main activities include blasting and movement of heavy equipment. This will disturb the peaceful environment that currently exists in the project area. The impacts will, however, be site specific and limited to the construction phase only. The impact will be direct and hence significant.

- ***Downstream water use and pollution***

Construction activities are likely to increase the turbidity, suspended solids, dissolved solids of the Dawei River, and other smaller water bodies near the construction sites. The river has no and minimum living organism, change in water quality is like to have minimal effect on aquatic ecosystem. The impact will be direct, short period and considered small.

- ***Disturbance and change in landscape and land use***

Construction of Pa Yain Byu Reservoir Project includes various types of construction activities such as site clearance, earthwork excavation, and quarrying, etc, Site clearance involves removal of soil and debris from the construction site, which might disturb natural slope stability. The impact will be direct, very short period and hence insignificant.

b) Biological Resources

- ***Loss and degradation of forest area/vegetation***

About 175 acres of private farmland and 252 acres of government oil palm plantation will require compensation. Few acres of forest and grassland are not dense. The impact will be direct and considered small.

- ***Disturbance and threat on wildlife***

The decrease in forest area and loss of habitat will create the problem for wild animals. The possible adverse impacts on species diversity of local wildlife population will be minimal. However, there will be limited disturbance to wildlife habitats in the project area due to mobility of people and wildlife. Noise and vibration produced by project activities during nighttime operations and hunting/poaching by project labor force may affect the population of wildlife to some extent.

Hunting and trapping of wildlife by workforce may increase and disturbances may take place by the increase in population, attracted in the project area. This will have local and short term impacts on wild animal populations. The impact will be direct and hence considered small.

c) Social and Cultural Resource

- ***Land acquisition***

During the construction phase, the local people of settlements in the project area suffer by their property losses and damage by construction works in some extent. The impact will be direct, and considered small.

- ***Possible impact on social, cultural and religious practices***

The project construction will attract a large of workers, job seekers, entrepreneurs and their dependents to the project area. The influx of new people, which will mostly consist of young male, will change the population structure in the area. This could lead to changes in social and cultural norms and values, and loss of community spirit, which is strong in small and homogenous society. The impact will be indirect.

- ***Impact on gender***

During construction, women workers will involve in various kinds of construction activities. They could be discriminated or sexually harassed by male workers. The impact will be indirect.

- ***Archeological sites***

The study team did not find any cultural or religious sites that might be affected by the project. The impact will be direct, short term and hence significant.

- ***Occupational health and safety***

Construction activities such as using heavy equipment, and working in dangerous areas such as in the mountain may cause accidents and injuries. The most common injuries that might occur from scaffoldings or other structures, injuries due to drilling works or other construction equipment, collapse of structures or excavations, and traffic accidents. The victims will most probably be construction workers although injuries to local people are also possible. The impact will be direct, short term and significant.

5.1.4 Operation Phase

The potential impacts that may be caused by the project activities during the operation phase deal with positive rather than negative effects. They are summarized in **Matrix 5.1-6**.

Matrix 5.1-6: Impact Prediction in the Operation Phase

Action Affecting Environmental Resources & Value	Potential Project Impacts	Recommended Feasible Protection/ Mitigation Measures	Impact Significance			
				Significant Effect		
			Insignificant	Small	Moderate	Major
1. Socio-economic development	Creation of man-made recreation and tourism	Follow green tourism approach				**X**
2. Compensation and resettlement	No resettlement and compensation	None		**X**		
3. Forestry & Wildlife	None	None		**X**		
4. Inundation of historical/cultural resources	None	None	**X**			
5. Watershed erosion silt runoff	None	None		**X**		
6. Impairment of navigation	None	None		**X**		
7. Groundwater hydrology	Minimal impact is predicted.	No specific mitigation is required.		**X**		
8. Migrating valuable fish species	Expected small impacts.	Yearly monitoring is required.		**X**		
9. Inundation of mineral resources	None	None	**X**			
10. Effects on downstream ecology and water uses	Minimal impact is predicted.	Yearly monitoring is required.		**X**		
11. Earthquake hazards	Minimal risk is expected.	No specific mitigation is required.	**X**			

5.1.4.1 Bio-physical Environment

a) Downstream ecology and water use

No further impacts on downstream ecology are expected, however yearly monitoring may be required.

There are 2 villages within 5 km radius from the Project area. Currently, villages in the Project area largely rely on groundwater as a source of drinking water; however, it is not the only source. Some villagers collect rainwater for domestic purposes (e.g. via Myanmar jars); while others buy bottled of drinking water.

Pa Yain Byu Reservoir will be temporary used during development of zone A. The Pa Yain Byu Reservoir can store water around 7.7 MCM. In terms of demand during the operation phase, it is expected that there will be adequate water to support the Project's withdrawal, which average raw water demand will be approximately 18,000 m^3/day. There will have enough capacity to supply water for Initial Industrial Estate. A potable water

demand for staff during operation is expected to be minimal. There are a small number of current water users in the Project area, and the Dawei River is considered an alternative water resource. Villages in the Project area largely rely on groundwater as a source of drinking water; however, it is not the only source. The resource/receptor sensitivity is considered Low.

In term of water ecology, Pa Yain Byu Reservoir is non-flowing water forms the habitat within the impoundment. It was observed as Lentic Habitats. This habitat is considered as Modified Habitat as it is within a human-made dam. Lentic ecosystems have layers from top to bottom that support different small organisms, depending on factors such as the amount of light and temperature. Algae and aquatic plants produce food for other organisms in the ecosystem. Many tiny invertebrates, called zooplankton, live in lentic waters. The common species of vertebrates in the water bodies are catfish and butter catfish. During the operation phase, water withdrawn from the Reservoir is treated at Water Treatment Plant. Potential impacts to water ecology expected to be of Small magnitude.

Given recent studies and the study of ESIA of Dawei Initial Industrial Estate Project, it is expected that the Project will not have an impact on consumption of the local communities and water ecology during the Initial Industrial Estate Phases. For this reason, the Project is not expected to have a significant impact on current water users.

b) Earthquake hazard

Effects from natural earthquake hazard or by the creation of Project pond itself seem to be insignificant. However, due to the Pa Yain Byu, a main dike is an earth-filled that may have some risks of water leakage at the foot of the dike. Monthly dike engineering checkup may be requires.

5.1.4.2 Socio-economic Environment

- ***Flood protection***

Pa Yain Byu Reservoir Project normally helps flood protection and control. However, the level of a reservoir must be kept below a certain elevation before the onset of the rainy season so as to allow a certain amount of space in which floodwaters can fill.

- ***Tourism and recreation***

The implementation of this project will have a positive impact on the improvement of the access roads in the project area. It is likely to affect recreation activity. However, the reservoir is not currently used for recreational activities suggesting that relative remoteness will tend to restrict such uses. This is considered only minor positive impact.

5.2 Cumulative Impact Assessment

Cumulative impacts will be related to the Pa Yain Byu Pond Project itself and other development projects in Dawei Special Economic Zone (DSEZ). These include:

- A Two-lane Road, connecting Dawei SEZ with the Thai border;
- A Small Port including A Small Port and a LNG Terminal;
- A Small Power Plant consisting of Temporary Power Plant and Boil-off Gas Power Plant;
- A Small Power Plant (initial phase);

- An Initial Township / Residential Area;
- A Small Water Reservoir; and
- A Telecommunications Landline.

Figure 5.2-1: Initial Phase of DSEZ Development

As above have been agreed by the Government of the Union of Myanmar and the Government of the Kingdom of Thailand. Therefore, it is anticipated that the above development projects/activities will provide both positive and negative impacts to the Dawei District and the Tanintharyi region.

It is also expected that the cumulative impacts are more positive rather than the negative that compatible with provincial and district development plan to reduce local poverty and generate huge employment and economic opportunity to the region. However, the minimization of environmental impacts and enhancement of project benefits to local people are considered an important agenda the Dawei.

5.3 Initial Risk Assessment

As illustrated in Figure 6-2, the project is located in low severe earthquake zone while there will be limited severe cyclone and tropical storm from the natural hazards.

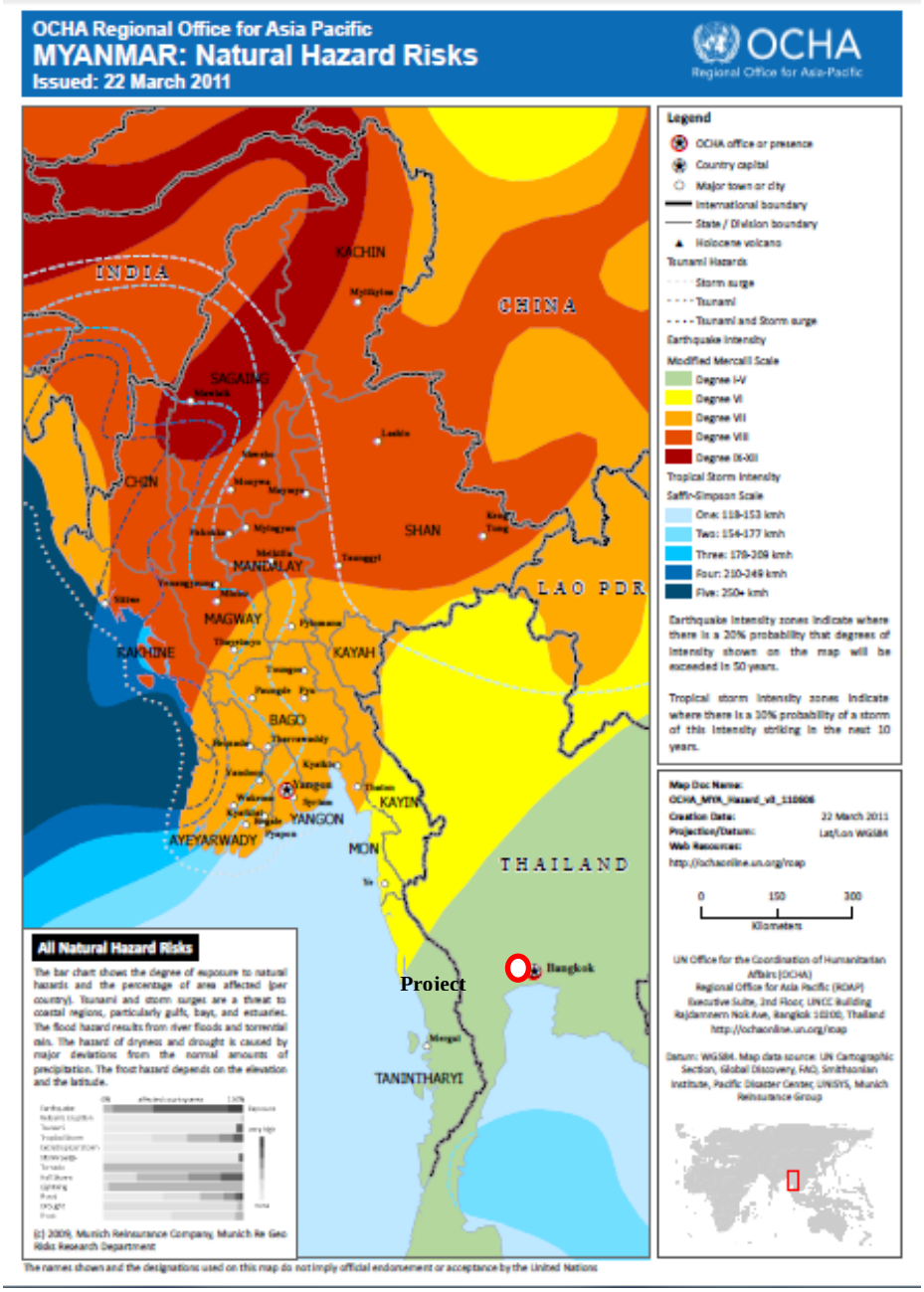


Figure 5.3-1: Potential Risk of Natural Hazards

For man-made risks the following issues were expected from the field investigations:

- The main dike is an earth-filled compact type that may risk of water leakage if without careful grouting by acceptable engineering technology;
- More accidents on local Road Number 8 may be expected due to more traffics during project construction and operation in the initial and full phases of DSEZ development, this required to follow good practice health and safety measures of road operation;

5.4 Mitigation and Enhancement Measures

In general, the proposed project will create surface-related environmental impacts, which are comparatively low in magnitude. Incorporation of mitigation measures in the detailed design, tender documentation and subsequent implementation should mitigate most of the likely environmental impacts. Almost all the adverse impacts mentioned above could be mitigated by implementing the following mitigation measures. An effective implementation of benefit maximization measures and adverse impacts mitigation measures would optimize the benefits expected from the project and avoid/minimize the adverse impact from the project. Mitigation measures are recommended actions that reduce, avoid or offset the potential adverse impacts on the environmental consequences of the project activities. Mitigation measures are of curative, preventive and compensation types. Based on the impact assessment and identification, benefit augmentation and adverse impact mitigation measures to be included in pre-construction (site selection, survey and design phase), construction phase and operational phase have been summarized below.

5.4.1 Benefit Augmentation/Adverse Impact Mitigation Measures during Pre-construction, Construction and Operation Phases

Benefit augmentation measures for beneficial impacts and mitigation measures for adverse impacts can be described in **Table 5.4-1**

Table 5.4-1: Environmental Impacts and Benefit Augmentation/Adverse Impact Mitigation Measures

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures
Pre-construction phase (location and design)		
Adverse impacts		
	Land acquisition	Avoid costly mitigation measures Local conditions and detailed design will be taken into due consideration as to which construction will take place in order to minimize land acquisition from cultivable land, settlement and cultural properties. Implement compensatory measures by preparing standard prices in accordance with regional government.
Construction phase		
Beneficial impacts		
Economic development	Employment opportunity to local people	Maximize the use of local labor force Maximize public participation about project related activities Keep the public informed about project related activities
	Enhancement of technical skill	Maximize the use of local labor force Provide training on income generating activities
	Induced commercial activities	No mitigation measures suggested
Adverse impacts		
Physical resources	Rising air and noise pollution	Sprinkle water on earthworks and other dust prone areas on a regular basis Proper maintenance of all vehicles Minimize cutting of trees Use of face mask by the workers to minimize air pollution due to dust generation All equipment and machinery will be maintained to manufacture's specifications to minimize unnecessary noise emission.
Adverse impacts		
Physical resources	Pollution of river and change in water quality	Workforce will be instructed not to throw solid waste including hazardous waste in rivers. All the lubricants and oil should be collected and recycled or disposed off in an appropriate manner by not causing environmental degradation
	Disturbance and change in landscape and land use	Make proper embankment Minimize cutting of unstable slopes Toe protection for unstable slopes Proper drainage management After the disposal, the site will be provided with proper drainage, vegetation and adequate protection against protection.
Ecological resources	Loss and degradation of forest area/vegetation	Cash compensation for vegetation/ plantation loss as per regional government price.
	Disturbance and threat on wildlife	The workers should be restricted from hunting.
	Induced commercial activities	No mitigation measures suggested
Social and cultural resources	Land acquisition	Provide compensation at full replacement cost as per regional government price. Cash compensation for damages to structures resulting from construction activities Compensation for full or partial loss of houses and other structures at full replacement cost of materials and labor according to house/structure type, with no deduction for depreciation.

Table 5.4-1: Environmental Impacts and Benefit Augmentation/Adverse Impact Mitigation Measures (Cont'd)

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures
Construction phase (cont'd)		
Adverse impacts		
Social and cultural resources	Possible impacts on social, cultural and religious practices	Instruct to all workers to act in a responsible manner Prohibit alcohol and gambling
	Impacts on gender	Ensure the equal daily wages of women and men workers
	Archaeological sites	Request people to use other sites nearby
	Occupation health and safety	Ensure that qualified first-aid can be provided at all times and equipped first-aid stations shall be easily accessible throughout the site. Provide protective clothing such as helmets, boots, gloves and masks to construction workers. Mark and provide signboards for hazardous areas such as energized electrical devices, storage and disposal area. Speed limit signs, traffic and safety barriers and other warning signs will be established in and around construction sites and access routes. Operation of machinery and other heavy equipment by authorized personnel only.
Operation phase		
Beneficial impacts		
Social and cultural resources	Flood protection	The project or contractor will conduct the monitoring in order to avoid any negative impacts on the project.
	Tourism and recreation	The project or contractor will conduct the monitoring in order to avoid any negative impacts on the project.

There might be some more impacts due to Pa Yain Byu Reservoir Project activities which are not predicted or identified during the IEE study. However, the project developer shall adopt an appropriate mitigation method. The Project proponent is legally responsible for environmental performance of the Project and/or environmental and socials issues relevant to the Project. The confirmation and undertaking for this IEE Report will be stated in the summary Executive Summary and it will be signed by the Project Proponent.

Chapter 6

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

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ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The Environmental Management Plan (EMP) is prepared to guide implementation of mitigation measures and monitoring requirements. It includes institutions and their roles, environmental management activities, environmental management organizational structure and budget for mitigation measures.

6.1 Institutions and Their Roles

The Forestry Department and Ministry of Agriculture and Irrigation are the main institution mandated to formulate and implement environmental policies, plans and programs at the national level. It is also charged with the responsibility for preparing and issuing environmental regulations and guidelines; development and enforcement of environmental standards; pollution control, commissioning environmental research and studies; and monitoring of programs implemented by other agencies.

The main responsibility for IEE and Environmental Management Plan (EMP) implementation is with Myndawei Industrial Estate Company Limited (MIE). During the implementation, Environmental Management Unit (EMU), Relocation and Resettlement Unit (RRU) and Corporate Social Responsibility Team (CSR) will assist MIE. The MIE will also receive necessary information from these teams for the implementation and monitoring of the EMP. The roles of these institutions are as follows:

1) ***Ministry of Natural Resources and Environmental Conservation (MoNREC)****:* As the concerned line ministry, the *MoNREC* responsible for review and final approval of study reports of IEEs, and for managing environmental monitoring. The MECF has established an Environmental Management Section (EMS) which is mandated with the overall environmental responsibility of the Ministry.

2) Myndawei Industrial Estate Company Limited (MIE): As key project implementer, MIE is responsible for screening, commissioning IEE studies, and carrying out mitigation works.

3) Supporting Working Body (SWB: As project implementer, SWB is responsible for suggestion to SD/PM and submitting to DSEZMC.

4) Site Director (SD): SD is developing policies and guidelines to PM.

5) Project Manager (PM): PM is responsible to facilitate the project implementation activities at the project site and review IEE report for necessary approval forward to SWB/SD and MIE.

6) Environmental Management Unit (EMU): It is responsible for managing the implementation of the program in the project site and surrounding areas.

7) Relocation Unit (RU): It coordinates relocation, resettlement and compensation issues with Compensation and Relocation Committee.

8) ITD Environmental Team: It is part of project team which assists EMU for the implementation of the program and project activities.

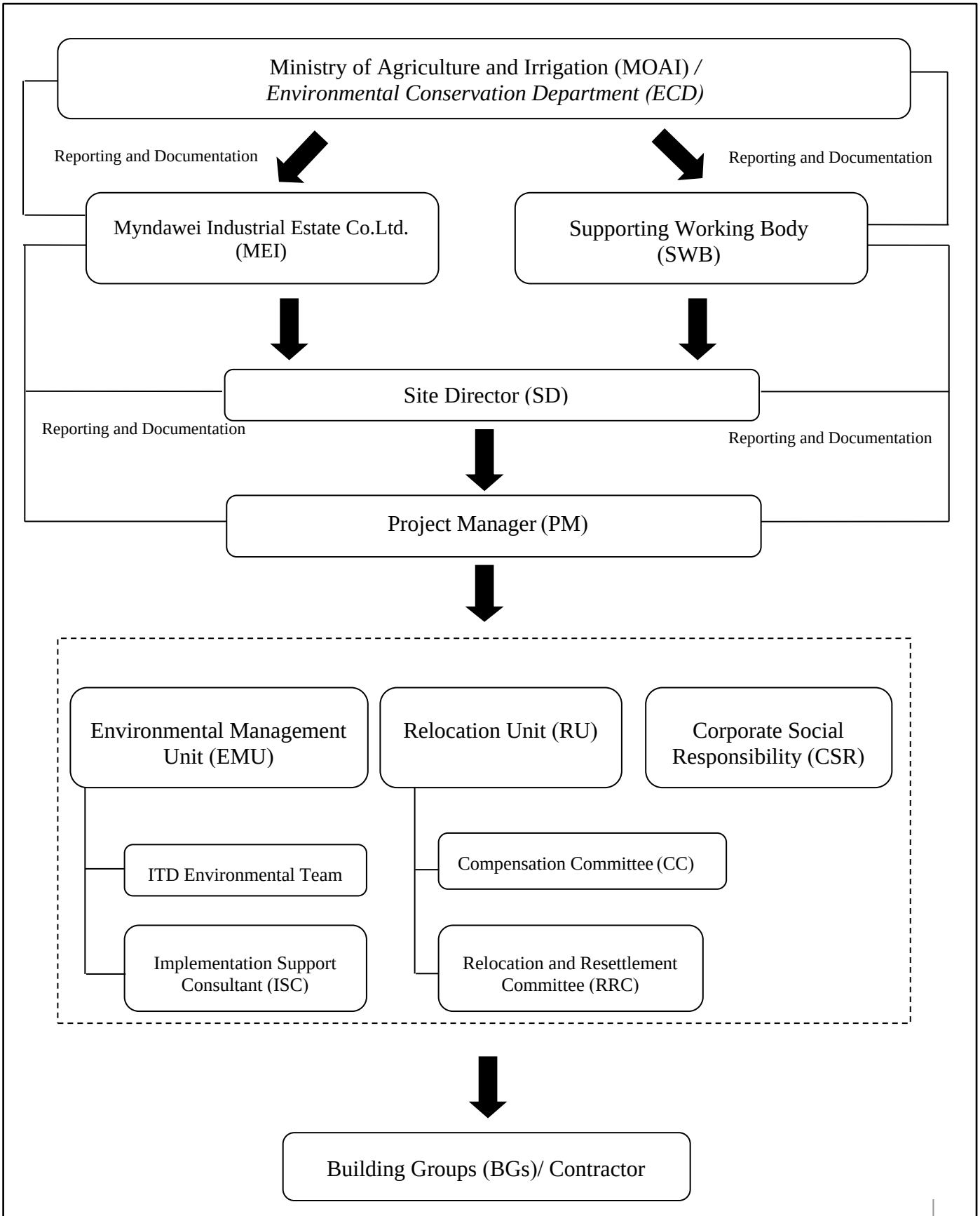


Figure 6.1-1 Environmental Management Organization Structure

9) Relocation and Resettlement Committee (RRC): It is sub-committee of the RU for the implementation of the relocation and resettlement activities with the Project Affected Persons (PAPs)

10) Compensation Committee (CC) : It is sub-committee of the RU for the implementation of the compensated for the Project Affected Persons (PAPs).

11) Implementation Support Consultant (ISC): It is part of project team which assists EMU. With technical, social and environmental expert teams in the implementation of the program.

12) Corporate Social Responsibility (CSR) : Responsible to promotion the occupation, training activities and any things to concern livelihood in DSEZ.

13) Building Groups (BGs) and Contractor: Responsible for Pa Yain Byu construction activities.

The environmental management organizational structure is illustrated by **Figure 6.1-1.**

6.2 Environmental Management Plan

The Environmental Management Unit will be responsible for the implementation of mitigation measures and of the monitoring plan. Overall implementation of the EMP is an obligation of the project developer.

Most of the mitigation measures are fairly standard methods of minimizing disturbance from the project. Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

Table 6.2-1 and **6.2-2** shows the proposed environmental management for this project, which specifies the various monitoring activities to be conducted during different phases of the project. The EMP describes: mitigation measures, location, measurement method, frequency of monitoring, and responsibility. (for both mitigation and monitoring)

6.2.1 Environmental Monitoring

Environmental monitoring is planned to ensure efficient and comprehensive environmental management during construction and operation of the project.

6.2.1.1 Types of Monitoring

Monitoring is an on-going component of the environmental assessment process and subsequent environmental management and mitigation activities. There are basically three types of environmental monitoring:

1. Baseline Monitoring – It collects and verifies additional environmental baseline data, which is scientific or sociological in nature and needs to augment information on baseline conditions initially generated during IEE.

Table 6.2-1 Environmental Management Plan

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures	Institutional Responsibilities	Period	Mitigation Cost (USD)
Pre-construction phase (location and design)					
Adverse impacts					
	Land acquisition	• Avoid costly mitigation measures • Local conditions and detailed design will be taken into consideration as to which construction will take place in order to minimize land acquisition from cultivable land, settlement and cultural properties. • Implement compensatory measures by standard price prepared in accordance with regional government and expert RSU/EMU.	PM	During site selection, detailed design and site survey	No additional budget is required (NABIR)
Construction phase					
Beneficial impacts					
Economic development	Employment opportunity to local people	• Maximize the use of local labor force • Maximize public participation about project related activities • Keep the public informed about project related activities	PM	Construction phase	No additional budget is required (NABIR)
	Enhancement of technical skill	• Maximize the use of local labor force • Provide training on income generating activities	PM	Construction phase	No additional budget is required (NABIR)
	Induced commercial activities	• No mitigation measures suggested	-	Construction phase	No additional budget is required (NABIR)

Table 6.2-1 Environmental Management Plan (Cont'd)

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures	Institutional Responsibilities	Period	Mitigation Cost (USD)
Construction phase					
Adverse impacts					
Physical resources	Rise of air and noise quality	• Sprinkle water on earthworks and other dust prone areas on a regular basis • Proper maintenance of all vehicles • Minimize cutting of trees • Use face masks by the workers to minimize air pollution due to dust generation • All equipment and machinery will be maintained to manufacture's specifications to minimize unnecessary noise emission.	PM	Construction phase	No additional budget is required (NABIR)
	Pollution of river and change in water quality	• Workforce will be instructed not to throw solid waste including hazardous waste into the natural streams. • All the lubricants and oil should be collected and recycled or disposed off site in appropriate manner by not causing environmental degradation	PM	Construction phase	No additional budget is required (NABIR)
	Disturbance and change in landscape and land use	• Make proper embankment • Minimize cutting of unstable slopes • Toe protection for unstable slopes		Construction phase	1,500

Table 6.2-1 Environmental Management Plan (Cont'd)

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures	Institutional Responsibilities	Period	Mitigation Cost (USD)
Construction phase					
Physical resources	Disturbance and change in landscape and land use	• Proper drainage management • After the disposal, the site will be provided with proper drainage, vegetation and adequate protection against protection.	PM/EMU	Construction phase	No additional budget is required (NABIR)
Ecological resources	Loss and degradation of forest area/ vegetation	• Cash compensation for vegetation/ plantation loss as per regional government price.	PM/CC/RU/EMU	Construction phase	5,000,000
	Disturbance and threat to wildlife	• The workers should be restricted from hunting.	PM/EMU	Construction phase	No additional budget is required (NABIR)
	Induced commercial activities	• No mitigation measures suggested	-	Construction phase	No additional budget is required (NABIR)
Social and cultural resources	Land acquisition	• Provide compensation at full replacement cost as per regional government price. • Cash compensation for damages to structures resulting from construction activities • Compensation for full or partial loss of house and other structures at full replacement cost of materials and labor according to house/structure type, with no deduction for depreciation.	PM/CC/RU/EMU	Construction phase	10,000

Table 6.2-1 Environmental Management Plan (Cont'd)

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures	Institutional Responsibilities	Period	Mitigation Cost (USD)
Construction phase					
Social and cultural resources	Possible impact on social, cultural and religious practices	• Instruct all workers to act in a responsible manner • Prohibit alcohol and gambling	PM	Construction phase	No additional budget is required (NABIR)
	Impact on gender	• Ensure the equal daily wages of women and men workers	PM	Construction phase	No additional budget is required (NABIR)
	Occupation health and safety	• Ensure that qualified first-aid can be provided at all times and equipped first-aid stations shall be easily accessible throughout the site. • Provide protective clothing such as helmets, boots, gloves and masks to construction workers. • Mark and provide signboards for hazardous areas such as energized electrical devices, storage and disposal areas. • Speed limit signs, traffic and safety barriers and other warning signs will be established within and around construction sites and access routes. • Operate machinery and other heavy equipment by authorized personnel only.	PM/EMU	Construction phase	6,100

Table 6.2-1 Environmental Management Plan (Cont'd)

Domain	Impacts	Benefit augmentation/adverse impact mitigation measures	Institutional Responsibilities	Period	Mitigation Cost (USD)
Operation phase					
Beneficial impacts					
Social and cultural resources	Flood protection	• The project or contractor will do the monitoring in order to avoid any negative impact on the project.	-	Operation phase	No additional budget is required (NABIR)
	Tourism and recreation	• The project or contractor will do the monitoring in order to avoid any negative impact on the project.	-	Operation phase	No additional budget is required (NABIR)
	Grand total				**5,017,600**

2. Compliance Monitoring - It verifies whether contract environmental clauses and the mitigation measures are properly implemented in the field.

3. Impact Monitoring - It confirms whether the environmental mitigation measures specified in the project design and contract are correctly formulated.

The nature and purpose of environmental monitoring will be different in the construction phase, impoundment phase and operation phase of the project.

6.2.1.2 Monitoring Indicators

The proposed project monitoring indicators of pre-construction, construction, impoundment and operation phases are classified as physical, biological, human use values and quality of life which are described in detail below:

a) Physical Indicators

- **Air and Noise Quality:** Use of good condition mechanical equipment and heavy vehicles, periodic maintenance of mechanical equipment and crusher during construction, use of quality fuels, sprinkling water during excavation, wherever possible and use of ear protection devices by the workers. The air quality and noise monitoring will be performed to comply with Myanmar applicable standards.
- **Water quality**: Water quality indicators to be monitored are dissolved oxygen, turbidity, suspended solid, dissolved solid, hardness and alkalinity, pH, conductivity, etc., These parameters will be monitored and complied with Myanmar applicable standards.
- **Landscape and Land Use:** Minimum removal of vegetation cover, controlled disposal of oil, unused construction materials and equipment, safe disposal and backfilling of excavated materials and restoration of degraded sites by plantation and protection of sites.

b) Economic Development and Social and Cultural Resources

- The impacts on social and cultural will be monitored including land and property acquisition compensation payment, socio-economic condition of the people, water supply and Sanitation, Implementation of safety measures.

6.2.1.3 Monitoring Mechanism

The proponent will set out environmental management requirements to develop procedures that ensure all mitigation measures and monitoring requirements specified in the report through Environmental Monitoring Plan (EMP) . It is prepared for construction, impoundment and operation phase of the proposed project. The EMP will actually be carried out in subsequent stages of the project implementation and operation.

6.2.1.4 Monitoring Locations, Schedules and Responsibilities

Timing for environmental monitoring depends on the nature of parameters. It can be done regularly or intermittently. Compliance monitoring will be done regularly whereas the impact monitoring will be done after the completion of the construction activities. In general, methods such as observation, inspection, interview, counting and measurement could be used for monitoring. The monitoring will be a specific location or the new whole project area, depending upon the nature and coverage of fore-mentioned parameters.

Monitoring is an integral part of the project proponent so as to know the unlikely impacts and implement corrective measures. The proponent will develop in-built monitoring mechanism to show its additional commitment for environmental improvement and mitigate undesirable environmental changes, if any during construction, impoundment and operation phases.

A summary of monitoring parameters, location of monitoring, schedules and responsible agencies, including monitoring method is presented in **Table 6.2-2**.

The proposed Environmental Management Unit will carry out the environmental monitoring works, not as a part of legal requirement, but as a community of the proponent to mitigate environmental impacts to make the project environmentally sustainable.

6.2.2 Grievance Redress Mechanism

A grievance redress will be set up within the EMU, to register grievances of the people, to ensure that all views of the people are adequately reviewed and suitably incorporated in the design and implementation process. Further, to ensure an effective disclosure of the project proposals to the stakeholders and the communities in the vicinity of the sub-project locations, a project awareness campaign will be carried out. If unsatisfied, the complainant will still have access to the Government's judicial or administrative remedies.

6.2.3 Reporting and Documentation

As part of EMP, reports should be produced at regular time intervals depending upon type and size of project by the EMP team or unit. Since, the construction period is less than 2 years, three monthly reports will be prepared and submitted to the MIE that will submit to the *ECD* and MOAI.

The Contract will need to state that the MIE must approve the building groups/contractor's arrangements for environmental protection, health and safety, waste management and other environmentally related actions identified during the detailed design phase and these must be written into the Contract Document.

The environmental consultant will inform the MIE in case of non-compliance and of any other environmental issues that require immediate attention. The contract will detail the remedies for non-compliance by the BG/Contractor.

The monthly reports will be based on recurrent site inspections and will report on the effectiveness of the mitigation measures; the Contractor's compliance with the environmental specifications; measures recommended in the events of non-compliance and recommendations for any other remedial actions, etc.

Table 6.2-2 Monitoring Indicators

Parameter	*Location*	*Monitoring Method*	*Monitoring Schedule*	*Responsible for Monitoring*
Pre-construction phase				
Inclusion of mitigation measures in the design and tender document	Office	During approval of contract	Detailed design, tender document preparation and review process	PM
Allocation of adequate budget for environmental protection including compensation.	Office	Review process	During approval of contract	PM
Implementation of mitigation measures	Project site	Site inspection, inquiry, measurement	Construction phase	PM/SD
Construction phase				
Vehicle maintenance	Workshop	Record inspection	Bi-yearly	PM
Air quality	Construction site	Observation	Weekly	EMU (ITD Environmental Teams)
Number of construction workers	Project site	Record, inquiry and inspection	Monthly	ISC
Type and number of accidents	Project site	File record	Monthly	EMU
Health status	Project site	File record	Monthly	EMU
First aid and emergency services	Project site	Observation	Yearly	EMU
Water quality (pH, DO, BOD, Fe, As, No_2)	Upstream and downstream areas	Water sampling and laboratory analysis	Monthly	EMU (ITD Environmental Teams)
Land acquisition (Private land, Public lands)	Project sites	Land use observation	3 months before construction	RU (CC, RCC)

Table 6.2-2 Monitoring Indicators (Cont'd)

Parameter	*Location*	*Monitoring Method*	*Monitoring Schedule*	*Responsible for Monitoring*
Construction phase (Cont'd)				
Clearing of the reservoir	Project site (reservoir area)	Observation and record	Construction phase	PM
Compensation payment	Office	Site inspection, inquiry, measurement	Pre-construction phase	CC
Impoundment phase				
Water quality (pH, DO, BOD, Fe, As, No_2)	Upstream and downstream areas	Water sampling and laboratory analysis	Monthly	EMU (ITD Environmental Teams)
Water level	Upstream	Staff guage	Daily	EMU (ITD Environmental Teams)
Rainfall	Project site	Rain guage	Daily	EMU (ITD Environmental Teams)
Operation phase				
Water quality (pH, DO, BOD, Fe, As, No_2)	Upstream and downstream areas	Water sampling and laboratory analysis	Bi-yearly	EMU (ITD Environmental Teams)
Water level	Upstream	Staff guage	Monthly	EMU (ITD Environmental Teams)
Rainfall	Project site	Rain guage	Monthly	EMU (ITD Environmental Teams)

6.3 Estimated Cost of Environmental Management

6.3.1 Mitigation Cost

The project will implement the environmental benefits augmentation and mitigation measures in consultation with the project committee. The Pa Yain Byu Pond Project by MIE will be responsible for overall mitigation measures. Many costs for the mitigation measures are included in the project cost.

6.3.2 Monitoring Cost

The project monitoring team should submit its report to PM, including forward a copy to the SD. Therefore, SD should submit the report to MIE and SWB, which should forward a copy to ECD/MoNREC. Total cost of environmental monitoring (field visits, observation, review of reports and report preparation) is estimated at **USD 76,150** as given in **Table 6.3-1.**

Table 6.3-1 Monitoring Cost

Parameter	*Unit*	*Quantity*	*Unit Cost*	*Estimation Cost*	
				USD	*THB*
Pre-construction phase					
Inclusion of mitigation measures in the design and tender document	-	-	-	No additional budget is required (NABIR)	
Allocation of adequate budget for environmental protection including compensation.	-	-	-	No additional budget is required (NABIR)	
Implementation of mitigation measures (Project design, Project contract)	-	-	-	No additional budget is required (NABIR)	
Construction phase					
Vehicle maintenance	month	5	270	1,350	40,500
Air quality	month	5	-	No additional budget is required (NABIR)	
Number of construction workers	month	5	-	No additional budget is required (NABIR)	
Type and number of accidents	month	5	-	No additional budget is required (NABIR)	
Health status	month	5	-	No additional budget is required (NABIR)	
First aid and emergency services	month	5	2,000	10,000	300,000
Water quality	month	5	200	1,000	30,000
Land acquisition	L.S	1	-	No extra cost	
Clearing of the reservoir	-	-	-	No extra cost	
Compensation payment	L.S.	1	50,000	50,000	1,500,000
Impoundment phase					
Aquatic/Water quality and uses	month	5	200	1,000	30,000
Water level	month	5	-	No extra cost	
Rainfall	month	5	-	No extra cost	
Operation phase (years 1-10)					
Aquatic/Water quality and uses	yr	10	1,200	12,000	360,000
Water level	yr	10	-	No extra cost	
Rainfall	yr	10	-	No extra cost	
Report preparation	L.S.	1	1	800	24,000
Grand total	-	-	-	**76,150**	**2,284,500**

Chapter 7

PUBLIC INVOLVEMENT

CHAPTER 7
PUBLIC INVOLVEMENT

7.1 Public Involvement in IEE

7.1.1 Stakeholders identification of Project

During the course of IEE process, the study team has carried out several meetings, discussions and interviews with key stakeholders.

The IEE Public Involvement (PI) activities included:

- Information Dissemination (disclosure of information about the intended activity, project objectives and their outcomes in order to enable meaningful discussions);
- Preliminary Consultation (using two-way flow of information, views and ideas between stakeholders and the Project).

The meeting and discussions from field investigation had consultation purposes to:

- Identify problems, concerns and needs.
- Inform stakeholders about the project.
- Obtain feedback.
- Learn from local knowledge and understanding.
- Evaluate alternatives.
- Promote ownership and enhance social acceptability.
- Avoid or resolve conflicts.
- Demonstrate commitment of the project proponent in addressing issues raised during discussions.

Identification of project stakeholders will be analyzed more in the implementation stage, these may include:

- ***Primary stakeholders:***
  - Residents who live and work within or near to the dikes/pond areas;
  - Communities and villager Committees;
  - Users of socially and culturally important buildings in affected areas;
  - State and local authorities responsible for the protection and conservation of environmental and forestry;
  - State and local authorities responsible in land acquisition and compensation.

- ***Secondary stakeholders:***
  - Other government institutions whose remit includes areas or issues affected by the project;
  - The financial lenders;
  - Non-governmental organization working in the project area.

7.2 Consultation and Disclosure conducted

Information disclosure and public involvement with the people of the reservoir investigation project have been continuing in different period. This process was intensified during the studies. Surveys were carried out in order to investigate physical, biological and socio-economic resources falling within the immediate area of influence of the project. The data collection were including of socio-economic survey tools in the field.

The Public involvement was conducted during the field surveys as follows;

No.	Date	Participants	Main topic	Village/school/Monastery
1	10-10-2012	Villagers	1. Introduce the information disclosure of the project 2. Explain the public participation and environmental assessment processes 3. Collecting environmental data of the local village. 4. Hear and record public issues and concerns 5. Provide opportunities for public input and gathering public knowledge	Wat Chaung Village
2	31-01-2013	Head and Villager		Yang Yeng Village Yang Yeng School
3	25-10-2013	- Monk - Teacher - Head and Villager - Monastery		Pa Yain Byu and Ot ta Ya Village
4	19-01-2015	Head and Villager Teacher		Ekani Village and Wa Zun Taw Village

7.3 Finding

The public involvement process accomplished the goals that were established at the outset of the process. In addition, the use of public involvement enabled project sponsors to identify specific stakeholder issues that project sponsors could then address at a very early stage of the project. For example, stakeholder concerns included:

- The impact of the proposed project on the small water reservoir project;
- Potential destruction of unique habitats and the cumulative impacts of this and other proposed projects in the area;
- Compensation issues and potential impacts on subsistence livelihoods; and

Many of the issues raised during the public involvement process were actively used to refine the project proposal and potential mitigation measures. For example, an issue related to compensation process, compensation price, supply water to the local villager and likelihood was raised by stakeholders as a significant issue. This issue was later investigated and actively addressed by the relocation department in refining the project proposal. In addition, the report noted that while initial mitigation measures were identified for many of the issues raised by stakeholders, further detailed investigation would be required to more precisely determine the significance of issues should the project move forward.

Figure 7.3-1 Interviewing the leaders of Pa Yain Byu village

Figure 7.3-2 Interviewing the teachers at Pa Yain Byu school where located at downstream area.

Figure 7.3-3 Interviewing the Wat Chaung villagers for East and West Wat Chaung Reservoir Project

Figure 7.3-4 Interviewing the teacher at Dou Lout School that located near the Project

Figure 7.3-5 Interviewing a monk at Monastery

Figure 7.3-6 Interviewing a monk at School.

Figure 7.3-7 Interviewing a monk at Yang Keng School that located near the Project.

Figure 7.3-8 Interviewing a monk at Yang Keng villagers that located near the Project.

7.4 The Third Public Consultation

The Third Public Consultation meeting with relevant government authorities, local media, NGO and local communities was held on 28 March 2018 in Dawei Special Economic Zone, Auditorium Hall. The objective is to disclose the Final EIA Report and Approval by Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC), Myanmar. The summary of participants is given below.

Participants:

1. Mr. Phyo Min Tun — Deputy Chairman of DSEZ Committee
2. Dr.Myint San — Vice Chairman-2 of DSEZ Committee
3. Environmental Conservation Department (Nay Pyi Taw and Dawei)
4. Dawei Special Economic Zone Management Committees
5. Myandawei Industrial Estate Company Limited
6. Italian-Thai Development Public Company Limited
7. Ministry of Construction, Naypyitaw (Department of Highways)
8. Karen National Union
9. Representatives from project affected villages
10. NGOs (WWF, TWU, DDA, ERZ)
11. Media (Dawei Watch, Hinn Thar)
12. Consultant

During the consultation meeting, there were comments and feedbacks from stakeholders. The Project's Proponent and Consultant responded and clarified those comments questions and responses, as shown in the table of Questions and responses. The Project presentation and photos are in following pages.

Questions and responses:

No.	Question	Response
1.	Villager - Is the Report follow EIA Procedure and under Myanmar Laws?	-The Report is followed Myanmar EIA Procedure (2015), related Myanmar Laws and International Guidelines.
2.	Villager -If there are affected land in rainy season, what shall the developer do for compensation?	-In rainy season, there will no effect on nearby land because the Reservoir is designed the system which can reduce water level and discharge the ingress water by spillway chute.

Initial Environmental Examination on Pa Yain Byu Reservoir for the Small Water Reservoir Project

In Dawei Distric, the Republic of the Union of Myanmar

Proposed by

PHISUT TECHNOLOGY CO., LTD.

Objectives

- To identify potential direct, indirect, cumulative and induced environmental impacts on and risks to physical, ecological, economic development and social and cultural resources and determine their significance and scope;
- To examine alternatives to the project location, design, technology, and components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks;
- To prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment. The EMP will include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.

Methodology

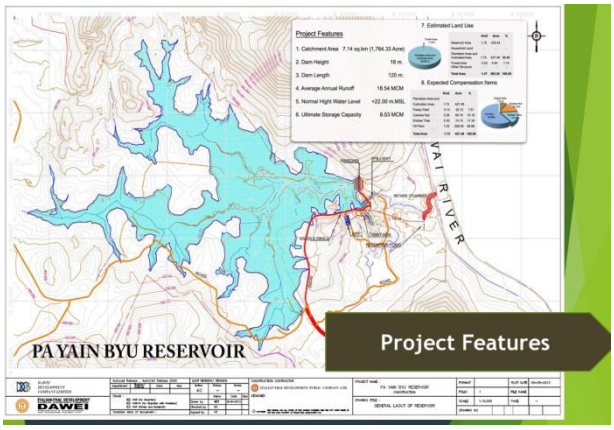
- Collection and initial review of literature on the concerned subjects;
- Field surveys to gather fresh data at sites including discussion with key stakeholders at the district and at the potential affected villages;
- Review and analysis of information and preparation of report.

Compliance

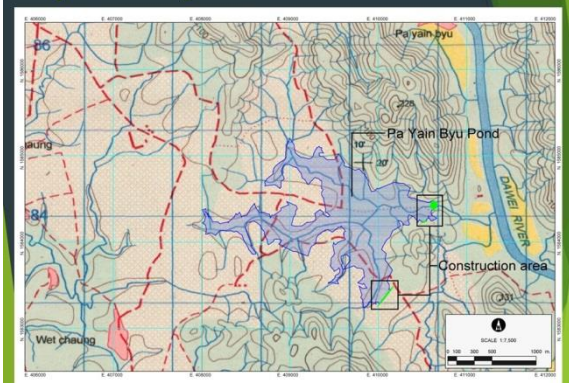
The IEE study will comply with the Myandawei Industrial Estate Holding Pte. Ltd (1 September 2015) on Initial Environmental Examination on Pa Yain Byu Reservoir for the Small Water Reservoir Project

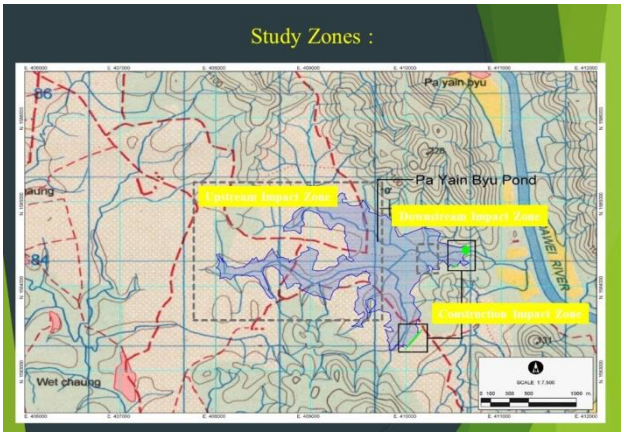
Alternative Water Supply RESOUCES

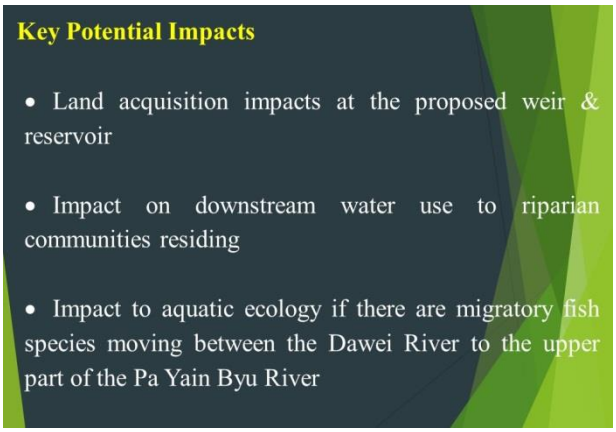
1. PA YAIN BYU RESERVOIR -- Selected
2. EKANI-WEST STORAGE POND
3. DWE TAW RESERVOIR
4. AI SHEY RESERVOIR
5. KA LOAT HTAR RESERVOIR AND DAM

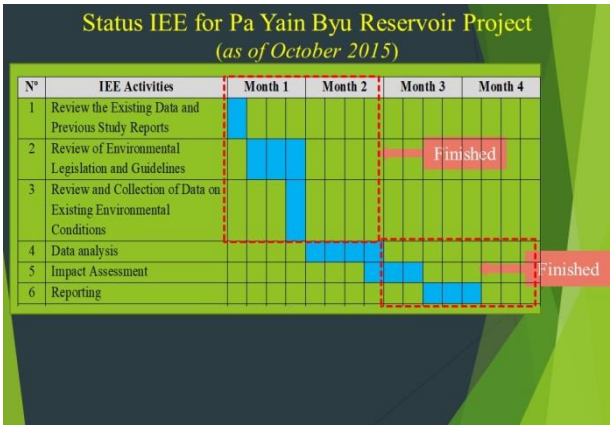


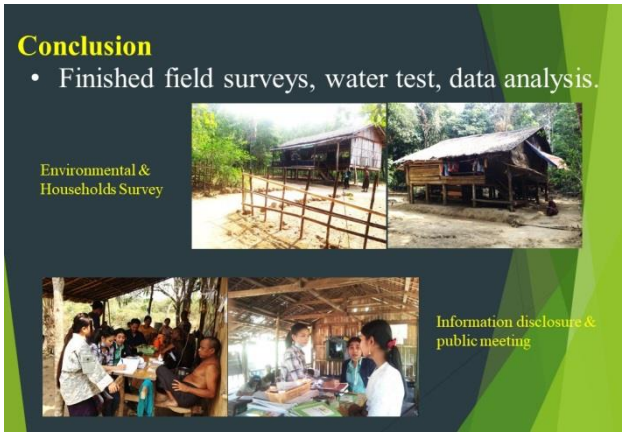
Impact Study Zone




Study Zones :
Pa yain byu
Pa Yain Byu Pond
Upstream Impact Zone
Downstream Impact Zone
Construction Impact Zone
DAWEI RIVER
Wet chaung


Key Potential Impacts
• Land acquisition impacts at the proposed weir & reservoir
• Impact on downstream water use to riparian communities residing
• Impact to aquatic ecology if there are migratory fish species moving between the Dawei River to the upper part of the Pa Yain Byu River


Status IEE for Pa Yain Byu Reservoir Project
(as of October 2015)
N° IEE Activities Month 1 Month 2 Month 3 Month 4
1 Review the Existing Data and Previous Study Reports
2 Review of Environmental Legislation and Guidelines
3 Review and Collection of Data on Existing Environmental Conditions
4 Data analysis
5 Impact Assessment
6 Reporting
Finished
Finished


Conclusion
• Finished field surveys, water test, data analysis.
Environmental & Households Survey
Information disclosure & public meeting


Site Survey
Existing of Upstream area


Geotechnical Investigation
Land use survey & tree counting

Public Involvement & Disclosure

- Discussed with Pa Yain Byu & Oata Yan Village Headman
- Discussed with Wat Chuang Village Headman
- Discussed with SWB and regional Gov.

Conclusions

- The project will create positive benefits to employment and economic development opportunity to local inhabitants.
- The potential project workers will be recruited from local with skill training program.
- The negative impacts include pond flooding of agriculture lands & government non productive oil palm planation.

- Public hearing and consultation with local people should be advertised and continually carried out.
- The compensation should be obtain a suitable standard.
- Non-Governmental organization and other outsider had gave the mislead information and unclear matter to villagers, and make them confuse the situation, so they request the concerned ministry and relevant department to assist and CWB to consult them






The Third Public Consultation Meeting

with concerned Agencies, the locals and NGO

The Third Public Consultation Meeting

with concerned agencies, the locals and NGO

Chapter 8

COMPENSATION PLAN

CHAPTER 8
COMPENSATION PLAN

8.1 Compensation Procedures

With regard to the compensation process mentioned in the Concession Agreement. The DSEZ MC shall appoint the Independent Relocation Expert (IRE) to ensure that the compensation and relocation process related to the Occupied Land is in line with international best practice and guidelines, such as those stipulated by the World Bank. IRE shall perform census, asset assessment, and market survey, prepare entitlement matrix, stakeholders engagement and provide consultation to the Compensation and Relocation Committee (CRC).

With careful consideration and support from IRE, the CRC shall setup policy, perform legislative review, endorse entitlement matrix, set the cutoff date and issue the Compensation and Relocation Plan.

While along the way, the project proponent provides all necessary compensation and relocation funding for the Occupied Land that it is granted under this Concession.

Ultimately, the DSEZ MC shall undertake to exercise its authority to enforce and complete the relocation and compensation process, including the exercise of Governmental power to relocate Persons and remove property out of the Occupied Land.

8.1.1 Confirmation Survey

The Confirmation Survey is conducted a comprehensive and detailed confirmation survey of PAPs who are eligible to receive entitlements including without limitation:

1. The identity of PAPs;

2.The identity of Persons who are entitled to receive transitional assistance and entitlements; and

3. Loss of assets, especially cultural heritage, income and net income, housing, access to community resources, natural resources, agriculture area and business opportunities and corresponding entitlements;

For the purpose of the projects, at least 2 surveys collect by Relocation and Compensation Department the above mentioned information:

- Census; and
- Asset registration survey.

The confirmation survey is considered the sole authoritative survey to identify all PAPs at the time of the cut-off date and all the assets of those PAPs that will need to be compensated. The Census has been implemented before start the project, following the declaration of the Cut-off-date.

8.1.2 Data Base

A database has been established, containing all relevant data such as census, asset and planting registration information. Each household and agriculture area including the sizing classification has been provided a household ID and area quantity. Each member of the household has been provided an individual project affected person ID that is linked to their household ID. This allows the project to follow changes in household composition, as people marry divorce, die, have children, move away, or break away to form new households; and it allows the project to follow the social and economic conditions of individuals over time, and their involvement with the project. The population today and the population at the expected end of commitment will be very different, and so the project needs a way to be able to track the many changes.

8.1.3 Compensation Calculation

- Compensation calculations are made based on a consultation with the Regional Government and combination of compensation unit rates for plants and relocation house as outlined in **Table 8.1 and Figure 8.1.**
- Compensation values for each individual, impacted household are calculated and summarized by Relocation and Compensation Department.
- Following the calculation of these compensation values, the Regional Government representative(s) on behalf of the DSEZ MC reviews the calculations and checks them thoroughly, as required by the responsibilities of the Government.

Even though the Compensation and Relocation Plan is not ready when this report has submitted. The Project Proponent would like to use the previous compensation program conducted during 2012-2013 as a precedent case to gauge and present the magnitude of the compensation sum. It is noted that the previous compensation program information referred to is for indication purpose only. The actual rate and actual amount of compensation is subject to CRC consideration.

8.1.4 Individual Consultation

Prior to cash compensation payments will be paid for agriculture area, and individual household consultation will be conducted with each PAP to inform the household, which includes both husband and wife(s) and possibly children of the household regarding their entitlements and compensation values based on their asset registration, entitlement matrix, and compensation rates. A record of the meeting with each PAP will be kept, mapping will be done including a photo of the PAPs attending the individual consultation. The PAPs have been informed regarding their right to submit a grievance if they do not agree with the information provided during the consultation.

Table 8.1-1 The Compensation Rate in Previous Compensation Program During 2012-2013

			Agreed rate for compensation in Myanmar Kyat		
No.	Tree Name	Unit	Large	Medium	Small
1	Rubber	tree	100,000	70,000	30,000
2	Cashew	tree	90,000	70,000	30,000
3	Betel Palm	tree	40,000	30,000	10,000
4	Coconut	tree	100,000	70,000	10,000
5	Toddy Palm	tree	70,000	30,000	-
6	Jackfruit	tree	150,000	100,000	50,000
7	Sone Pa Dat	tree	150,000	100,000	50,000
8	Pepper	tree	50,000	-	-
9	Durian	tree	300,000	250,000	-
10	Pomelo	tree	70,000	-	-
11	Lime	tree	50,000	30,000	-
12	Lemon	tree	80,000	50,000	-
13	Mangosteen	tree	100,000	-	-
14	Rambutan	tree	300,000	-	-
15	Mango	tree	80,000	-	-
16	Tamarind	tree	100,000	70,000	-
17	Marian	tree	150,000	-	-
18	Danyin	tree	150,000	-	-
19	Guava	tree	80,000		
20	Drumstick	tree	30,000		
21	Plum	tree	70,000		
22	Rice Field	acre	3,000,000	1,500,000	-
23	Nipa	acre	800,000	-	-

Note : When Resettlement and Compensation Expert and Committee has settled, the compensation rate in more updated.

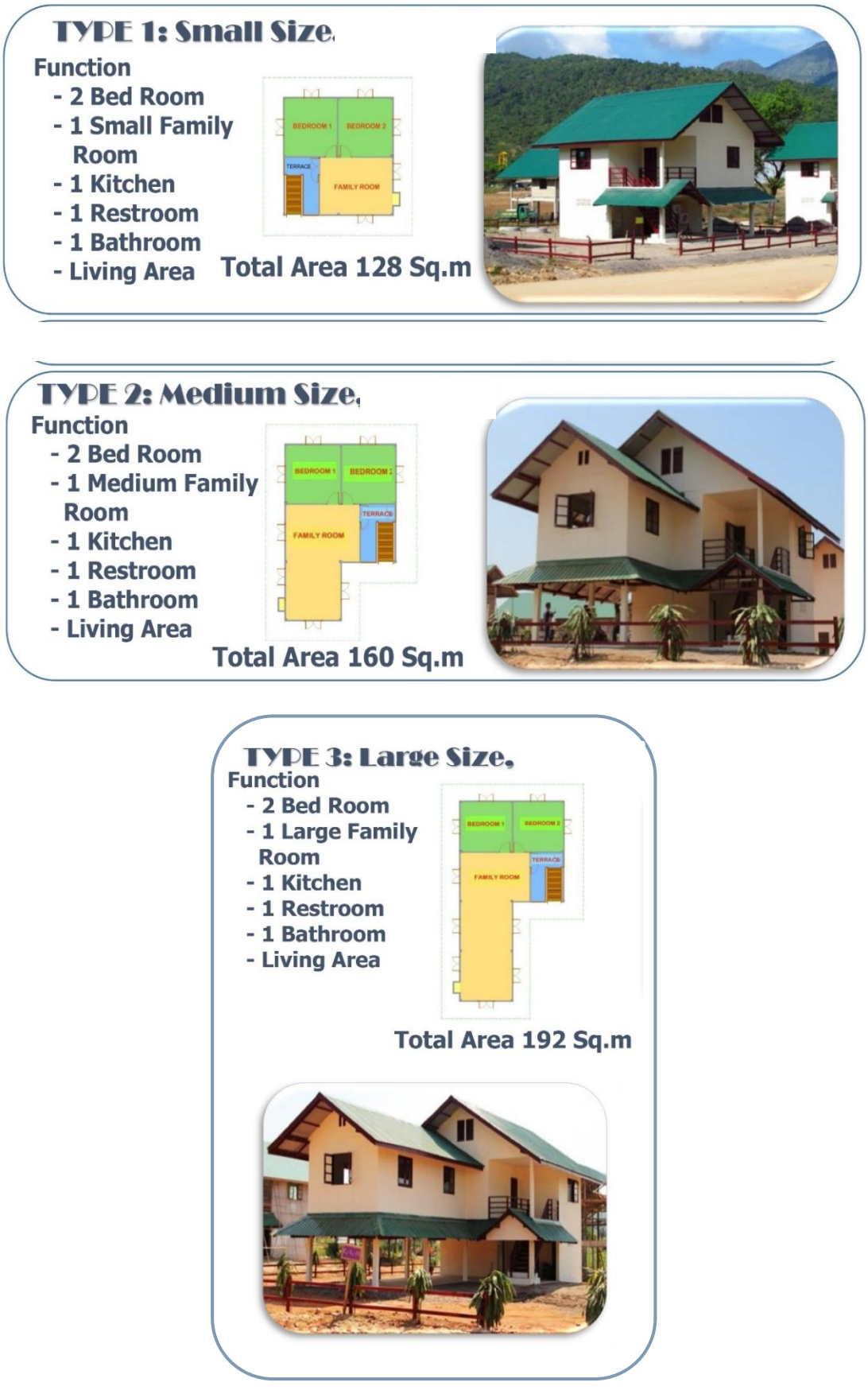


Figure 8.1-1 The households indifferent size for the relocation of PAPs.

8.1.5 Bank Transfer

Cash payment will be made through a bank account of Regional Government in case a PAP has no such account or pay to PAPs directly including registered in the name of PAPs and requiring dual signature that the witness of Government will be observed.

8.1.6 Documentation of receiving Compensation

- Signing of compensation forms for cash compensation
- Payment of compensation through a bank account requires trust and several steps to complete the process.
- Following the entitlement calculation for an individual household, plants or asset, a review of this entitlement by the Regional Government and Relocation and Compensation Department and individual household consultation with the PAP, compensation payment forms are printed and kept in hard copy and included in the data base.
- The compensation forms will require PAP's signatures
- Following the transfer of the funds and the updated compensation status,
- One fully signed set of compensation documents is handed over to the PAP and kept by the PAP in the project folder.

Chapter 9

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 9
CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The water resources were investigated several reservoirs to supply the Initial Industrial Estate in technical, environmental and financial such as volume, dam type, budget and environmental impacts to verified the suitable of dam alternative selected. According the results, Pa Yain Byu is to be supply water in sufficiency.

Sufficient hydrological data have been collected from year 19m 80 until 2009, which based on Quai Noi Basin in Thailand of 29 years. The storage of Pa Yain Byu Pond can carry the runoff in the wet season to be used in the dry season. There is serious water shortage in 3 months, such as March, April and May. The water supply is required to pump the water from the Dawei River during the wet season (June-November) to be stored in Pa Yain Byu and used for water supply without water shortage.

From sedimentary exploration on the prospect area and geological map of Myanmar compilation based on the geological survey, according to SPT drilling, Pitting, Field geological mapping and Drill coring. Local geology of Pa Yain Byu Pond can be subdivided into Stratigraphy unit, Shale, Siltstone, Sandstone and Quaternary sediment.

The project will create positive benefits to employment and economic development opportunity to local inhabitants. The potential project workers will be recruited form local with skill training program by the project. In contrast, the negative impacts of pond flooding to approximately 175 acre of private agricultural lands, Government oil palm plantation of 252 acre including very few forest area.

Compensation procedures for the project will be provided and identified in line with the construction schedules, and depending on the extent of disruption to individual landowners. Every effort will be made to schedule these works during months which will cause least disruption to local people, agriculture area, cultural heritage and allow cultivation to continue undisturbed. Unanticipated impacts during the survey will be addressed on a case by case basis.

To avoid speculation and claims from local people who are not owners of assets, not residing/using or not having any legitimate claim to membership in the communities in the project affected areas the Project's has declared an eligibility cut-off-date for all compensation phases. The Project accepts compensation entitlements for all impacted assets established before the declaration and dissemination of the cut-off-date as well as the commencement of the asset registration. All compensation for involuntary resettlement/land acquisition will be provided prior to commencement of construction work in the respective sections.

Adequate budget has been estimated for the project especially the budget for environmental and social monitoring.

At this point this small project need to be start as one of the necessary infrastructure to the initial stage of DSEZ development.

9.2 Recommendations

The IEE for the Pa Yain Byu Reservoir Project shows that the proposed components will result in net environmental benefits, and that any adverse environmental impact can be addressed through control of construction activity and mitigation measures. The Environmental Management Plan (EMP) provides for mitigation of all identified impacts and the Contract clauses for the environmental provisions will be part of the civil works Contracts. Further, the proposed designs have been consulted with the stakeholders and no significant issues requiring specific conflict resolution in terms of environmental safeguards exist.

Public hearing and consultation with local people should be advertised and continually carried out so as to enable the local people to clearly understand the project impacts on them and that is proposed that they obtain a suitable standard compensation.

The implementation of the Pa Yain Byu Reservoir Project will be administered in the following frameworks:

- Working closely with local authorities to comply with environmental and social legislation in consultation with the affected people;
- Support the socio-economic development of the Dawei District and the Tanintharyi Region;
- Flooding control in areas;
- Secure the raw water for locally use;
- Ensuring that releases pollutions on environment not exceed the Myanmar national environmental standards;
- Periodically monitoring and reporting must comply with local, regional, national and law and regulations;
- Treatment and elimination to reduce environment and social impacts.

Appendix A

Consultant's Profile

The profile of Phisut Technology Co., Ltd.

PHISUT TECHNOLOGY CO.,LTD is the IEE consultant. The Phisut Technology can be contacted at the following address:

Phisut Technology Co., Ltd
The Pann Building, 5th Floor,
125 Khlong Lam Chiak Road,
Nawamin, Bueng Kum, Bangkok 10230, Thailand,
Contact person: Mr. Songkrit Sappakit
Tel : + 66-2943 9619-20
Fax : + 66-2943 9621

SCOPE OF COMPANY SERVICE

- **Master Plan Study Strategic Planning and Feasibility Study**
  - Master Plan Study and Strategic Planning
  - Project Evaluation and Pre-feasibility Study
  - Initial Environment Examination (IEE)
  - Environment Impact Assessment (EIA)
  - Economic and Financial Assessment
- **Survey-Design, Tender Documentation and Construction Supervision**
  - Preliminary Design
  - Survey and Detail Design
  - Tender Documentation and Cost Estimate
  - Project Management and Construction Supervision
- **Plan Preparation**
  - Regional Plan and Strategic Policy Plan
  - Comprehensive Urban Development Plan
  - Specific Area Development Plan
- **Survey and Mapping**
  - Topographical Survey
  - Land Use and Building Use Survey
  - Land Ownership Survey and Property Compensation
  - Geological, Soil Foundation Survey and Testing
  - Population, Social and Economic Survey
  - Environmental Survey
- **Information Systems and Communication Technology**
  - Information Technology Systems
  - Geographical Information Systems (GIS)
  - Management Information System (MIS)
- **Public Relations and Participation**

- Public Opinion Surveys and Consultation
- Public Relation
- Public Awareness & Participation

SPECIALIZATION

Urban Development and Urban Planning

- Urban Planning
- Comprehensive Development Master Plan
- Urban Design
- Land Readjustment
- Property and Real Estate Development
- Land Subdivision and Industrial Estate Development
- Office Building & Housing

Tourism Development and Recreation Management

- Tourism Master Plan
- Tourist Attraction Design and Management Planning
- Sport and Recreation
- Tourism Impact Assessment
- Cultural, Art and Historical Heritage Tourism Site Conservation

Water Supply, Agricultural and Irrigation Development

- Water Resource Conservation and Management
- Surface Water and Groundwater Resource Development
- Hydroelectricity Development
- Dam, Dyke, Irrigation System Engineering
- Agricultural, Farming And Plantation Development

Information Technology System and Communication

- Asset Registration and Tax Mapping
- Land Ownership Database, Land Use & Building Use
- Computer System and Data Analysis Program Design
- Mathematical Modeling
- GIS Database Management
- Information System and Remote Sensing Data Application

Logistics Infrastructure and Energy

- Traffic and Transport Planning

- Road Work and Bridge Engineering
- Coastal Infrastructure
- Railway and Airport
- Mass Transportation
- Energy Conservation and Alternative energy
- Public Safety and Disaster Relief
- Natural Resource and Environmental Management
- Soil, Water, Coastal Marine Resource
- Management and Conservation of Water Catchments Area, Forest and Mineral Resources
- Social and Environmental Management

Waterworks System, Waste Water Treatment, Waste Management and Sanitation System

- Waterworks and Sewerage Systems
- Drainage System
- Waste Water Treatment System
- Water Pollution Control
- Waste Management and Hazardous Waste

Public Relation and Capacity Building

- Public Opinion Surveys and Consultation
- Public Relation and Public Awareness
- Organizational Management and Capacity Building
- Seminar, Training and Workshop

COMPANY EXPERIENCE

-Revival and Development of Thonburi Boat Itinerary for Conservative Tourism Project

-Study and Synthesis the Requirements for Private Investment to develop Bangkok Dockland at Charoen Krung Road. Project

-Feasibility Study on Economic, Engineering and Environmental Impact Assessment on Kolok Bridge Construction at Amphoe Tak Bai , Narathiwat Province Project

-Feasibility Study on Economic, Engineering and Environmental Impact Assessment and Detail Design on New Chonburi-Ban Bung Highway, Project

-Detail Design High-End Campsite, Wanakorn Beach National Park ; Sea Village at Pran Buri Estuary, Prachuap Khiri Khan Province ; Grand Light House and Diving Center at Mustree Hill, Paradonparb Beach, Chumphon Province Project

-Governmental Land Development Master Plan at Kood Island, Trat Province Project

-Pattaya City Plan Evaluation and New Plan Preparation Project

-Feasibility Study on Puket Sea and Vicinity Area Designation for Sustainable Tourism Development Project

-Potential Enhancement of Puket Tourism Capacity Project

-Master Plan on Hua Hin Station Slate Railway Land Development for Fiscal Year 2551. Project

-Environmental Impact Assessment Study and Report Preparation for Chulabhon Dam Hydropower Project in Chaiyaphum Province for the Electricity Generating Authority of Thailand

-Environmental Impact Assessment Study and Report Preparation for Chulabhon Dam Hydropower Project in Chaiyaphum Province for the Electricity Generating Authority of Thailand

-Feasibility Study, Preliminary Drawing and Documentation for Grey Line (Watcharaphon-Rama IX Bridge Project for the Office of Transport and Traffic Policy and Planning

-Environmental Impact Assessment Study and Report Preparation for Chulabhon Dam Hydropower Project in Chaiyaphum Province for the Electricity Generating Authority of Thailand

-Feasibility Study for the Establishment of the Media and Entertainment Industrial Estate for the Industrial Estate Authority of Thailand

- Environmental and Social Management and Monitoring Plan (ESMMP) and Resettlement Action Plan (RAP) for Ka Loat Htar Dam & Reservoir for DSEZ Water Supply Project, Dawei, Union of Myanmar for Italian-Thai Development Co Ltd.

-Feasibility Study and Detailed Design for Jetty and Rong Nam Ban Krut Pier, Bang Saphan, Prachuap Khiri Khan Province for the Marine Department

-Environmental Safety Assessment Study and Report Preparation for Kieo Kho Ma Hydropower Project in Lampang Province for the Electricity Generating Authority of Thailand

- Consulting Services on EIA for the Khlong Tron Hydropower Project for the Electricity Generating Authority of Thailand (EGAT)

- Feasibility Study on Houay Palay Hydropower Project, Champasack Province, Lao PDR for Papeng Wood Industry

-Feasibility Study (FS), Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) of Water Grid System in 19 Crisis Areas in Khong, Chi and Mun Basins for the Department of Water Resources

-Master Plan Study on Mini and Micro Hydropower Project in National Parks (Northern Region and Thong Pha Phum National Park) for the Department of Alternative Energy Development and Efficiency

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